PROCEEDINGS

of the

5TH INTERNATIONAL FISHERIES OBSERVER CONFERENCE

Victoria, BC, Canada

15 – 18 May 2007

Edited by T.A. McVea and S.J. Kennelly

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Contents

Short abstracts of other posters presented at the conference

APPENDICES

Acknowledgements

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- Major sponsors including: NOAA Fisheries, Canadian International Development Agency, Fisheries & Oceans Canada, the Province of BC, Archipelago Marine Research Ltd., and the Australian Government.
- Supporters including: New South Wales Department of Primary Industries, Gordon and Betty Moore Foundation, Pacific States Marine Fisheries Commission, International Pacific Halibut Commission, and World Fisheries Trust.
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- The various trade exhibitors for their excellent information booths and presentations.

Members of the International Steering Committee

Howard McElderry	(CHAIR) Archipelago Marine Research Ltd., Canada
Victoria Cornish	The Ocean Conservancy, USA
Murray Gilchrist	Department of Fisheries & Oceans, Canada
Steve Kennelly	NSW Department of Primary Industries, Australia
John LaFargue	NOAA Fisheries, USA
James Nance	NOAA Fisheries, USA
Mark Showell	Department of Fisheries & Oceans, Canada
Michael Tork	NOAA Fisheries, USA
Teresa Turk	NOAA Fisheries, USA
Bruce Wallner	Australian Fisheries Management Authority, Australia
Greg Workman	Department of Fisheries & Oceans, Canada

The 5th International Fisheries Observer Conference Steering Committee

Back Row (left to right): Mark Showell, Howard McElderry (Conference Chair), Jim Nance, John LaFargue, Bruce Wallner, Greg Workman, Murray Gilchrist; Front Row (left to right): Mike Tork, Teresa Turk, Steve Kennelly, Victoria Cornish.

Minister's Welcome

A poster session and reception was held at the Victoria Conference Centre on the first evening of the conference. The Honourable Barry Penner, Minister of Environment, gave an opening speech at the reception. The Minister thanked the national and international agencies and organisations that helped to make this event possible and made a special thank you to the Victoria-based Archipelago Marine Research Ltd., the Canadian host organisation of this conference and a world pioneer and leader in electronic fisheries monitoring technology. The Hon. Penner noted that it is an honour for the Province of British Columbia to join these dedicated organisations in the sponsorship of this event and that it is a treat to see representatives of so many different countries and cultures gathered in one place to share knowledge, experience and expertise, and to explore the best possible ways to improve fisheries monitoring programs around the world. Following is a summary of the comments made by the Minister, which was warmly applauded by the conference delegates at the completion of the speech:

"By looking after the sustainability of world fisheries, we are not only protecting fish stocks, their habitats and ecosystems, we are also safeguarding the strength of our economy – without healthy ecosystems and thriving stocks, fisheries-based economies would be hopelessly affected. That is why the global seafood market is increasingly calling for substantiated proof that seafood products from around the world originate from healthy, environmentally-sustainable fisheries. In British Columbia we believe in the importance of this and we are working with the Canadian federal government to obtain internationally-recognised, third-party certification for a number of fisheries, including sockeye salmon, halibut and hake."

Certification is only a small part of ensuring sustainable, well-managed fisheries. These days, fisheries monitoring programs and data collection systems are essential to the successful management of most commercial fisheries. They help to monitor compliance with fishery regulations, and to reduce the issue of accidental capture of a diversity of species, including marine mammals, sea birds and sea turtles. They also provide information to better protect the health of marine habitats, ecosystems and fish and shellfish population, and, last but not least, they also contribute to informing the public and assuring international markets of the safety and sustainability of marine fishery practices.

In British Columbia, groundfish trawl fisheries have had 100% observer coverage since 1996. Last year, Fisheries & Oceans Canada introduced the use of electronic monitoring technology – like the one pioneered by Archipelago Marine Research in Victoria's own backyard. This has allowed coverage for British Columbia's small vessels that fish with hook and line, longline and trap gear. We are doing our part to support the increase in monitoring programs – not only to ensure the sustainability of our stocks, but to address conservation, reduce discards and improve the information base for stock assessment and management.

When we think of fisheries monitoring, we think of at-sea, on-vessel observers, dockside monitoring and, these days, electronic monitoring technology. However, a successful monitoring program is also greatly dependent on the cooperation between scientists, industry and fishermen, which is why it is key to bridge the interests and communication gaps between these different sectors, and to find common ground between our different priorities and goals.

As long as we keep in mind that our interests are not at all disparate, it should not be hard to keep the lines of communication and understanding open. We may all have different approaches and different priorities, or even particular agendas to address our countries' economic needs, but the bottom line is, there is not one of us who would not benefit from successfully sustainable fisheries.

From fishermen to consumers, scientists to fisheries observers and managers, we all know the importance of maintaining healthy fish and shellfish populations, and of protecting ecosystems and harvests. Simply put, these resources are finite and if we don't do our part to ensure their successful renewal, we will all have to deal with the consequences – sooner rather than later. The fact that you're here today, and that every two years since 1998 you've convened somewhere in the world to reach consensus and share approaches to fisheries monitoring, is indeed promising.

To borrow words from Henry Ford, *"Coming together is a beginning; keeping together is progress; working together is success"*. You have already come together, kept together and are constantly working together, with one clear goal in mind: To build better fisheries monitoring programs by sharing your knowledge and expertise, and by learning to better understand each other's needs and approaches. Every one in this room today has something to offer, and something to learn from someone else and these exchanges will benefit us all in the long run.

Our oceans and the creatures living in them know no boundaries, and neither should our efforts to ensure our responsible use of these valuable resources. As different nations come together to learn from each other, we will ensure the best possible approach to effective fisheries monitoring around the world, and together reap the environmental and economic rewards of our efforts. On that note, ladies and gentlemen, allow me to once again give you a warm welcome to Victoria and to British Columbia. I'm confident that your stay will be both productive and pleasant.

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Following the Minister's opening speech, the Chair of the 5th International Fisheries Observer Conference, Howard McElderry and the keynote speaker, Martin Hall were invited to participate in a press interview for the local newspaper and an article was published in the *Times Colonist (Victoria)* on 17 May 2007 entitled *"Conference sets new course for fisheries' future: Monitoring innovations can help sustain oceans"*.

A welcome reception was also held at the Strathcona Hotel on the evening prior to the conference which was generously funded by the following Canadian Observer Companies:

- Archipelago Marine Research Ltd., Victoria, British Columbia.
- Beothuk Data Systems Ltd., St. John's Newfoundland.
- Biorex Inc., Quebec City, Quebec.
- Javitech Ltd., Halifax, Nova Scotia.

Executive Summary

This conference marks the fifth in the biennial series of International Fisheries Observer Conferences, which are designed to bring together individuals that are active or interested in fisheries observer programs throughout the world to share ideas and to discuss key issues of common interest. The conference was hosted by Archipelago Marine Research Ltd., and was held in the Victoria Conference Centre in Victoria, British Columbia, Canada. Over 280 participants from 45 nations attended the conference, including representatives from fishery monitoring programs, fishing industry groups, end-users of fishery-dependent data collection systems, scientists, managers, lawyers and others.

The conference consisted of ten panel sessions that included extensive audience participation to explore a range of topics. Three work group sessions, run concurrently with three of the panel sessions, expanded on inter-sessional dialog and resource-sharing across three important areas of at-sea observer programs: safety, training and professionalism. An interactive session on the latest techniques to reduce long-line related mortality of sea turtles, and a Safety Room where products and techniques to promote safety of workers at sea were demonstrated, were both special features at the conference.

A record number of posters was displayed at the conference, with a poster session and reception held at the Victoria Conference Centre on the first evening. The Honourable Barry Penner, the British Columbian Minister of Environment, officially opened the conference at this reception.

The conference was generously sponsored and supported by Archipelago Marine Research Ltd.; the National Oceanic & Atmospheric Administration, National Marine Fisheries Service (NOAA Fisheries); Fisheries & Oceans Canada; the British Columbia Ministry of Environment, Oceans & Marine Fisheries Division; the Australian Fisheries Management Authority; the Canadian International Development Agency; the Gordon & Betty Moore Foundation; the NSW Department of Primary Industries, Australia; the Pacific States Marine Fisheries Commission; the International Pacific Halibut Commission; and the World Fisheries Trust.

The conference began with presentations from five of the sponsor organisations followed by an enlightening keynote presentation by Martin Hall from the Inter-American Tropical Tuna Commission on the evolving goals, changing structures and increasing significance of fisheries observer programs. Each subsequent panel session addressed a central question facing observer programs and involved a series of short (approximately 7-minute) presentations followed by lengthy discussion involving questions, discussion and participation from the audience. A summary of each panel session follows.

What are the reasons and objectives for monitoring a fishery?

Although the reason for monitoring a fishery seems like a fundamental question, this session showed that the connection between the objectives and the sort of monitoring program that can be realised is not simple. In reality, the data needs of observer programs grow and often get tasked with more things than they're designed to do or are even capable of doing, from scientific monitoring, through real-time management tools to law enforcement. The speakers in this session came from a variety of backgrounds who discussed the many reasons and objectives behind observer programs. The session also focussed on the costs associated with monitoring programs, the risks to industry of not having observer programs and ways to fund the programs.

What are the important elements and considerations in the design of fishery monitoring programs?

The basic messages learned in this session for designing new observer programs are: to do it carefully; build it up using "monitoring creep"; have pilot programs; and see if other established programs in the world may be applicable to your particular situation. You also need to have processes in place to develop ever-expanding

priorities and give consideration to various legal requirements.

The session also focussed on ways to avoid bias in observer sampling; developing a uniform international approach for observer activities; the importance of feedback from data-users to observers; the implications of discard bans in Europe; the data needed for ecosystem-based fisheries management; and prioritising the tasks assigned to observers.

Industry panel: what are the commercial fishing industry's perspectives on fishery monitoring programs and how they can be improved?

The panellists in this session included current and former fishers, observers and a former fish processor. The session showed that fishers are often the key clients of fishery monitoring programs, although they are not usually acknowledged as such. Fishers are not only often burdened with the cost of these programs, but are also the most directly affected by the findings and results of fishery monitoring programs. The presentations in this session were on a range of topics including: using fishers as observers; the integration and rationalisation of fisheries in the role and requirements of monitoring; possible new directions in fishery monitoring; and the growing acceptance of monitoring as an integral part of fisheries management.

The session also looked at ways that industry, government agencies and private contractors can work together to maintain the right balance of roles relative to the changes that are happening in fisheries management, and ways to get fishers to embrace monitoring programs. There was also a significant discussion about the costs associated with observer programs; who bears these costs; and the issues associated with public access to the data collected by observers.

How can industry play a role in monitoring fisheries?

This session outlined the many roles that industry can play in fishery monitoring, including assisting observers in the collection of data, or even replacing observers, using electronic logbooks for collection of real-time data and using video-based monitoring for increased compliance. It was universally concluded that we should encourage participation from industry in fishery monitoring so that we can utilise their knowledge and give them ownership of the data. Ultimately, we're all trying to do the same thing, which is to create sustainable fisheries.

The session looked at ways to get industry initially involved in observer programs, such as through port meetings, pilot studies and vision statements. There was also a discussion about the selection of vessels for study fleets, the issues of accuracy and public confidence in data that are collected by the captain and crew, and ways to ensure observers are a reliable third party scientist onboard a vessel. The matching of expectations of an observer program with the reality of what can physically be collected was also examined.

What is the role of non-governmental organisations (NGO's) in fishery monitoring programs?

This conference tried to recognise the various groups that interact with fishery monitoring programs and this session involved presentations from environmental non-governmental organisations (ENGOs). These organisations work towards getting better data and larger coverage from fishery monitoring programs, and are also helping to fund fishery monitoring programs. There has been an evolution in how the various interest groups work together which, as demonstrated by the panellists in this session, has been a lot more collaborative and less confrontational than originally perceived. Some ENGOs are participating directly in management processes, and they can also facilitate technology transfer, assist with implementing programs on the ground, and can work with governments to analyse observer data.

Some additional roles of ENGOs were noted during this session. These included the role that ENGOs can play in convening forums; in supporting observer programs in ways that strengthen the policies and laws that call for observer programs; and in developing market-based incentives to promote sustainable fisheries.

How are fishery monitoring data analysed and used by government, industry, academics, and NGO's?

This session looked at how different stakeholders analyse and use fishery monitoring data. There were 15 speakers in this double session. The first group of speakers talked about analysis and data collection issues and the second group spoke about some of the analyses that have been done and associated management outcomes. The session highlighted that, from a statistical standpoint, it is important to know about the biases of the data so they can be taken into account during data analysis. Fishery monitoring data are most often used for discard estimation and stock assessments, but the data can also be used to improve the program itself. An important role of ENGOs is providing analysis of observer data on topics that may not be routinely carried out by fisheries agencies

This session also discussed the feasibility of ranking observer data according to its accuracy, and the techniques used to analyse such data. There was also comment made about the value of the report currently being prepared by NOAA on discard estimates throughout the U.S. and other such reports in providing guidelines for observer programs and by-catch estimates throughout the world. Various comments were made with respect to observer data for use in ecosystem modelling and in the understanding of the interactions between fisheries and other species.

What can be shared between fishery monitoring programs throughout the world?

New observer programs are constantly starting up around the world and it makes sense to share our knowledge and experience rather than 're-invent wheels'. This session discussed which and how information is being shared among observer programs around the world.

The session discussed expanding the data collected by observers to incorporate more information on by-catch and some of the specific uses of the Ocean Biogeographic Information System data. The session also discussed ways to provide training opportunities for people who are interested in developing observer programs; ways to get fishers involved in the ecosystem-based management approach for fisheries; the issues and laws associated with the protection of observers from harassment and interference with their duties; and the role of the World Fisheries Trust and similar organisations in sharing information, experiences and opportunities among developing and developed countries.

What can advanced technologies offer fishery monitoring programs?

Advancing technology was listed on the program at the first International Fisheries Observer conference in Seattle, but it was mostly about general ideas and some pilot projects just getting started. In this session at this conference, the technology for fishery monitoring programs was found to have evolved rapidly over the last ten years and there are now a broad variety of tools that are used to collect data from commercial fisheries. Technology is also now offering us better tools that help facilitate communication and create better observer programs via partnerships around the world.

During this session, the panel talked about the advantages of Personal Digital Assistant (PDA) systems and there was also a discussion on video-based electronic monitoring systems (EM). One of the major challenges of EM is implementing the technology from a pilot-level project to the whole fleet. The session also discussed the relative costs of various electronic monitoring systems versus human observers.

How to achieve fishery monitoring by integrating multiple data collection tools?

This session examined various data collection methodologies and strategies and how to pull those together to deliver a complete and comprehensive product. It was noted that integrated fisheries management tools and practices must be designed to yield 'actionable information' in order to be able to act in sufficient time to make a difference. Improving data quality, integrity, timeliness and currency through data capture at its source (land-based and sea-based data capture, fishers and third parties) and converting integrated data to information / knowledge are critical to the design of an effective monitoring program.

Ecosystem-based fisheries management requires a comprehensive understanding of many disparate elements over and above the more

traditional single-species based systems of the past. In this new management regime, there is a need and opportunity for the use of electronic monitoring systems to enhance observer functions.

The session also discussed the public accessibility of metadata collected by observer programs; how to scale-up electronic monitoring from a pilot project to a whole fishery; and novel ways to monitor discarded by-catch.

How to address information requirements for fisheries that are difficult to monitor?

This session dealt with the challenges of monitoring problem fisheries. The panellists spoke about the lack of funding in developing countries for observer programs and using consumption surveys of households as a way to collect data. Issues of working on small boats and sampling rare or highly aggregated species were also discussed.

It was noted that some of the problems associated with resisting observers by fishers can be solved with an appropriate communication strategy and also ensuring that liability and accountability issues are clearly understood. Also, for self-reporting, it is important to have the right governance structure in place and to have all sectors represented in the monitoring strategy. The session also looked at the feasibility of using samples collected by captain and crew as an alternative approach to monitoring catches on small vessels and the safety aspects associated with sampling sharks from small vessels.

Concluding Session

The purpose of the closing session was to summarise what was learned at the conference. A panel of speakers was selected comprising people from various sectors that contributed throughout the conference, each of whom gave a brief talk about what they learned and their ideas for future directions for the conference. The panel included a fisheries observer, an industry representative, a representative from an ENGO, a representative from the European Union, an end-user of observer data, the keynote speaker and the Chairs of this, the previous and the next conference.

In general, the conference addressed 5 main areas of fisheries observer programs that more-or-less resembled the chronology associated with doing an observer program: (i) why we do observer work; (ii) how we do it; (iii) what we do; (iv) what do we get out of it; and (iv) how can we do it better.

One of the key points raised was that the the multi-stakeholder makeup of the attendees at the conference did a lot to build the awareness that fisheries monitoring issues are best solved with a common understanding that there is a problem, honesty, and a collective effort to work toward a solution. Martin Hall's comment, repeated several times by delegates at the conference, was that solutions to large, complex issues like bycatch are best solved by a shared commitment of everyone making progress in areas where they can. The collective of individual efforts, however small, build toward effective solutions. Having many different stakeholders present also resulted in a lot of candid discussion about fisheries management in general. The conference was very successful in examining a variety of fishery management practices and recognising the importance of advertising success stories in management

The discussion in this session talked about the future direction of the conference, with suggestions including: a continued focus on observer safety and the 'Safety Room'; the Fisheries Observer web site to be maintained and used as a major forum to share information between individuals, programs and nations; greater participation to be encouraged from a broader range of international delegates (e.g., from Europe, Japan, Taiwan, Korea); encourage greater participation from fisheries modellers so they can understand the types of data that are available from observer programs; and a funding strategy to allow for the continued participation of delegates from developing countries that are new to observer programs.

Suggestions that were put forward for future session topics included: a session devoted to the legal aspects of running observer programs and using the data from these; a 'lessons learned' session where people can discuss the ideas they have had that have not worked out which could be used to help others avoid making the same mistakes; a panel session to look at the different service delivery models from around the world and how they affect cost, data quality, industry

compliance with regulations, observer morale, and the retention of experienced observers; and a session on self-sampling and how industry can monitor fisheries, including an interactive workshop session to provide training to fishers on how to collect observer data.

Much praise was given to the conference organisers and participants for making the conference a success. It was noted that the quality of the abstracts and presentations given at these series of conferences has increased with each conference. It was also noted that the number, quality, sophistication and use of observer programs throughout the world has improved at each 2-year 'stocktake' of this field – perhaps in part due to the existence of this conference series. NOAA fisheries generously offered to host the next conference in the northeast of the United States in 2009.

PANEL SESSIONS

OPENING SESSION

Opening Remarks:

Howard McElderry	*Archipelago Marine Research Ltd. – Canada*

Presentations from the Sponsors:

Bud Graham	*BC Ministry of Environment – Canada*
Joachim Carolsfeld	*World Fisheries Trust – Canada*
Alan Sinclair	*Department of Fisheries & Oceans – Canada*
John Boreman	*National Marine Fisheries Service – USA*

Keynote Speaker:

Martin Hall	*Inter-American Tropical Tuna Commission – USA*

Opening Remarks

Howard McElderry

Archipelago Marine Research Ltd.

On behalf of the International Steering Committee I am very pleased to welcome you to the 5th International Fisheries Observer Conference. In keeping with the goal of the IFOC series we have developed a conference program to help share and develop best practices within fishery monitoring programs and promote their implementation globally, and to establish dialog between those responsible for monitoring fisheries and those who rely upon the data they collect. We are extremely pleased with the delegation this conference has attracted, with over 280 people from over 44 countries around the world – the largest yet in the IFOC series. In addition to the geographic diversity, we are also pleased to see that the conference delegation represents a diverse delegation of fishery monitoring programs interests including: observers, observer program organisations, governments, NGO's, academics, and other interested groups.

I would like to introduce you to the International Steering Committee for this conference and ask that each committee member stand up so that conference delegates can recognise with you: Vicki Cornish, Murray Gilchrist, Steve Kennelly, John LaFargue, Jim Nance, Mark Showell, Mike Tork, Teresa Turk, Bruce Wallner and Greg Workman.

The International Fisheries Observer Conference series is designed to address practical issues in fisheries monitoring – it is all about getting practitioners together to share experiences and exchange ideas. The conference is not trying to compete with, or even be viewed as, a scientific conference – it involves people that are in the trenches (so to speak) on all levels of fishery monitoring programs and seeks to find ways to make these programs work better. That theme has been the focus from the very start of the conference series and was very much in our thinking in the design of this conference. The conference handbook outlines the program in detail and the following points are of note:

- *Panel Sessions* – the conference includes a series of panel sessions involving a group of speakers who will give short presentations on a particular theme followed by an interactive discussion period. The goal of the speakers is to flesh out the theme and seed discussion which will be captured in the proceedings and published after the conference. The conference is planned as an interactive session and all conference delegates are encouraged to participate in the discussion periods at the end of each session.
- *Work Groups* – there will be three work group sessions at the conference on Observer Safety, Observer Training and Observer Professionalism and these will be run concurrently with the panel sessions. This is the first time that work group sessions have been introduced into the conference and they are designed to develop themes that will last beyond the conference and serve as an inter-sessional communication process.

- *Poster Sessions* – there are about three times more posters at this conference compared with previous conferences. The poster sessions provide a medium for people to explain complicated stories which might not be possible to explain in a seven minute oral presentation – they are a highlight of the conference and delegates are encouraged to put in their vote for the best poster and the winner will be announced at the conference dinner on Thursday night.
- *Interactive Training* – Mary Luz Parga will be running an interactive training session on hook removal techniques to reduce mortality of sea turtles – this will be held at 5pm on Wednesday in the Oak Bay Room.
- *Safety Room* – Mike Tork, with assistance from Jason Vestre, Jon McVeigh, Gord Perkins, John LaFargue and Eric Matzen, has set-up a Safety Room to display an array of sea safety equipment. There will also be a number of safety related activities throughout the conference including emergent suit donning races and a life raft demonstration.
- *Closing Session* – the closing session held on the last afternoon of the conference is an important part of the conference series as it generates discussion on where to go to next and ideas for topics and themes for the next conference.
- *Social Program* – a number of social activities have been organised for the conference including the welcome reception that was held last night and hosted by the Canadian observer contractors; a reception and poster display to be opened by the Minister of the Environment; a reception at the Maritime Museum; a banquet in the Crystal Ballroom; and a traditional display in the longhouse at Mungo Martine House. Half hour tours of the ichthyology collection at the Museum are also available during the coffee breaks – the collection includes several contributions from the Canadian observer programs.
- *Questionnaires* – Conference delegates are encouraged to complete the three questionnaires compiled by the Work Groups as well as the conference feedback questionnaire.
- *Conference Proceedings* – All oral and poster presenters have been asked to provide an extended abstract (or a copy of their poster) for inclusion in the conference proceedings. These are to be provided to Tracey McVea who is the conference rapporteur and will be putting together the proceedings for the conference.

This conference series began in 1998 as a bilateral meeting in Seattle to try and get the Canadian and United States observer programs aligned and sharing ideas. Bill Karp was one of the convenors of that meeting and it largely consisted of participants from Canada and the United States and a small international delegation. Another three meetings occurred after that approximately every two years and moved from Seattle to St Johns, New Orleans and Sydney and during that time the conference has expanded in terms of the delegation and scope of the conference this progression highlights the growing global interest in improving monitoring approaches for commercial fisheries. The conference series started with the main focus on human-based observer programs and the scope has naturally broadened because observers are not practical in many monitoring applications. The problem of monitoring fisheries a requires consideration of other approaches including electronic monitoring, improved integration of different information systems, and, most simply, capacity building approaches to engage the fishing industry in more comprehensive data collection. The scope of this conference includes all of these elements and speaks to the increasingly complex ‘science’ in the development of fishery monitoring programs.

Our first session is dedicated to our major conference sponsors followed by a keynote address from Martin Hall. Dr Hall is from the Inter-American Tropical Tuna Commission (IATTC) and has a long history with observer programs and, most notably, has been involved at various levels within observer programs – he is a leader in developing international agreements and programs to reduce by-catch in fisheries and he is knowledgeable on the role of observers, management and conservation as a tool to bridge with fisheries. Dr Hall is currently head of the tuna-dolphin program at the IATTC where he has worked since 1984.

A Focus on Sustainability

Bud Graham

Assistant Deputy Minister, Oceans & Marine Fisheries Division, BC Ministry of Environment –Canada

There is a growing environmental ethic and awareness of sustainability issues in world fisheries. Monitoring of commercial fisheries is essential for successful management and compliance. Accurate catch data is crucial to stock assessment and key to conservation based management. Fisheries observer programs play a pivotal role in ensuring sustainable use of the ocean resources.

British Columbia's (BC) seafood sector is an important contributor to the provincial economy. The fishing industry has been and continues to be one of the economic foundations for many coastal communities. BC's seafood industry is largely export-oriented. Over 80% of the total production is exported and must compete in a global market for seafood products.

Management of Pacific fisheries is complex and involves shared jurisdiction with the Federal government. First Nations are seeking increased access to BC fisheries and more involvement in the management and decision-making processes for fisheries.

BC's goal is the protection and enhancement of our fisheries resources for the economic, social and environmental benefit of British Columbians. Fisheries reform initiatives include addressing the discard/by-catch issues in our groundfish fisheries with 100% electronic or observer monitoring programs and obtaining third-party certification of the sustainability of our fisheries through programs like the Marine Stewardship Council.

Ensuring sustainability of our fisheries helps the seafood industry in developing a strong reputation in domestic and international markets.

International collaboration in fisheries observer programs to foster sustainable and equitable global fisheries

Joachim (Yogi) Carolsfeld

World Fisheries Trust

World Fisheries Trust is concerned with the sustainability of fisheries resources and the related livelihoods, including the question of how conservation looks in practice when not only livelihoods but survival may depend on an over-subscribed resource.

We have not worked specifically with fisheries observers before, but recognise this as an essential element to combating the prediction by Boris Worm and colleagues that all the world's fisheries will collapse by 2050. Observers or the equivalent provide the monitoring tools to drive fisheries to a more sustainable basis.

Our interest in this conference is that the management functions of observer programs become more broadly available to less affluent countries. These countries are increasingly providing the bulk of international fisheries resources but are often not equipped to monitor their use nor have adequate control to ensure sustainable use and equitable returns. Better fisheries data are a basic element to improving equitable management control in these countries of their fisheries resources, and observer programs or something similar are excellent means of getting there.

I think that there are in fact lessons to be learned both from 'developed' to 'developing' and vice versa. 'Developing' countries often find novel, economical ways to deal with impossible situations and can be more attune to social forces, while more affluent countries can demonstrate more precise, intensive, and technological tools and data management. The answer to foster management of sustainable fisheries globally probably lies somewhere between these two, and a conference that brings the different experiences together and builds communication and collaboration channels is an excellent first step.

Equitable opportunities and treatment are also cornerstones of our activities and a priority for

our funder, the Canadian International Development Agency (CIDA). In particular, equity amongst men and women and amongst people of different ethnic origins is of concern. Considering that equity needs to start at home, we have also contributed components to the conference to assess levels of gender and ethnic inequities in the observer community and start building ways to overcome any barriers that may exist to inhibit improved equity in this profession. We hope that modelling such equity in the observer programs can eventually contribute also to improved equity in the fisheries themselves.

With the help of funding from CIDA, Archipelago, the conference committee, and Martin Hall, we managed to substantially enhance the international participation at this conference – we hope that this will indeed be a first step towards increased facilitation of world-wide sustainable and equitable fisheries.

Twenty-five years of research opportunity from observer programs in Canada, one person's perspective

Alan Sinclair

Department of Fisheries & Oceans, Nanaimo – Canada

I would like to thank the organising committee for this opportunity to address the fifth IFOC and to reflect on a number of years experience with observer programs, observer data, and how these may be incorporated into fisheries research programs. The objective of my talk is to highlight the importance of observer data and what they offer that traditional fisheries data do not. My talk covers five themes, accuracy of catch, spatial resolution, detail on fishing strategies, biological sampling and mutual trust. Examples are drawn from my experience with Canadian observer programs, but I expect others have seen similar examples in other areas.

The International Observer Program was established in eastern Canada in 1977, shortly after the extension of fisheries jurisdiction. It had long been suspected that foreign vessels fishing these waters had been under-reporting catches of Atlantic cod, and in particular juvenile cod since the fisheries were prosecuted with small mesh. Initial deployments of observers on these vessels produced by-catch estimates of cod along with biological samples of size and age composition. A re-evaluation of the data on catch at age led to a 3-fold increase in the estimates of numbers of age 1 and 2 cod over a period of a decade (Gray, 1979). The negative effects of small-mesh gear by-catch on production of cod were clearer as a result.

Observer data offered detailed spatial information on fishing as well as better information on catch composition. During much of the 1970s and 1980s, traditional fisheries data recorded fishing locations in large geographic areas, and catch information was aggregated over a number of fishing events before it was stored. The observer data, on the other hand, recorded set by set information on location and catch composition. This allowed small scale investigations of spatial variation in habitat and species interactions. Sinclair (1985) described 5 fishery types on the Scotian Shelf, based on similarities in catch composition. These fisheries were stable in location and catch composition over a number of years. The analysis was entirely based on observer data and was the first of its type in this area.

Commercial fisheries catch per unit effort (CPUE) time series are often used as indices of abundance in fish stock assessment. However, it is recognised that many factors will influence the relationship between CPUE and stock abundance. The existence of detailed and accurate data from observer programs has allowed exploration of these controlling factors. One example is Gillis (1999) where the possibility of interference among vessels engaged in the Scotian shelf silver hake fishery was examined. The study revealed periodicity of CPUE that may be related to tidal, diel and technological factors, over and above the apparent interference competition. This study was not possible with traditional fisheries data.

Traditional fisheries data records landings by species. Discards are rarely reported accurately. Fishery observers record catch weights of all species. When the British Columbia, Canada, groundfish trawl fishery went to 100% observer coverage in 1996, there was an increase in the reported weight of discarded fish from slightly over 2,000 t in 1995 to 9,400 t in 1996 (Fig. 1). In addition to obtaining more accurate data on discard weights, there was also a considerable

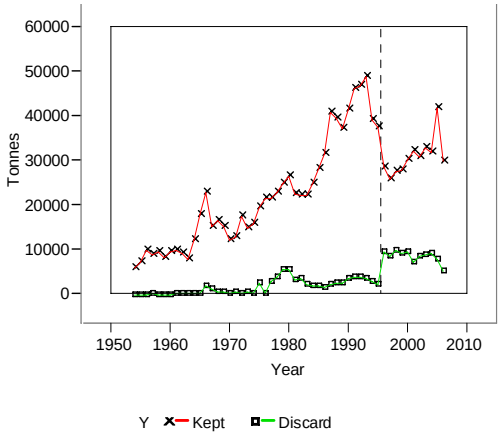


Figure 1: *Reported kept and discard catch weights (t) in the BC groundfish bottom trawl fishery, 1954 – 2006. The dashed line indicates when 100% observer coverage was put in place. It should be noted that the accuracy of the reported discard weights prior to 1996 is not known and are not representative of how much discarding occurred then.*

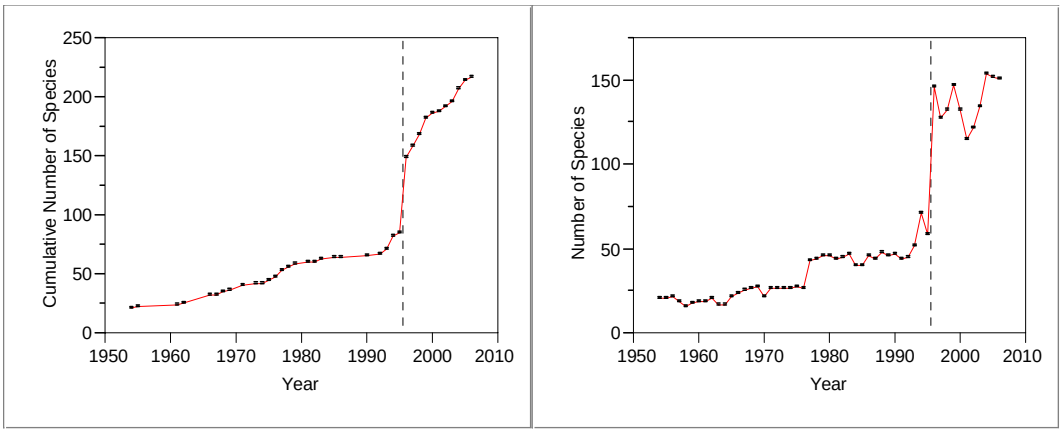


Figure 2: *The cumulative (left) and annual (right) number of species reported in the BC groundfish bottom trawl catch, 1954 – 2006.*

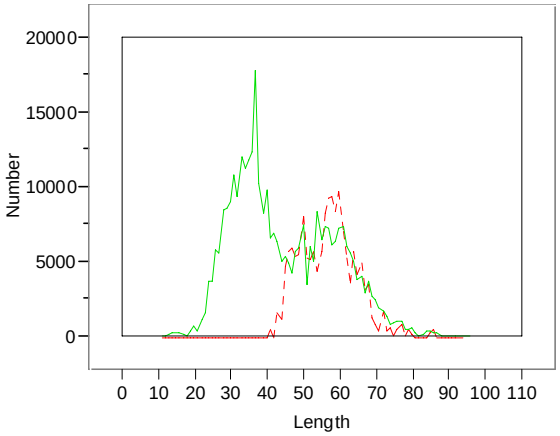


Figure 3: *Comparison of size frequency estimates for total catch (solid line) obtained by at-sea observers and the landed catch (dashed line) obtained by port samplers. The estimates are for Pacific cod in Hecate Strait in 2003 from the BC groundfish trawl fishery.*

increase in the number of species reported in the catch. In 1996, there were 63 new species added to the cumulative list of recorded species catches in this fishery (Fig. 2). Where there were approximately 50 species reported annually from this fishery in the early 1990s, this increased to almost 140 species reported annually since the establishment of 100% observer coverage.

In addition to recording weights of species catches, observers also collect size frequency samples of the catches. With a carefully designed sampling protocol to ensure representative coverage of the catch, it is possible to obtain estimates of the size frequency of the total catch of a given species in a given time period and area. The landed portion of the catch is also sampled at dockside. Again, with a similar attention to sampling protocols, it is possible to estimate the size frequency of the landings. It is then possible to estimate the numbers and size frequency of the discarded portion of the catch by subtraction. An example is shown in Figure 3 (Sinclair & Starr, 2005).

Detailed observer data on the location of fishing and species composition of the catch can be matched with additional data on the composition of the substrate and oceanographic conditions to form a more detailed description of fishing strategies. Sinclair *et al.*, 2005 overlaid maps of fishing and geologic data to reveal an affinity of fishing to areas covered by sands and gravels and an aversion to areas dominated by exposed bedrock, thin sediments over bedrock, and glacial till. Species-specific affinities to different sediment types were also demonstrated. Areas of high fish density occurred along frontal zones, the steep sides of banks, and across one of the three main troughs on the BC central coast. These are areas with high tidal energy, good nutrient supply, and opposing surface and near-bottom currents which allow zooplankton to hold position by vertical migration.

One of the greatest advantages of a well designed observer program with a high level of coverage is that there is considerably less controversy regarding data accuracy when it comes to analysis for stock assessments. It is much more difficult to verify traditional fisheries data than observer data. The level of detail is much higher for observer data. When observer data are used in stock assessments, it is recognised by all parties involved that these are about as accurate a picture as one can obtain of fishing operations. This results in an enhanced feeling of trust among all involved in the analysis and review of stock assessment results.

Questions & Panel Discussion – Opening Session (Part I) –

Paul Parker (Cape Cod Commercial Hook Fishermen's Association) to Alan Sinclair

Comment / Question:

I'm not familiar with the integrated groundfish plan but I was curious as to how some of the information on bottom types and tow tracks were generated.

Response:

Alan Sinclair – The data on bottom type came independently from the geologists and the observer data was provided by the at-sea observers. The bottom-type information was collected by the Geological Survey of Canada over a number of years using a combination of techniques (e.g., bottom grabs, seismic scanning, side-scan sonar) and then plotted on interpretative maps as polygons – we then overlaid the fisheries data on top of that. I took the start and end point of the tow and distributed the fishing effort and catches along that vector over a spatial grade of 1km^2.

Howard McElderry and Teresa Turk (IFOC Steering Committee)

Comment:

There is a large map on the wall just outside the theatre which is entitled "where in the world are you observing?" We would like everyone to identify where their programs are located on the map and then we will create these into GIS coverages. We'll put this information on the web site after the conference so we can see where fisheries observer programs currently are and we'll update it as new observer programs come on line.

Observe locally, think globally: addressing the growing responsibilities of fisheries

John Boreman

Director, Office of Science and Technology
National Marine Fisheries Service, Silver Spring, MD – USA

Background

The United States National Marine Fisheries Service (NMFS) implemented two fisheries observer programs during the early 1970s that addressed the increasing concern over conservation and management of the Nation's marine resources. The first U.S. mandatory observer program began in 1972 with placing observers onboard tuna purse seine vessels in the Eastern Tropical Pacific to monitor by-catch of dolphins. A second federal observer program was initiated in response to concerns over foreign fishing activities in the North Pacific. The primary purpose of observers was to determine incidental catch rates of Pacific halibut in groundfish catches and to verify catch statistics in the Japanese crab fishery.

The passage of the *Magnuson Act* in 1976 had a huge impact on domestic fishing activities. It established a 200 mile zone of exclusive fishing rights (later called the Exclusive Economic Zone or EEZ). The focus of fisheries management shifted away from monitoring the activities of foreign fishers to growing domestic fisheries and phasing out the access of foreign nations (commonly referred to as the 'Americanisation' of fisheries). At the same time, the *Magnuson Act* provided NMFS with the authority to place observers on all U.S. vessels fishing for species subject to a fishery management plan (FMP) that requires observers for the purpose of collecting data necessary for the conservation and management of the fishery.

As foreign fisheries were phased out, some observer programs transitioned from foreign programs to domestic and continued collecting the same kinds of information. Many new domestic observer programs were established to monitor interactions with sea turtles and marine mammals. Many of these programs were established independently with little guidance, coordination, or 'lessons learned' from other observer programs.

With the continued propagation of observer programs throughout the country and having vastly different standards for eligibility, training, safety, data management, insurance, the National Observer Program (NOP) was created in 1999 along with an advisor team represented by an observer program manager from each region and called the NOPAT (National Observer Program Advisory Team). The task of the NOP and NOPAT was to harmonise policies and strive to create consistency in how NMFS conducts and executes its observer programs.

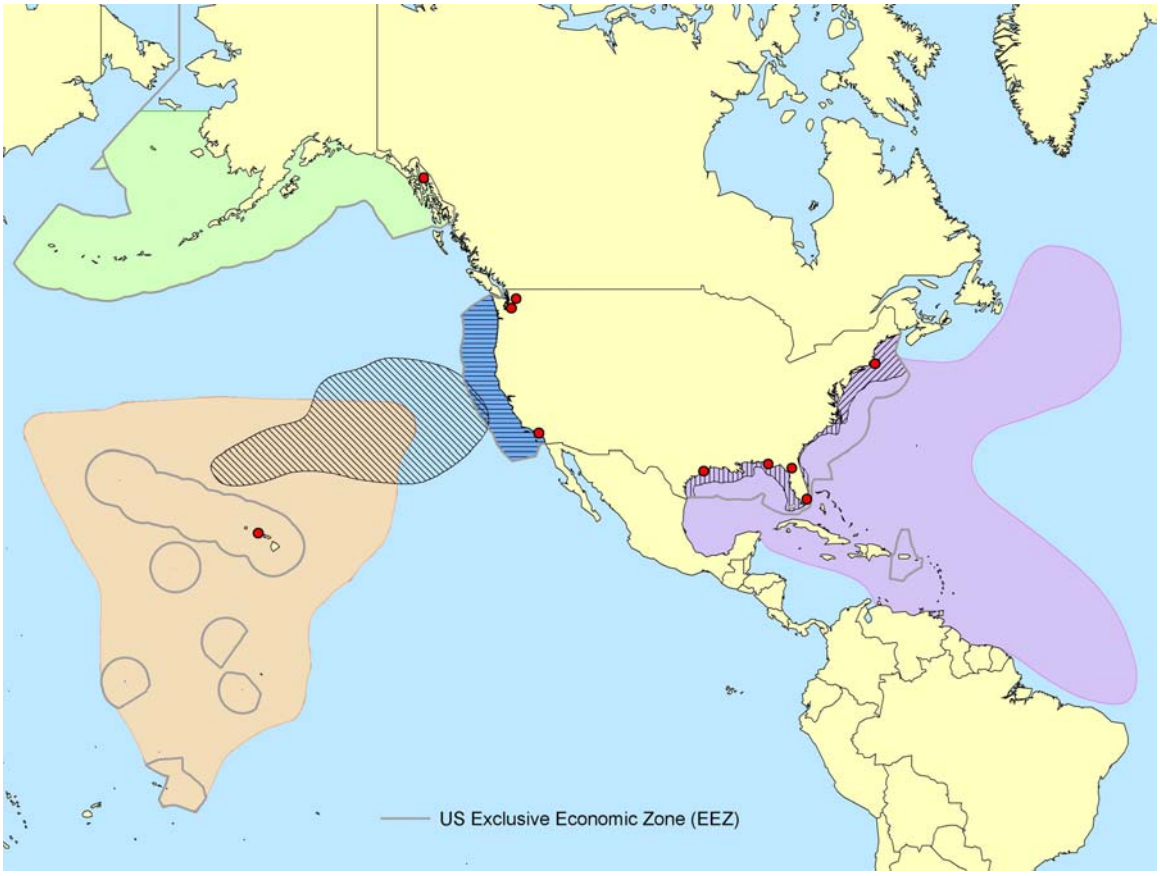
Current U.S. observer programs

The *Magnuson Stevens Act* (MSA) authorises NMFS to place observers onboard any fishery that has a fisheries management plan. MSA provides jurisdiction over fisheries operating in federal waters between 3 and 200 miles from shore. The National Marine Fisheries Service also has the authority under the *Marine Mammal Protection Act* to require observer coverage. Currently NMFS is in the process of finalising a regulation that would allow us to place observers onboard any vessel that is fishing in an area that may encounter sea turtles under the *Endangered Species Act*. NMFS anticipates having this authority within the next 3 – 6 months.

Currently, United States observer program goals emphasise by-catch monitoring, catch estimation, and biological sampling. These programs are funded by a combination of federal and industry monies totalling approximately $44M/year with industry providing approximately $13M for observer coverage for Alaska groundfish, West Coast hake, and the Northeast scallop fishery. United States fisheries observers are hired primarily through permitted or contracted service providers with over 500 observers deployed annually in 42 fisheries that amount 63,000 observed sea days per year. Observer coverage levels average about < 20%, with exception of North Pacific. Currently in the North Pacific, observer coverage is based on vessel length requiring 100% observer coverage on vessels 125 ft or larger, 30% coverage per quarter for vessels 60 – 125 ft and no coverage for vessels less than 60 ft.

U.S. observer coverage is present throughout the U.S. EEZ and international waters in the Atlantic and middle of the Pacific (Fig. 1). However, not all fisheries have observer coverage onboard in these seas. Observer programs are administered in each of the six NMFS regional office (Red dots, Fig. 1 indicate where our regional observer program offices are located). In Seattle, the Alaska Fisheries Science Center manages the North Pacific Groundfish Program and the Northwest Fisheries Science Center manages the West Coast Groundfish Observer Program and At Sea Hake Observer Program. The Alaska Marine Mammal program office is located in Juneau, AK. The California Oregon pelagic driftnet and California Longline is located in Long Beach, CA. Three programs are located in the Gulf of Mexico area: Galveston, Texas for shrimp and reef fish, Panama City, Florida for shark bottom longline and drift gillnet, and Miami, Florida manages the Pelagic longline observer program. Observer programs that monitor scallop and groundfish species in New England and the mid-Atlantic are located in Woods Hole, Massachusetts.

Observers are our 'eyes and ears' out on the water and most of the time there is no other way to record key information on by-catch species encountered during the fishing operation. Observers also provide a means for verifying fisheries data collected from other sources, such as fishery logbooks and landings reports; provide high quality fisheries, environmental, and socio-economic data for fisheries science and management; and monitor compliance with fisheries and other environmental laws and regulations. In addition, U.S. observers also represent NMFS to fishermen and are a sounding board for concerns and ideas. Observers also assist NMFS with research projects such as the collection of biological samples for stock assessments and genetic research, tagging of released animals, and assisting in research activities between deployments.



In the past, U.S. observer programs have provided assistance in international activities by serving as the principal international sponsor of this International Fisheries Observer Conference and hosting the very first (U.S. only) conference in Galveston, Texas in 1993. NMFS has also provided observer training assistance and materials to other countries (e.g., Korea, Papua New Guinea, Micronesia, Japan, Republic of Palau, Republic of Marshall Islands, and Federated States of Micronesia). In many cases, representatives from these nations have attended U.S. training or sometimes U.S. trainers have provided training or assisted with training in other nation's observer programs.

More recently, the U.S. has provided International Convention for the Conservation of Atlantic Tuna (ICCAT) with the U.S. draft contracting template, other U.S. best practices such as safety information and requirements, and consulted with ICCAT throughout the design and implementation of their transhipment observer program. The U.S. has also provided funds to other countries to assist in paying for observer salaries and other expenses associated with administering observer programs, such as Ghana.

Not only has the U.S. provided administrative and training expertise, but also at sea participation by placing observers onboard Japanese, Korean and Taiwanese vessels from 1989 – 1991 in the High Seas driftnet observer program. During 1998 – 1999 three U.S. Southern bluefin tuna observers were placed onboard Japanese vessels. Japan requested observers from other countries to monitor a scientific survey. Most recently in 2006, Kevin Bailey from the Pacific Islands Regional Observer Program assisted Spain and other EU nations with turtle dehooking techniques and other by-catch reduction technology.

The United States will continue to provide training or some training assistance to the countries for help in improving or initiating the development of an observer programs**.** In addition, the U.S. anticipates continuing to work with ICCAT as the tuna transhipment observer program develops. If this program is successful, it is anticipated that the program will expand to cover all 5 tuna Regional Fisheries Management Organisations (RFMOs) world wide with respect to the transhipment of tuna. The benefits of such a program as this are that observers would not have to disembark/embark once the vessel crossed into a new ocean that is managed by a different RFMO. Cost savings will be available due to economies of scale in terms of training, logistics, data standards, and data warehousing.

The recently reauthorised *2006 Magnuson-Stevens Act* now seeks to address Illegal Underreported and Unregulated (IUU) fishing and by-catch of protected Living Marine Resources (LMRs) through definitions, publication of a biennial report on international compliance, and the establishment of certification procedures. Observers are a very critical element to this activity. Many countries do not have sufficient observer coverage to document their by-catch of fishing operations and may have poor catch tracking systems. The U.S. is interested providing technical and other forms of assistance to improve monitoring and control of marine resources. Our cooperative and collaborative efforts with other nations will also strengthen our RFMOs that monitor highly migratory species and straddling stocks.

The International Fisheries Observer Conference provides an excellent opportunity to collaborate and develop standards for all observer programs throughout the world's oceans. It is a challenging proposition to obtain consensus from each program within one country, much less 40 different nations of the world. There is considerable need to combat IUU fishing by increasing providing good catch and by-catch information and reporting those values. This conference serves as the venue to develop those standards that can allow a better global view and analysis of fisheries information especially for highly migratory and straddling stocks. Three working groups have been established to address these key issues (training, safety, and professionalism) at the conference and intersessionally. The working groups provide the engine to investigate and create standards for this conference and the observer community to adopt.

The U.S. advocates the development of baseline international standards for:

Safety: According to U.S. Labour statistics, fishing is the 3rd most deadly occupation in the United States. Observers are exposed to almost the same risk as fishers and need to be provided

with the best safety training and gear as possible.

Training: If observers are not trained well in all areas, they cannot collect high quality data.

Conflict of Interest (observer and provider): If observers or their employers have a financial stake in the outcome of the data, they may be discredited and their findings discarded.

Observer Conduct: Must be above reproach. By providing incentives to remain in a program, observers will be more invested in conducting themselves in a professional manner.

Statistically-based coverage levels if it is a scientific program: We must do the research and be able to analyse if the coverage rate is adequate and our sampling and observer deployment operating procedures are as unbiased as possible. The U.S. has reviewed our vessel selection and deployment strategy to ensure that they are as unbiased as possible. The U.S. has also established that a 30% CV produces is a minimum level of information that can be used in assessments and is considered 'adequate'.

Defining 'sea day' or 'coverage day': We need to develop common definitions of what comprises a sea day or a coverage day for the purposes of comparison across fishery and across nations and to ensure sufficient coverage for scientific or enforcement purposes.

Data standards: The more we are able to be consistent with data collection fields, the less we have 'gaps' in our information and the less we need to assume or use proxies to translate this information into other formats for further analysis. A good example of recent efforts is a result of a pre-conference workshop at the 2004 IFOC on 'Best Practices for the Collection of Longline Data to Facilitate Research and Analysis to Reduce By-catch of Protected Species'.

Observer remittance: High turnover in the observer community leads to additional training costs and may lead to lower data quality and higher injury rates.

KEYNOTE PRESENTATION

Evolving goals, changing structures and increasing significance: Fisheries observer programs in the XXI century

Martin A Hall

Inter-American Tropical Tuna Commission – USA

I have worked for over 23 years in the mitigation of by-catch problems, and from the very beginning it became obvious to me that observer programs were a necessary ingredient to achieve solutions. The fact that we have won a few battles makes me an optimist: we are learning how to fight them; conservation NGOs and fishers are evolving; and we are cooperating across the planet, as this conference shows, thanks in part to the generosity of Canada.

We have learnt that to solve by-catch problems we need to involve the fishers, and that observers play a critical role for this. We are learning to work with the fishing communities. My experience is based in two very different situations: working with purse seine skippers and crews to reduce dolphin mortality in the tuna fishery of the eastern Pacific (an industrial fleet with high technology), and working with artisanal longline fishers from the same region (very large numbers of small scale boats, low technology).

In both cases I understood that the information needed to figure out why by-catch happened, and how to tackle it must be obtained through observer programs designed with that purpose in mind: not just counting dead animals, but searching for the causal factors of the problem.

By-catch is always the product of two components: the level of effort, and the average impact caused by each unit of effort. That gives us a simple system with two levers to control the problem: fishing less or fishing better. Fishing better frequently implies technological or operational changes, management actions, performance requirements, etc. Observers or in some cases electronic monitoring systems are needed for implementing and evaluating the effectiveness of most of them. In the tuna-dolphin case, observer data were critical to identify the large number of factors that contributed to dolphin mortality, and to design a management program that could deal with them. Dolphin mortality was reduced to less than 1% of the initial level, and the dolphin populations appear to be recovering, in spite of the continued effort on tunas associated with dolphins. After years of conflict, the different stakeholders came around to an agreement that has been in place for over a decade, guaranteeing the low levels of mortality.

In the case of the incidental mortality of sea turtles in longlines, we have used the previous experience to encounter and develop an implementation strategy based on a multi-sectorial, regional, bottom-up approach. We have facilitated the test of alternative technology, implemented an observer program, worked on improving the release of captured turtles, and in general, tried to engage the fishing communities in the task. The program has expanded from Ecuador, where it started, to practically the whole coast of America, from Mexico to Peru, building a network of connected programs, sharing information, materials, and experience. Exporters and fisher's cooperatives from Ecuador, together with their government authorities took the initiative for the program. Conservation organisations such as WWF, joined the program enthusiastically, and took a leading role in the organisation and support of the program. The Ocean Conservancy, Defenders of Wildlife-Mexico, and many other national conservation groups have also joined, in what is now a full regional network of researchers and organisations,

strongly connected to the industry and fishers groups, and with the support of the fisheries authorities from the countries. NOAA from the U.S. contributed technical and scientific support to launch the program, and it has steadfastedly continued to do it. The Overseas Fishery Cooperation Foundation of Japan has also made significant contributions of scientific and technical knowledge, and economic support, and they are another critical participant.

To develop a program involving all the sectors, we adopted a simple set of premises: (i) "*Nobody wants to kill sea turtles or drive them to extinction*"; and (ii) "*Nobody wants to put fishers out of work*". Organisations that share those premises can join us in our efforts to find an inclusive solution to the problem that doesn't leave the fishing community out.

The extensive observer program, now exceeding 1,000 trips in the region, is showing us that in most fisheries, the alternative technology tested, the circle hooks, reduce sea turtle hooking rates by a very significant amount, without negative effects on the target catch rates. The first 100 boats have made a permanent switch to the proposed hook. Our observers are adding, as usual, a wealth of observations, suggestions, and new ideas to test, while they work as a fluid conduit to get feedback from the fishing boats.

With the priceless cooperation of the fishers from the region, we are performing a series of experiments to test other hook designs, sizes, and shapes, to reduce entanglements of turtles in the lines, and to develop and improve the instruments and techniques to release the hooked or entangled sea turtles. We recently invited an experienced veterinarian, who has treated many hooked turtles in the Mediterranean, to review, with our observers, and the fishers, the instruments and techniques used in the removal of hooks and entangled lines, in the recovery of turtles, etc. The review was performed at sea, in the normal operating conditions that observers or fishers would have to perform the same tasks. Once again, the experience of the observers was critical. They had developed their own techniques, and had become very effective in the removal of hooks.

The contrast between these two programs helps to understand the evolution of the subject and of the players. The sea turtle program has had from the very beginning the support of the industry, and as such it grew as a voluntary program. As the conservation NGOs became a driving force, the program developed a high degree of transparency, coming from the shared purpose of understanding why by-catch happened in order to mitigate it. Stridency and antagonism have been replaced by a constructive relationship, that matches the knowledge and expertise of the fishers, with the motivation, resources and communication skills of the conservation NGOs, and it is supported by the technical knowledge contributed by NOAA, IATTC, and OFCF. The support of the governments adds the legal framework for the future regulation, when the right ('right' from the point of view of the turtles and of the fishers) mitigation gear is determined. The observers have a key function, in the centre of this matrix. The function of these observers has a strong component of education, and outreach. They are helping train the fishers to release the turtles, at the same time they are keeping them aware of the need to do so.

In the future, observer programs should include mechanisms to maximise the observer input to the program, and a channel for creative ideas, suggestions, etc. The role of the observer as a connector, and their participation in outreach activities will replace the simple monitoring approach. Optimal combinations of observers and electronic monitoring would contribute to increased sample size, and lower costs.

Questions & Panel Discussion – Opening Session (Part II) –

Joachim (Yogi) Carolsfeld (World Fisheries Trust)

Comment / Question:

I was wondering about those small boats where you have three fishing people plus an observer onboard – is there a trend towards training up the fishing people so they don't need an observer onboard or vice versa?

Response:

Martin Hall – The observers help the fishers in every way they can but their first rule is not to get in the way of the fishers. The operation is automated and I don't think the fishers can reduce the number of people onboard (for instance, they need someone to drive the boat and another to bait the hooks). We don't want fishers to be careless in their fishing operation at the cost of writing something down and we also don't want the observers to lose information. We're trying not to ask the fishermen to do too much but also ensuring that the observers produce a solid database.

Paul Parker (Cape Cod Commercial Hook Fishermen's Association)

Comment / Question:

Where would you start if you lacked a consensus from industry that there was a problem? For instance, if industry did not acknowledge that there was a by-catch problem?

Response:

Martin Hall – We hold a lot of workshops with fishers to talk about the issues (there could be anywhere from 6 to 200 fishers in the room) and we always get acknowledgement from the fishers that something is happening. For instance, we know that in some cases fishers are living on the economic edge and they need to recover their hooks from inside the turtles and this is not always to the benefit of the turtles – we tell these fishers that we know it happens and they accept it. Sometimes there is a perception issue, for instance, someone might say that they only get one or two turtles a year and so there is not a problem. In these cases, we try to modify their perception by explaining to them that there could be up 10,000 boats in the region and if every boat caught just one turtle a year, then it **is** a problem.

Bob Branton (Ocean Biogeographic Infomation System)

Comment / Question:

You showed that there was a reduced efficiency on the target species when you used the new circle hooks. Do the fishers want to fish more hooks as a result of this and does that have an effect on the by-catch?

Response:

Martin Hall – The circle hooks may catch more of some species and less of others, but we have not seen statistically significant differences between the circle hooks and J-hooks yet. However, in Ecuador and Peru during the mahi-mahi season, circle hooks catch significantly fewer mahi-mahis, and this difference is caused by the fact that J-hooks are better at catching smaller-sized mahi-mahi than the circle hooks. Furthermore, even though the fishers cannot sell the smaller fish on the export market, they do not want to give up the fish and so they take it home for food (everything that is caught in these fisheries is used – there is no discard of any kind). Fortunately mahi-mahi are very fast growers and have very high reproduction, but it is a waste that they are being caught when they are too small when they could be taken at larger sizes and sold on the export market. In this particular case, we are trying to come up with a solution that does not involve catching the small fish but still has similar value for the fishers. The problem is further complicated though because a small fish that is caught in one country can grow to market size and be caught in another country and the fishers would rather take the small-sized fish than let somebody from another country catch it when it is bigger.

SESSION P1

What are the reasons and objectives for monitoring a fishery?

Moderator:

Howard McElderry	*Archipelago Marine Research Ltd. – Canada*

Speakers:

Bruce Wallner	*Australian Fisheries Management Authority – Australia*
Prabhath Patabendi	*Institute of Human Development & Training – Sri Lanka*
William Karp	*NOAA – Alaska Fisheries Science Centre – USA*
Michel Vermette	*Department of Fisheries & Oceans – Canada*
Bruce Turris	*Pacific Fisheries Management Inc. – Canada*
Gordon Gislason	*GS Gislason & Associates Ltd. – Canada*

Adaptive real-time management of southern bluefin tuna by-catch in the eastern Australian pelagic longline fishery using fishery observers

Bruce Wallner*, Steve Auld, Gavin Begg, L. Kranz and J. Webb

Australian Fisheries Management Authority – Australia

Fisheries observers may be used to monitor fisheries for a range of reasons. These include:

- Collection of data for assessment of stocks;
- Validation of information;
- Implementation of science programs;
- Industry extension and training;
- Reporting on compliance with regulations;
- Determining interaction rates with protected species;
- Measuring by-catch; and
- Facilitating fishing opportunity by minimising risk.

Fishery monitoring information collected by fisheries observers usually becomes available to scientists and managers after considerable time lags. However, adaptive management of by-catch can require access to information in close to real time. The management of Southern Bluefin Tuna (SBT) catches by longliners off the east cost of Australian is an example of this type of real-time management.

SBT is an overexploited pelagic tuna species. The global harvest is limited to a TAC set by the international Commission for the Conservation of Southern Bluefin Tuna. The Australian share of the global harvest is tightly regulated by a quota system. Restrictive quotas have caused a problem of high levels of SBT discarding by some longline vessels. This problem occurs seasonally during winter when large SBT migrate up the Australian east coast and longline vessels encounter high abundance of SBT during their target fishing operations for yellowfin, bigeye and billfish. There are a number of high risks associated with this fishery:

- Risk of industry exceeding allocated quotas and breaching the TAC;
- Risk of discarding and high-grading to avoid exceeding quotas;
- Risk to SBT population from over-harvesting.

The management solution to address these risks is to limit fishing access to waters with high SBT abundance by fishing vessels holding little or no quota. This is a controversial management policy as it severely restricts industry access to

* When an abstract has multiple authors, an asterisk is used to indicate the author that presented the paper at the conference.

other species and can impose an economic and social burden as vessels are forced to migrate northwards seasonally to seek open waters to continue to fish. Hence, the seasonal SBT closures are implemented in a complex regime of dynamic spatial closures. The closures are designed to maximise the waters open to fishing, but minimise the risk of high levels of SBT by-catches. The closures change through time in response to oceanographic conditions. A predictive model to determine the likelihood of SBT occurrence has been developed by the CSIRO using sea surface temperature and identification of thermal fronts. Three zones are defined based on the probability of SBT occurrence and the model output is a coloured map of these three probability zones – an OK zone where probability of SBT occurrence is up to 5%, a buffer zone where probability of occurrence up to 15% and a core zone where the probability of occurrence is up to 80% (see Fig. P1.1). Closure arrangements based upon the model outputs are validated using fishery observer data and continually refined. The model is run every two weeks and observer data are used at daily intervals to make adaptive changes if required.

In summary, the monitoring of SBT by-catch in the Eastern Australian pelagic longline fishery is an example of integrating observer monitoring data and science for adaptive management that balances the risks to compliance and fish stock sustainability while maximising fishing opportunity. This approach is resource-intensive and places high demands upon the observer program however benefits are judged to outweigh these costs.

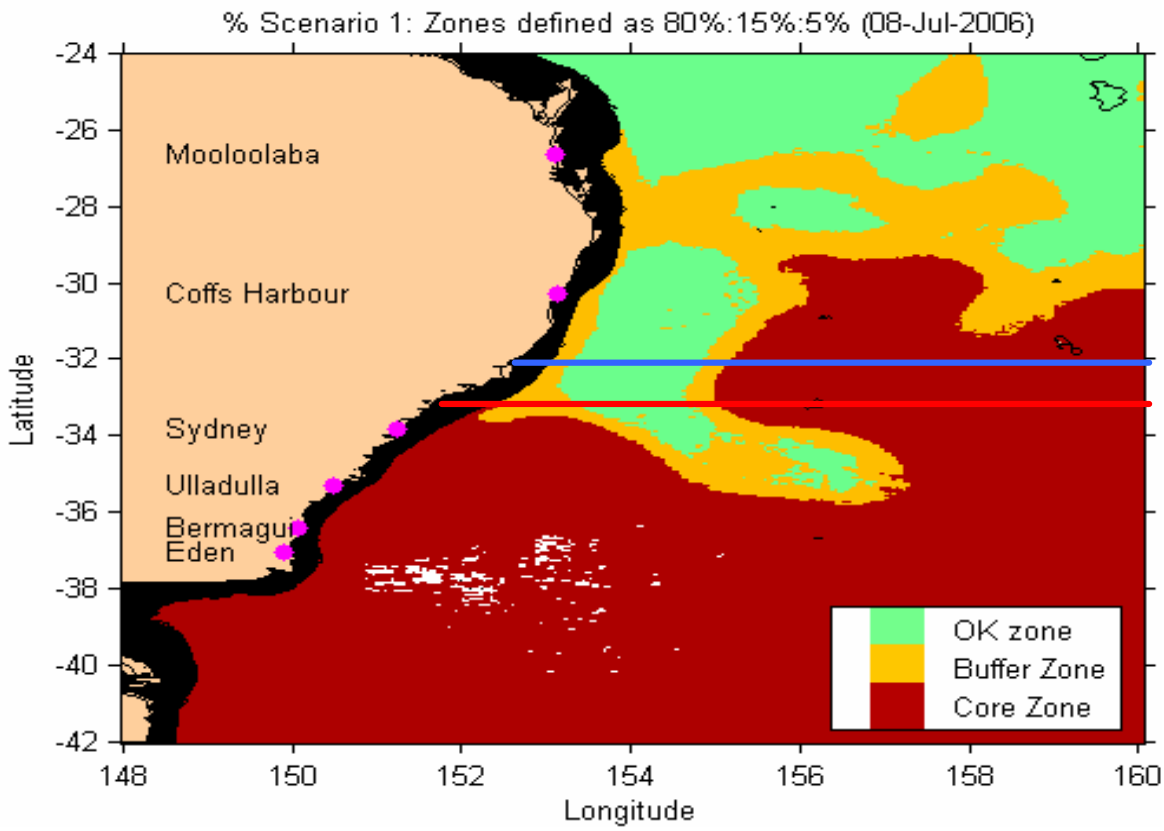


Figure P1.1: *Example of SBT predictive model output.*

Monitoring and observation of fishery in Sri Lanka – a case study

Prabhath Patabendi

Institute of Human Development & Training – Sri Lanka

Sri Lanka's coastline circles along about 1,585 km of sandy beaches, extensive lagoons and estuaries, mangroves, coastal marshes and dunes. It is an island with a land area of 6,570,134 ha and supports highly productive marine ecosystems such as fringing coral reefs and shallow beds of coastal and estuarine sea grasses. The biodiversity of coastal and marine ecosystems provide over 65% of the animal protein requirement of the country. The coast is home to a third of the population and the highly productive ecosystem is an important base for the country's growth. The coastal zone accounts for nearly 80% of fish production. However, with the rapid increase in effort and an open access regime, fishing in coastal areas has become difficult with low catches and fishing rights conflicts. A large proportion of marine fish stocks are fully exploited, over-exploited, depleted or in need of recovery. Sri Lanka recognised that reducing fish stocks to biologically and ecologically harmful levels will result in loss of potential benefits as food, income, or employment, both immediate and in the long-term. Therefore Sri Lanka has recognised that monitoring and observation of fisheries is very important for her economy and its people in the long run.

The fisheries sector plays a key role in Sri Lanka's social and economic life. Fish products are an important source of animal protein for the population and the sector contributes about 2% to GDP. Exports of fish and fishery products was 13,680 t and valued US$ 94.3 million in 2004, while imports of fish products (mostly dried and canned) amounted to 67,284 t, valued at US$ 59.4 million. From an economic viewpoint, there is significant scope for increasing the level of contribution from the sector through increased output, exploiting the potential for value addition and import substitution.

The fisheries sector of Sri Lanka consists of three main sub-sectors, namely coastal; offshore and deep sea; and inland and aquaculture. These three sub-sectors employ around 250,000 active fishers and another 100,000 in support services. This workforce represents a population of some one million people.

On the basis of resources studies carried out in the past, annual sustainable yields from the coastal sub-sector have been estimated at 250, 000 t, consisting of 170, 000 t of pelagic species and 80 000 t of demersal species. The actual reported coastal fish production in 2004 was 154, 470 t. About 610 species of coastal fish have been reported from Sri Lankan waters, of which the more common species caught are *Sardinella* spp., *Amyblygaster* spp., *Rastrelliger* spp., *Auxis thazard*, *Anchova commersoni* and *Hirundichthys coromandelensis*. Most of these species live near the surface or high in the water column (pelagic species). These small pelagics account for about 40% of the coastal fish catch.

Though there are no comprehensive resource studies available for offshore and deep-sea areas, about 90 species of oceanic pelagic species of fish have been reported from Sri Lankan offshore and deep-sea waters. *Katsuwonus pelamis* and *Thunnus albacares* dominate the large pelagic catches. Moreover, it has been reported that about 60 species of sharks live in the oceanic waters off Sri Lanka. Some of the more common shark species are *Carchanius falciformis*, *C. longimanus*, *C. malanopterus*, *Alopices pelagicus*, *Sphyrnee zygaena* and *S. leveni*. About 215 demersal species have been reported from the oceanic waters around Sri Lanka. The commercially important, larger species are *L. lentjan*, *L. nebulosis*, *Lutjanus* spp., *Pristipomoids* spp. and *Epinephelus* spp. Some surveys have indicated that surface tuna schools are available in areas offshore from the west, south and east coasts, with higher concentrations of fish within the 60 to 70 km range from the shore. Skipjack and yellowfin tuna have dominated the catches.

In Sri Lanka, output control tools such as total allowable catch (TAC) limits, individual transferable quotas (ITQs) or non-transferable quotas have not yet been introduced. A significant characteristic of the fishing industry in Sri Lanka is that it has always been dominated by the private sector. Except for a handful of boats owned by cooperative societies or by the very few companies, the fishing boats and gear deployed in the industry are owned and

operated by thousands of individual fishers, family units or informal groups.

The fishing industry plays a major role in providing the animal protein so important in the diet of the Sri Lankan population. According to the Food Balance Sheets (Department of Census and Statistics), fish has consistently contributed around 65% of the animal-based protein intake of the population. In recent years, the fisheries sector has also emerged as an important source of foreign exchange through the export of several items of high value fish and fishery products, such as chilled and frozen tuna, and other marine products such as shrimp, lobsters, shark fins and sea cucumber. Starting from a low level in late 1970s, the total value of fishery-based exports has been continuously on the increase and reached a level of US$ 90 million in 2004.

This paper analyses the present status of the fishery monitoring and observation activities in Sri Lanka including challenges and obstacles and lessons learned during the operation.

By-catch management and north pacific groundfish observers: what have we learned?

William A. Karp

NOAA, Alaska Fisheries Science Center – USA

In the Bering Sea/Aleutian Islands (BSAI) groundfish fisheries, by-catch is managed through a complex suite of regulations that prohibit retention of some species at all times, establish maximum retainable species-specific by-catch allowances in target fisheries, and specify incidental by-catch allowances. Some by-catch species are designated as 'Prohibited Species Catch' or PSC because they are not considered to be groundfish and are harvested by fleets managed under different regulations. These include salmonid species and Pacific halibut. Retention of PSC by vessels fishing for groundfish is prohibited and regulations require fisheries to be curtailed or relocated when by-catch of some of these species exceeds specified levels. PSC by-catch rates are determined from catch composition data submitted by fisheries observers.

Walleye pollock is the most important target species in the Alaska groundfish complex in terms of catch value and quantity and is the target species for one of the world's largest fisheries. All directed pollock fishing employs large mid-water trawls. While this minimises the impact of fishing on habitat and limits by-catch of demersal species, it does not mitigate the potential for incidental capture of salmonids, which are generally distributed in the pelagic zone. This fishery was managed in an 'Olympic' style until 1999 when legislation rationalised the fishery and resulted in the establishment of fishery cooperatives which received permanent quota allocations. The industry manages salmonid by-catch through a process that depends on near real-time data provided by observers and this process has improved markedly since rationalisation.

The multi-species demersal catcher-processor fleet consists of approximately 26 vessels that harvest a range of flatfish, rockfish and other species. These vessels range from 30 m to 76 m length overall and, because of their size, processing on most of them is restricted to heading and eviscerating of fish, thus they are commonly referred to as the 'head and gut' fleet. When vessels from this fleet target flatfish, Pacific cod and some rockfish species, halibut by-catch is not uncommon. Even though significant changes in the management of the fisheries are under consideration, rationalisation has not occurred and 'Olympic' style fisheries continue. Since halibut PSC is often limiting, fishery participants have employed a range of tactics to reduce these by-catch rates. However, changes in fishing behaviour likely to reduce halibut by-catch generally result in reduced target species catch rates and this is especially problematic in fisheries that are not rationalised. Deliberate interference with observer sampling to reduce apparent halibut by-catch rates has been documented on some vessels in this fleet.

Observer sampling bias is always of concern, but incentives to influence observer sampling by pre-sorting, or changing fishing behaviour when observers are aboard may be especially problematic when by-catch is limiting. Furthermore, as the scale of fishery management progresses from the fleet level to the cooperative or individual vessel level, incentives to bias observer sampling to maximise fishing opportunities may increase. Conversely, some problems may be mitigated by fishery

rationalisation which slows down the race for fish and opens up some opportunities for participants to effect by-catch reduction through collective action, such as relocation of fishing effort, which may be guided by reliable observer data.

The BSAI walleye pollock and multi-species demersal trawl fisheries provide good examples of successful and unsuccessful PSC by-catch management measures and an opportunity to evaluate the role of observers in by-catch monitoring and management.

Fishery monitoring objectives – the fisheries management perspective

Gerry Sullivan

Fisheries & Oceans Canada – Canada

[Note: this presentation was given by Gerry Sullivan on behalf of Michel Vermette (VermetteM@dfo-mpo.gc.ca)]

Abstract

Fisheries Management objectives for monitoring fisheries are quite distinct from those of the scientific community. They are in large part related to enforcement and fisheries management planning in the context of broader planned conservation and protection outcomes relevant to fisheries sustainability. Fishery monitoring from a pure fisheries management perspective is based on key risk-based indicators (whether biological or socio-economic) in the context of a broader fisheries sustainability strategy founded largely on the precautionary (PA) and ecosystem (EA) approaches. Utilising 'actionable information' gleaned from its ongoing monitoring activities, Fisheries & Oceans Canada (DFO), as part of its annual Integrated Fishery Management Plans (IFMPs), establishes monitoring and related coverage priorities and strategies.

On April 12, 2007, the Canadian Minister of Fisheries & Oceans announced that multi-dimensional annual fishery sustainability reports would be developed reflecting a balance of key PA and EA considerations. Selected monitoring methodologies and practices are a function of a broad array of available techniques and integrated tools applied in a balanced and complementary fashion and adjusted in-season as required. The generation and interpretation of timely and quality monitoring information (actionable information) expedites resource management planning and the targeted deployment of enforcement resources for timely management and operational action. These reports will also ultimately assist consumers to understand sustainability of Canadian fisheries.

Introduction

Section 6 of the proposed new *Fisheries Act* stipulates that the Minister and every person engaged in the administration of the Act and regulations must take into account principles of sustainable development and the ecosystem approach in the management of fisheries and in the conservation and protection of fish and fish habitat; and must seek to apply a precautionary approach such that, if there is both high scientific uncertainty and a risk of serious harm, they will not use a lack of adequate scientific information as a reason for failing to take, or for postponing, cost-effective measures for the conservation or protection of fish or fish habitat that they consider proportional to the potential severity of the risk.

Historically, Canadian fisheries management has been guided by a multitude of mostly complementary management frameworks including the Precautionary Approach, policies specific to target by-catch and forage species, international agreements, court decisions, social and economic viability and legislation such as the *Species at Risk Act* (SARA).

However, to date there has existed no single or over-arching strategy or model to integrate these management drivers in such a way as to maintain a concerted and consistent focus on the end vision or goal, that being an economically viable and sustainable fishery. Such an overarching framework would assist in:

- Consulting with fishery stakeholders, developing incentive strategies and securing support and commitment;
- Reporting on performance internally and externally;
- Encouraging more transparent decision-making;
- Meeting international certification requirements for fisheries; and
- Meeting commitments reflected in the renewal of the *Fisheries Act*.

This paper focuses on the design and implementation of effective Fishery Sustainability Reporting mechanisms critical to the success of an over-arching sustainability strategy.

Key message

An overarching and integrating fisheries sustainability strategy is required in order to integrate and maximise the collective effects of a multitude of historically-applied fisheries management frameworks, and in particular the precautionary approach (PA) and the evolving ecosystem approach (EA). Combined, the PA and EA are fundamental to achieving the strong conservation objectives envisioned by DFO's Fisheries Management Renewal initiative.

Critical to the success of such an integrated regime will be the processes and tools put in place to monitor and evaluate progress and to identify gaps in implementation relevant to sustainable development objectives and strategies. Control processes will need to be in place to identify gaps between stated objectives and the application of policies and programs designed to meet those objectives. As a minimum, this process should include an assessment tool or checklist that can be applied to all fisheries, containing a comprehensive set of questions regarding the effective implementation of polices and programs as they are intended, lending itself to aggregation for a total overview of the state of Canada's fisheries.

Conclusions

Truly actionable information requires timely and accurate data on the conduct and performance of the fishery, the integration of data from multiple sources such as the fishing industry, dockside monitors and onboard observers, and DFO sources (licensing, compliance, science, etc.). It will require tools to allow information to be rapidly and easily accessible by all parties, strengthening existing and developing new collaborative fora, and finally a much better understanding of fish as part of the ecosystem, and of fishing's impacts on the ecosystem.

Ultimately, fishers and fish consumers will benefit from an ocean to plate approach to developing and using actionable information.

Reasons and objectives for monitoring the British Columbia groundfish trawl fishery

Bruce T. Turris

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Abstract

The author discusses the objectives for catch monitoring from a fishery management and commercial industry perspective; where those objectives are similar and where they differ; and how have those objectives changed over time.

Reasons for monitoring a fishery

- Improve resource sustainability.
- Maintain or increase market access.
- Provide for fair and equitable access to the resource.
- Greater accountability to the public.

Objectives for fishery monitoring

- Comprehensive harvesting information.
- Accurate catch and mortality information.
- Timely information and communications.
- Compliance.
- Traceability.
- Operational flexibility.

Varying levels of monitoring

- The level and type of monitoring depend largely on the management requirements of the affected resources and the economics of the fishery:
  - Single coast-wide stock versus multiple area stocks.
  - Multi-species versus single species.
  - ITQ versus Olympic fishing.
  - Ecosystem management.

BC Groundfish Bottom Trawl Fishery

- Multi-species fishery (approximately 60 different stocks – cods, soles, rockfish).
- 142 limited entry licensed vessels of varying sizes (50 – 150 feet) fishing to different markets (fresh versus frozen) with different

gear (mid-water versus bottom trawl) in different locations (localised to coast-wide).
- Commercial fishery that is closely scrutinised by environmental sector.
- Labour intensive volume fishery focussed on species with relatively low landed value.

Objectives

- Stay within TACs.
- Manage on a stock specific basis.
- Accurately account for all mortality (retained catch and at-sea releases).
- Harvesting data available in a useable format in a timely manner.
- Provide for individual accountability and responsibility.
- Provide for operational flexibility.

Management framework

- Limited entry licensing.
- TAC management for each stock.
- Individual Transferable Quotas (ITQs).
- Individual allocations on a stock specific basis.
- Individual species caps.
- Total holdings caps.
- Carryover of ITQ overages or underages.
- Species prohibitions.
- Size limits.
- Area closures.
- Gear restrictions.
- Designated landing locations.

Monitoring framework

- Hail requirements
  - Vessels hail out their plans to fish and to request an observer and hail in their landing time, location and estimated catch and request a Port Monitor.
- Logbook requirements
  - Vessel skipper records all fishing information.
- 100% at-sea observer coverage
  - Observer estimates retained and released catch by species and area; records trawl locations and duration; takes biological samples; estimates total mortality.
- 100% dockside monitoring of landed catch
  - Port Monitor records total weight of catch by species.
- Fisheries Operating System (FOS)
  - All hail, at-sea observer and dockside monitoring data are entered into a centralised system.
  - At-sea and dockside data are merged to determine total stock specific mortality to be charged against each ITQ for the vessel.
  - Within 24 hours of landing, vessel receives an updated Quota Status Report (QSR) showing the current status of the vessel ITQ holdings.
  - System identifies vessels in violation of allowable overages, species caps or holdings caps, or fishing in a closed area.

Benefits of the monitoring program

- Provides reliable accurate mortality information essential to stock specific management.
- Allows for individual vessel accountability and responsibility.
- Provides individual vessel operational flexibility.
- Provides credible information about the impact of the fishery and its compliance with management rules.
- Provides for a level playing field for participants.
- Supports increasing requirements for product traceability.
- Increases the value of the fisheries assets.

Commercial catch monitoring: Gatekeeper to sustainability and public confidence in Pacific Canada

Gordon Gislason

GS Gislason & Associates Ltd. – Canada

Abstract

Users of public resources in Canada need to conduct their operations in a responsible sustainable manner. Catch monitoring of all fish caught – landings plus discards – increasingly is becoming a necessary condition for demonstrating that a commercial fishery is environmentally sustainable. Catch monitoring also enables formal intrasectoral and intersectoral allocation processes and the resulting economic benefits derived there from. Long term economic sustainability requires environmental sustainability, and rigorous catch monitoring systems are critical to both. The

paper outlines the linkages among catch monitoring, sustainability and the social license to use a public resource for commercial fishery sectors in Pacific Canada. Differences between salmon and non-salmon sectors are highlighted. The paper also addresses the question – can you have collective fleet responsibility without individual vessel responsibility and meet catch targets?
Keywords: accountability, sustainability, viability, allocation, transparency, social licence.

Introduction

There are many competing interests or potential users for the ocean environment and its resources. These users include traditional commercial fisheries and recreational fisheries. But these users also include aquaculture, ecotourism, cruise ship, offshore energy and minerals, foreshore developments, commercial shipping, and many other operations. In Canada the federal Department of Fisheries & Oceans (DFO) has led responsibility for managing ocean commercial fisheries. The ocean is considered a public resource subject to public regulation and policy. This paper outlines the linkages between catch monitoring, sustainability and public confidence for the commercial fisheries in the Pacific Ocean of Canada off British Columbia.

Catch monitoring – sustainability – public confidence linkages

The environmental ethic is growing worldwide with major implications for the operation of capture fisheries. The federal government of Canada has the responsibility to manage the Pacific Coast commercial fisheries in a precautionary manner for present and future generations. If public confidence in fisheries management is eroded, then the Canadian public will demand action. This action could include drastic changes in fisheries management, reallocation of resources to other users, or legal challenges. The key to public confidence in fisheries management is demonstrable evidence or proof that fisheries are being managed sustainability. Criteria for assessing sustainable fishing practice:

1. *Sustainable harvest of target species and stocks*

Harvest rates and techniques should aid in the maintenance or recovery of a stock's health so that present and future generations can benefit from the resource.

2. *Limiting impacts of the fishery on non-target species, habitats, and ecosystems*

Harvests should use techniques to minimise the amount of unintended by-catch and impacts on the ecosystem and habitat.

3. *An effective fisheries management system*

A solid management system, emphasising scientific principles, credible and reliable data gathering systems, co-management principles and transparency, monitoring and surveillance, and adherence to national and international law, is essential to ensure that the first two principles are observed. Implementation of the three sustainability principles above requires that reliable estimates of total removals or 'catch' – landings plus discards – be available for use in stock assessment work and for gauging adherence to Total Allowable Catch (TAC) and allocation targets. Discards are the residual share of catch that is not landed but discarded or used at-sea, including that which is cut up and used as bait.

These sustainability criteria require that independent monitoring systems be employed such as (GS Gislason & Archipelago Marine Research, 2004):

- Dockside monitoring programs – a shore-based observer provides independent verification of offloaded weights by species;
- At-sea observer programs – on-vessel observers provides independent verification of catch, including discards and other fishing trip information such as time and area of fishing;
- Electronic monitoring (EM) programs – using a tamper evident automated digital video imagery of the catch retrieval process.

A key advantage of third party catch monitoring is that it provides a transparent, easily understandable system for demonstrating actual catch. This feature in turn instils confidence amongst other users of the fish resource and the public at large as to the sustainability of commercial fishing activities. In essence, the catch monitoring–sustainability–public confidence loop becomes closed with third party monitoring of both landings and discards.

Catch monitoring is critical to economic sustainability

Catch monitoring is also key to effective allocation policies, both intrasectoral allocation amongst different commercial gear types and intersectoral allocation between commercial and recreational sectors (Gislason, 2006a; Gislason, 2006b). Formal allocation reduces business uncertainty, removes an impediment to fisheries reform, and engenders trust amongst users and the government regulatory authority. Formal allocation processes for BC herring and groundfish commercial fisheries have allowed the sectors to concentrate on important emerging issues rather than get mired in allocation debates. The aboriginal treaty process in British Columbia is a form of allocation policy – the rigid catch monitoring provisions of the Nisga'a Treaty, for example, have helped engender confidence in the agreement. Moreover, in my view, the groundbreaking formal 88% commercial: 12% recreational allocation policy for halibut, with provision for market-based adjustments, would never have happened if the commercial halibut sector did not have an independent third party catch monitoring program in place (Gislason, 2006b). The commercial halibut catch monitoring program was a necessary condition to fleet rationalisation, IQ management and improved economic performance (Gislason, 1999).

Effective catch monitoring can increase the catch available or TAC to the fleet. For example, the BC groundfish trawl likely would have seen its TACs, fishing areas and fishing times restricted in the absence of 100% dockside monitoring of offloads and the 100% at-sea observer coverage of fishing vessels.

The Marine Stewardship Council (MSC) or other eco-labelling certification of sustainable fishing practices is becoming a requirement for access to certain seafood markets especially in Europe (GS Gislason, 2004). Traceability is also becoming a market requirement. Eco-labelling and traceability can increase prices.

Simply put, catch monitoring can increase the net returns of a commercial fishing fleet through increasing catch opportunities and market access and through cost reduction resulting from fleet rationalisation.

Report card for BC fishing fleets

Table P1.1 provides a report card for four BC commercial fishing fleets – roe herring (about 1,520 gillnet & seine licences), groundfish trawl (142 licences), halibut longline (435 licences), and salmon (2,220 gillnet, seine & troll licences). The first three fisheries have Individual Quota (IQ) management and third party catch monitoring of landings and discards.

Table P1.1: *Report card on commercial fisheries performance in Pacific Canada.*

	Roe Herring	Groundfish Trawl	Halibut Longline	Salmon
Management Regime				
Limited Entry Licences	X	X	X	X
IQ or Pool Fisheries	X	X	X	
Independent Catch Monitoring	X	X	X	
– Dockside Offloads				
– At Sea Observers*		X		
– Electronic Monitoring (EM)*			X	
Relinquishments/Penalties for Target Catch Overages	X	X	X	
Penalties for By-catch Overages	n/a	X	X	
Fishery Performance Indicators				
Can Meet Target Catch TAC	yes	yes	yes	no
Can Limit By-catch	yes	yes	yes	no
Effective Fisheries Management System	yes	yes	yes	no
Biologically Sustainable	yes	yes	yes	mixed
Economically Viable	yes	yes	yes	no
Effective Intrasectoral Allocation Regime	yes	yes	yes	no
Fishing Opportunities Lost	no	no	no	yes

* *roe herring – by-catch is essentially zero*
groundfish trawl – 100% at-sea observer coverage
halibut – operators can choose onboard observers or EM (vast majority choose EM)
salmon – no third party monitoring of discards

The 2,220 salmon licences are divided into eight gear-area combinations (2 for seine plus 3 for each of gillnet and troll). The licence holders operate in competitive or derby fisheries although a couple of pilot demonstration IQ fisheries have been implemented in recent years. Salmon catch targets or TACs depend on run size and can change in-season from pre-season expectations. There is no third party catch monitoring of either landings or discards in salmon derby fisheries. The management of the salmon fishery relies on self-reporting hail, logbook and sales (transaction) slip systems – these have been judged inadequate (Archipelago Marine Research, 2001; DFO, 2002; DFO, 2003; GS Gislason, 2004; McRae & Pearse, 2004).

The herring, groundfish and halibut fisheries with independent catch monitoring meet the three sustainability criteria: (i) limiting catch of target species; (ii) limiting catch of non-target species; and (iii) an effective fisheries management system. The commercial salmon fishery meets none of the above criteria.

The IQ fisheries management regimes make the individual licence holder responsible for their catch regardless of disposition, catch or discard. This fosters collective responsibility (Environmental Defense, 2007; White, 2006).

Individual and collective catch responsibility does not exist in the salmon fishery. For example, in 2006 all southern BC salmon fleets operating in derby fisheries targeting Fraser River sockeye exceeded their allocation targets – but there were no relinquishments of overages, fines or sanctions imposed. In 2006 there was a small pilot demonstration IQ sockeye salmon troll fishery, with mandatory dockside monitoring of landings – this was the only salmon fishery component that operated within its Fraser sockeye TAC. The herring, groundfish and halibut fleets are economically viable whereas the salmon fleet is not. The herring, groundfish and halibut fleets have meaningful intrasectoral allocation processes – the salmon fleet does not. The herring, groundfish and halibut fleets can fish to the limit of their target TACs whereas the salmon fleet can not e.g., the overall Fraser sockeye commercial TAC may be reduced by 25% or more due to constraints imposed by the existing fisheries management regime (GS Gislason, 2006).

The evidence is striking as to how poorly the BC salmon fishery scores on biological sustainability and economic sustainability grounds (Table P1.1). In my opinion, this is directly related to the lack of independent third party catch monitoring and individual responsibility embodied in the current salmon management regime.

It is true that certain BC commercial shellfish fisheries, such as prawn and Area A crab, do appear to operate sustainability even though they do not have dockside monitoring programs (Archipelago Marine Research, 2001) – but both have monitoring at-sea. The Area A crab fleet has 100% Electronic Monitoring (EM) coverage with on-board cameras recording all trap hauls whereas the prawn fleet has independent monitors boarding vessels at sea to check trap contents. The two fisheries do not have TAC management but rather operate under input controls to protect mature female spawners. Both fisheries use trap gear which are highly selective and allow the live release of non-target species. Nevertheless, both commercial prawn and crab fisheries are poorly positioned to pursue formal commercial-recreational allocation processes, a concern in light of increasing recreational catches, because they do not have third party monitoring of landings.

Conclusions

The evolution and experience of catch monitoring programs in Pacific Canada suggest several 'lessons learned'.

Lesson #1: Effective third party monitoring of total catch – landings plus discards – is a necessary condition to meet environmental sustainability criteria.

Lesson #2: Effective third party catch monitoring of total catch provides needed transparency in sustainable fishing practices and this in turn instils public confidence in the commercial fishery in question.

Lesson #3: Regardless of regulatory requirements, public confidence is becoming more and more important to commercial fishing operations – it provides a social licence to operate in the marine environment with many competing uses.

Lesson #4: Third party catch monitoring through enabling greater fishing opportunities, access to markets and needed industry rationalisation also is crucial to economic sustainability.

Lesson #5: For fisheries with aggregate catch targets, it is very difficult if not impossible to have collective catch responsibility without individual catch responsibility.

These lessons are broad and may apply to several other fisheries jurisdictions as well.

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Questions & Panel Discussion – Session P1 –

Bill Karp (National Marine Fisheries Service)

Comment / Question:

There are benefits for having high levels of coverage, but there is also a significant cost and I have not heard any discussion about the marginal benefit of incremental coverage costs above some threshold. Does anyone have any comments regarding the linkages between coverage level, uncertainty in the information provided, and the costs?

Response from the panel:

Gordon Gislason – I would argue that there is a core level of information on fisheries that is needed for them to pass the sustainability test. In Canada, there have been some recent court decisions and debate regarding the responsibilities of fisheries management versus that of the users of the resource, and the collection of data for stock assessment and the funding of stock assessments. For example, are we off-loading costs to commercial fleets and observers which should be core stock assessment activities? I believe the fleet should be responsible for meeting the sustainability test, but there are certain things beyond that which are in a grey area and which deserve further discussion.

Bruce Wallner – I tend to agree, I think there is a minimum threshold level of information that is required but we've traditionally been very bad at defining what that minimum level is. In Australia, my Minister issued a direction to my agency about a year and half ago to get us to conform to some minimum standards that were prescribed and now we're rolling out observer programs to every fishery. The minimum level has been difficult to define and we have tended to engage in the debate with industry a lot – there is an expectation of having harvest strategies that have built-in actions and performance measures as well as minimum monitoring activities like satellite tracking of every vessel in a fleet.

Bill Karp – John Boreman also spoke to that this morning with regard to the observer programs in the United States and the 30% CV as a reference point for by-catch estimation. It obviously depends a lot on the goals of the program – if you're dealing with estimating catch rather than by-catch then the information needs are greater. I think there is a minimum requirement for stock assessment, but fishers should share the costs where the fleet or individual fishers gain from the level of monitoring.

Response from the audience:

Martin Hall (Inter-American Tropical Tuna Commission) – There is a statistical risk for industry associated with observer coverage and if we can establish a percentage risk that is accepted, we can then make a good economic judgement based on that. For example, run a simulation using one or two years of high observer coverage data and, from that, show the chances of a fishery being shut down earlier compared with if a minimum coverage was in place.

Wes Erikson (Commercial Fisher) – I'd like to express my point of view as a commercial fisher (and I think there is only one other commercial fishermen in the room here today). We've recently gone through this in the Groundfish Fishery in British Columbia – there has been a

lot of resistance from industry with respect to observer coverage and electronic monitoring. To use an analogy – if you're sick and slowly dying but there was a medication available which was expensive, would you go and pay for that medication if you knew it would cure you? There are a lot of fishermen that are still in denial and would rather continue to fish irresponsibly (I used to discard a lot of fish too and would think to myself, *"how long can I do this – I know it's wrong, but I'm going to keep doing it anyway"*). We've had to be accountable and sustainable, and the medication for that was monitoring – in our fishery we chose electronic monitoring and, as a result of that, we're still fishing. We will be talking about this in detail in tomorrow's session, but I think if you consult with industry, you will find there are ways to bring costs down. We will show that it is possible to have 100% monitoring where the costs are quite low (or not much different to what it currently costs) and we have managed this by bringing fishers together in a room and thrashing out ways to reduce the costs – we're still working on it but, the benefits far out-weigh the costs.

Steve Kennelly (NSW Department of Primary Industries) to Prabath Patabendi

Comment / Question:

Yours was one of the most different talks about fisheries that I've heard – a fishery that collapsed because two-thirds of its participants died! In relation to the question about costs, is any of the aid / relief money that flowed into those countries after the tsunami being devoted to rebuilding the fishing industry and will it eventually be used to establish observer or monitoring programs?

Response:

Prabath Patabendi – Two thirds of the fishermen lost their lives in the Tsunami and it will take about 10 – 15 years to produce more fishermen – you can't just put people into schools and teach them how to be fishermen. Also, the government are moving people into the interiors (away from the coastlines) and boundaries have been set-up, which means that the fishers that are left have lost their original places and are no longer fishing. Sri Lanka received about 3 billion rupee from aid monies, but this is mainly going towards livelihood programs. There are also several livelihood programs that are supported by the NGOs. There are some large fishing companies that have agreements with the government to fish in Sri Lankan waters, but there is limited traditional fishing and I didn't address observer programs in my talk because of this resource allocation issue.

Reuben Beazley (Fisheries Observer – Canada) to Bill Karp

Comment / Question:

As an observer, I'm quite familiar with how fishers can influence the results of your data. I was wondering what you're doing to overcome that problem in the Alaska fleet and if the situation is getting any better?

Response:

Bill Karp – We're working very closely with the enforcement division to get the message out there that this type of behaviour is not acceptable. This has worked quite well and, in particular, there have been a couple of court cases that have resulted in fishing companies being fined very heavily for pre-sorting and interfering with observer's sampling. Ultimately though, I think we need to improve the whole management infrastructure and design solutions to the by-catch problems that involve the fleet.

Reuben Beazley – We have also seen that in the Pollock fishery with respect to the salmon by-catch problem and pre-sorting has become much less of a problem since rationalisation was introduced. When the fleet is able to work together to develop a solution, it is much less of a problem and it also makes an easier environment for observers to work in.

Amy Van Atten (National Marine Fisheries Service)

Comment / Question:

The funding for our observer programs usually goes towards the costs of sea days and data quality and, because our observer data are often used to manage a crisis situation, it often gets interpreted in a negative way rather than focussing on the positive aspects of a fishery. For example, our data can be I used to close down a fishery. I'm interested in the last speaker

in terms of a funding source for doing some analysis by a third party and any other comments on how funding could be invested so observer data are used in a positive way and presented in a positive way to the public.

Response:

Prabath Patabendi – After the tsunami, the funding and projects came to Sri Lanka in an *ad hoc* manner but now, a year later, the government is monitoring it. Before we can begin setting up observer programs and monitoring our fisheries, the government needs to establish the fishing communities along the coast. If you go to Sri Lanka today, you will find very few fishing activities to observe because the donors have advised them to seek alternative livelihoods and also because others are too afraid to go to the sea. The fishermen are doing other jobs such as selling sweep tickets in the street or selling king coconut to the tourists. It will take another 3 years or more to reconstruct, reactivate and regenerate the fishers. The government is supplying them with houses but will not allow them to return to their original places – this is in 'preparedness' for another tsunami. Before we can begin observer or conservation programs, we must firstly establish a fishing community in Sri Lanka.

General comments from the panel

Bruce Wallner – In my experience with observer programs, and monitoring in general, there tends to be 'monitoring creep'. That is, whenever we start to do any level of monitoring, it inevitably creates questions and a need for greater levels of monitoring. However, this brings us into conflict with industry because they think we're not being upfront and honest about our original design. We need to be cautious about factoring expansion into our monitoring programs but also mindful of the additional questions that are raised once monitoring has started and ensure we maintain the fishers' and public's confidence.

Gordon Gislason – Firstly, I've noticed a lot of people wearing the 'Go safe or go home' T-shirts and I think another message should be 'Go sustainable or go home'. Secondly, with respect to monitoring creep, I've also seen this happen in sport-fishing creel surveys – originally you're just doing catch and effort sampling, then you're doing biosampling, then expenditure surveys and so on. Once people find out you are dealing with a fishermen, whether it is a commercial or sports fishermen, they want to tag along for the ride. Lastly, I have produced a formal paper for my presentation and, if you're interested, I have a few copies to distribute at the conference or I can email it to you after the conference.

Bill Karp – The BC Groundfish management and monitoring system is a good example and I think it is no accident we had a number of people speaking to different aspects of that today. It serves as a reference point for those of us that are struggling with monitoring problems and complex management issues. There are still some problems that need to be solved but I take my hat off to everybody that has been involved in the BC process – industry, observers and the various stakeholders.

SESSION P2

What are the important elements and considerations in the design of fishery monitoring programs?

Moderator:	
Steve Kennelly	*NSW Department of Primary Industries – Australia*
Speakers:	
Lisa Thompson	*NOAA – Alaska Fisheries Science Centre – USA*
Lisa Borges	*Wageningen IMARES – The Netherlands*
Kevin Busscher	*National Marine Fisheries Service – Pacific Islands Regional Observer Program – USA*
Tod Dubois	*NOAA Fisheries – Office of Law Enforcement – USA*
I-Hsun Ni	*National Taiwan Ocean University – Taiwan*
Janell Majewski	*West Coast Groundfish Observer Program – Canada*

Managing expanding priorities in an established fishery monitoring program

Lisa M. Thompson

NOAA Fisheries, Alaska Fisheries Science Center – USA

The North Pacific Groundfish Observer Program provides a prioritised list of duties in our sampling manual for observers. These priorities are destined to expand as the Observer Program continues to mature, as new resource concerns arise, and as more researchers become aware of the Program as a potential source of valuable data. Standard observer data such as species composition, sexed length information, otolith and other age collections, and 'special' one- or two-year projects are the most commonly updated data collections as information to support new fishery management regimes, monitor recently listed endangered or threatened species, or provide increased life history information is requested.

It is essential that a monitoring program have processes in place to cope with this influx of requests and to evaluate the feasibility of new data collections, particularly if new priorities are in addition to, rather than replacing, existing data requirements. The Fisheries Monitoring and Analysis (FMA) Division of the Alaska Fisheries Science Center (AFSC) has three work groups (the Observer Manual team, the Policy Development group, and the Special Project team) that aide in this necessary decision making process. These groups consider all increased data requests and decide what is feasible and what will need further investigation for completion each year. Deadlines are sent out to all data users each year soliciting requests and providing an opportunity for stakeholder input. All requests are then collected and prioritised by combined efforts of the specific teams. Decisions are made and passed on to the FMA Division Director for final approval. Changes are then implemented into the new fishing year's observer training sessions. This process is only successful if there is consistent communication among FMA staff and data requestors. A balance between changing data needs and an increased work load for observers is necessary to achieve a realistic data collection priority list.

An example of these processes at work can be shown by laying out the steps taken to increase

observer identification specificity for North Pacific skates, sculpins, and smelts.

Identifying the need

In 2002, stock assessment scientists at the AFSC recommended to the North Pacific Fisheries Management Council that sharks, skates, sculpins, and smelts be separated out of a fishery management complex, allowing for finer scale management of these species groups. FMA staff attended Council plan team meetings and worked directly with data requestors to stay informed of potential data needs and to provide feedback to the data requesters. This insured that the staff responsible for implementing updates were not overwhelmed when a large change became reality in the fisheries that our observers work in.

Testing the tools

As soon as the increased data need became clear, FMA staff began to develop a dichotomous key for species of skates, sculpins, and smelts found in the Bering Sea and Aleutian Islands and Gulf of Alaska. (Our observers already identified sharks to species, so no further change was needed). By July of 2002 the new identification keys were ready and available for testing by observers in the field. A special project was developed and implemented mid-year. The project was distributed to experienced observers only. The purpose of the special project was to test the effectiveness of the new skate, sculpin, and smelt keys by actual observers aboard commercial fishing vessels and to record the amount of time and effort it took for experienced observers to add this task while still accomplishing all other sampling duties. By March of 2003, 131 observers had completed this project and the results were positive – observers found the keys straightforward and the additional work proved not to degrade the quality or quantity of other high priority tasks. (See NOAA Technical Memorandum NMFS-AFSC-142 *Identification of Skates, Sculpins and Smelts by Observers in North Pacific Groundfish Fisheries (2002 – 2003)* by D.E. Stevenson).

Implementing change

A combined total of 1.5 years of preparatory work took place to implement a full scale sampling change. In the 2004 fishing year, the edited and improved skate, sculpin and smelt keys became standard issue to all observers and this material was incorporated into our regular observer training materials.

Expanding priorities are to be expected. A developed prioritisation process aides the decision process of data expansion requests. Communication is paramount in maintaining a balance of priorities and workloads. Without that balance, observer programs, and those who rely upon the data they collect, can lose focus and fail to achieve not only the new objectives, but the original priorities that the monitoring program was designed to achieve.

Observer programmes in European fleets

Lisa Borges

Wageningen IMARES, Institute for Marine Resources & Ecosystem Studies – The Netherlands

Quantifying discards has become more important in recent years as fisheries management objectives change to include an environmental perspective. In the European Union, this change has resulted in the introduction of the Data Collection Regulation (DCR – Council Regulation No. 1543/2000 and Commission Regulation No. 1639/2001), which aims to establish *"a community framework for the collection and management of the data needed to conduct the Common Fisheries Policy"*. These regulations provide funding for sampling in all areas of the fisheries sector, and include onboard discard observer's programmes. These sampling programmes are based on voluntary schemes (skipper may or may not accept observers onboard when requested).

Discarding is legal in European waters, and as a result the observers of the discard programmes are not, in principle, in a conflict situation when onboard. Furthermore, the data collected is confidential, i.e., the skippers and vessels are never identified; and finally the data is used only for scientific purposes. For all these reasons, the fishing industry did not see the observers (and the sampling programmes) as a threat, and in fact observers routinely witness illegal actions, such as misreporting landings. *Conclusion:* the quality of the data collected in European discard programmes was very good!

However, in 2004 in Ireland an angry fisherman wrote to the authorities accusing several fishermen of misreporting landings. There was a much publicised police raid on boats, offices and homes of fishermen, and a large criminal fraud investigation ensued. Prosecutions followed for several owners but the various cases are still going through the Irish courts. In response to the problem the authorities drafted the 'sea fisheries bill' to strengthen control and enforcement legislation. During the political storm surrounding this, a summary report showing misreported landings based on observer's data became public under the *Freedom for Information Act.* The consequences were that the Irish fishing industry stopped all collaboration with scientific institutions. The observers were no longer allowed to sample onboard or in fishing ports. This led to a 'data blackout' impeding stock assessments in 2006, and probably in 2007 for some stocks.

In the mean time, the DCR is going trough a review process and the contradiction of voluntary sampling schemes associated to a compulsory national obligation to sample onboard has been highlighted, particularly in view of the recent disputes in some Member States between the fishing industry and scientific institutions. It is envisaged that the new DCR will change the nature of onboard observer's programmes for a compulsory scheme (skippers are legally obligated to accept observers onboard when requested), but also broadened its objectives to include catch sampling (not only discards). On the other hand, the European Commission has recently made a Communication presenting a policy to reduce unwanted by-catches and eliminate discards in European fisheries. A discard ban is envisaged in the future for all European fisheries, starting with some selected fisheries in 2008.

These possible changes in EU regulations have major impacts for European discard sampling programmes. There are several aspects that need to be considered. First of all, the quality of the data collected will most certainly decrease, because there will probably be a change in fisherman's behaviour when an observer is present. Also, what will be the impact of changing the process of selecting vessels from voluntary vessels to all vessels, regarding data quality and sampling levels? There are also serious issues concerning observer's safety onboard that needs to be addressed. So, in the near future, discarding by European fleets may be illegal; the role of observers onboard can be mistaken by inspectors, since discard data maybe used for real time closures or sanctions; and the data may not be strictly confidential under European/National legislation. *Conclusion:* the quality of the data collected in future discard programmes may not be very good!

The review of the DCR and the discard communication are all open to discussion and several aspects may change at the end of the consultation and negotiation period. Nevertheless, if the compulsory system goes ahead, data quality can be monitored by comparison with past data from existing programmes. Training the observers will also be fundamental to prepare them to deal with conflict situations. And finally, a bit of common sense should be used when choosing vessels to sample…but mainly when choosing the objectives that data from scientific programmes are used for.

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Design and implementation of the American Samoa Observer Program

Kevin D. Busscher

National Marine Fisheries Service, Pacific Islands Regional Observer Program – USA

The Pacific Islands Regional Observer Program (PIROP) started the American Samoa Observer Program (ASOP) in April, 2006. Before starting the program, the PIROP completed three voluntary pilot trips in 2002. These pilot trips gave us valuable information about the fishery. The length of the pilot trips varied from 13 to 74 days. Since we started the mandatory program the longest trip has been 84 days and the shortest trip has been 23 days. This was important to know in order to make sure all the observers had enough data forms and sampling supplies for a potentially long trip. More importantly that each observer knew they could

be out to sea for up to seven weeks. We also got a good idea on what the species composition and catch rate was in American Samoa. Completing the three pilot trips also introduced the fishery to our program personnel and started getting them use to the idea that a mandatory program was coming. In addition, we had the opportunity to find out where potential office space and various venders were located.

After the pilot trips were completed, five management planning committees were formed to plan the infrastructure of the ASOP. These committees were data, debriefing, logistics, protected species, and safety and enforcement. We used our experience from the PIROP and the pilot trips in American Samoa to model the ASOP. When the PIROP began in 1994, we were a field office out of the South West Region. Although there are many differences between Honolulu and American Samoa, it gave us the basics to start planning the logistics and other areas of how to operate a field office in American Samoa.

The species encountered during the American Samoa pilot trips turned out to be very similar to the species caught in the Hawaii longline fishery. However, the percentage of the species caught varied from the Hawaii longline fishery. The target species in American Samoa is primarily albacore tuna, which accounts for 50.1% of the catch, followed by skipjack tuna (17.5%), then wahoo (6.7%), then yellowfin tuna (6.5%). The target species in the deep set fishery in Hawaii is Bigeye tuna which accounts for only 18.2% of the catch, followed by longnose lancetfish (17.7%), then blue shark (10.9%) and mahi-mahi (8.9%). Even though the percentages of the species caught in American Samoa were different than Hawaii, the species were nearly the same. Since the species composition and the gear were also similar to that used in the Hawaii longline fishery we decided to use the same data forms that we use in Hawaii. We also did not have to develop additional species identification training for American Samoa. In addition, since the catch rate was higher in the American Samoa fishery and there was the potential for a long trip, we knew the observer would need to take out plenty of data forms in order to record all the data.

For data entry we considered using either Microsoft Access or Oracle database. In Honolulu, the data are entered into an Oracle database. It is entered online using a high speed direct internet connection to the Pacific Islands Fishery Science Center (PIFSC). Since the internet capabilities are much slower in American Samoa, it was not practical to enter the data online. We considered installing a stand alone version of the Oracle database in the American Samoa office, but this option was too costly for the amount of coverage we were planning for American Samoa. We also considered using Microsoft Access to enter the data in American Samoa. We decided against this because of the problems associated with maintaining two separate databases while trying to keep them identical at the same time.

We decided the initial debriefing would take place in American Samoa at the end of each trip. The data entry and final data editing would take place in Honolulu at the end of the observer's contract when the observer returns to Honolulu. This way the data entry and all the data editing were consistent with what was used by the PIROP for the Hawaii longline data.

The logistics committee had to determine what had to be transported to and from American Samoa and investigate what methods were to be used for transportation. Most of the office supplies and gear were initially flown to American Samoa by the United States Coast Guard (USCG). Once the initial setup was complete it was most practical to transport new observer gear, most sampling supplies, office supplies and other items with the observer during their flight to American Samoa at the beginning of their contract.

Once the planning was complete, a NMFS port coordinator was reassigned to American Samoa for the implementation and management of the observer program. In Honolulu, we have the contractor make all the vessel placements, vessels assignments, and vessel call-backs. The NMFS Port Coordinator performs all the duties normally performed by the observer contractor and the NMFS Debriefers. Since American Samoa is a field office and coverage is low, it was not feasible to have both a government port coordinator and a port coordinator for the observer contractor in American Samoa.

For protected species, we had to find out what specimens the scientists at the PIFSC needed from the protected species in American Samoa

and we had to make sure the scientists were prepared to receive delivery if samples were transported. Next we had to apply for the permits to import protected species samples from American Samoa and we had to determine what method of transportation would be used to import the samples. Biological specimens such as whole turtles had to be flown up on the airline.

The major obstacles for safety and enforcement were safety regulation compliance, complying with the 72 hour call in requirement, and getting the needed support from enforcement when the requirements were not met. The NMFS Port Coordinator has played an important role in collaboration with the USCG, and the fishing fleet to assist these vessels in fulfilling the NMFS safety requirements and obtain USCG safety examination stickers.

Although the American Samoa Observer Program was well planned out and the program is running good, there are still many problems being worked out. Some of the vessels were fishing in the Cook Islands. For several months we had to take observers off the vessels going to the Cook Islands due to political uncertainty. That situation has since been resolved. Coverage levels are difficult to predict because of the large variation of trip length. When the ASOP started most observers did not want to leave Hawaii to go to American Samoa once they heard about the details of the fishery. There were often long departure delays due to periodic tuna cannery closures, slow delivery of vessel safety equipment, or other unforeseen reasons. During these long delays the observer was not getting paid. We had to provide incentive for observers to want to go to American Samoa. During long delays the observers can now work half days to help out with Port Coordinator duties. In addition, while at sea the observers are able to work more overtime because the hauling of the gear takes longer in American Samoa than the fishery in Hawaii. This has provided necessary incentive for observers to want to go to American Samoa while also providing the Port Coordinator with much needed assistance. Safety compliance for vessels continues to be the most challenging problem. Safety equipment is in short supply and no one in American Samoa is certified to service life rafts or EPIRBs. Most of the equipment has to be shipped in from the mainland U.S. or Honolulu. The only vendor in American Samoa for safety supplies does not carry many of the items required for the renewal of the safety examination stickers. The majority of the vessels still do not have USCG Safety Examination stickers. For the vessels that have safety examination stickers nearly all of their life rafts will need to be serviced in the same month this year.

To deal with these and other problems the ASOP plans to continue to collaborate with the fishing community and USCG to educate the fishing community on fishing and safety regulations and continue to assist the fishing community during safety drills and USCG Safety Examinations. The main focus is to be proactive to offer assistance while building good working relations with the fishing community.

Importance of law enforcement for observer programs

Todd Dubois

NOAA Fisheries, Office of Law Enforcement – USA

Fishery managers, policy makers and the public require high quality, unbiased observer data to ensure that appropriate fishery management decisions are made. The Office of Law Enforcement (OLE) plays a critical role for observers and observer programs by enforcing regulations that provide for the safety of observers, protect data integrity and ensure observers are not prevented from carrying out their duties.

The increasing reliance on observer data to meet a myriad of science, management (including in-season decisions on fishery closures) and compliance needs often creates incentives to bias the observer's data. Observer data is often the most accurate, reliable data available and is increasingly being used to make in-season management decisions on fishery resources. With more 'real time' impacts of observer reported data, there is an increased incentive to circumvent the observer and introduce sample bias (mechanical or physical pre-sorting) or otherwise impede an observer's ability to carry out his/her duties (harassment, interference, etc.). This further emphasises the importance of observer programs and law enforcement

working together routinely to ensure observers are able to provide high quality data needed to manage and protect living marine resources.

Initiatives for integrated relationships between law enforcement and observer programs have demonstrated significant benefits to observer programs and NOAA as a whole. These models use a dedicated, collaborative approach to observer training, regulatory development, observer safety, public outreach and observer related enforcement priorities. By introducing enforcement in observer training, observers understand what situations they may encounter and how to respond to, and document, unlawful situations they may face. Through the involvement of law enforcement and legal counsel in regulatory development, appropriate regulations are drafted that support the intent and goals of the observer program and fishery managers while providing enforceable regulations. Joint public outreach initiatives provide maximum exposure of new or changing requirements to the fishing public in an effort to prevent observers from being in placed in the inappropriate role of explaining requirements and regulations. Throughout this program, law enforcement priorities emphasise safety of observers, quality and integrity of observer data and enforcement of regulations designed to ensure observers can successfully perform their duties.

A joint law enforcement/observer program initiative was started in the North Pacific in 1998 with the assignment of dedicated law enforcement resources assigned to work directly with observer program staff and observers. This program has demonstrated exceptional success and now serves as the model for other initiatives in the United States to improve the coordination between observer programs and law enforcement. This integrated approach resulted in a coordinated plan in response to major changes in observer safety requirements in the northeastern United States, ensuring enhanced safety for observers with very little lost fishing time or lost observer sea days. The coordinated approach improved the safety of observers and fishers at sea while minimising adverse impact on the fishing industry involved.

The critical and growing importance of partnerships between observer programs and law enforcement would benefit from further exploration in a dedicated workshop at a future International Fisheries Observer Conference. A discussion on 'Legal issues in Observer Programs' could include topics such as domestic and international law, international fisheries treaties, privacy laws, confidentiality of observer collected data, legal uses of observer data, consequences of observer involvement in court proceedings, development of sampling protocols that support compliance measures, evidentiary uses of observer information and protection of observers at sea. The perspective of law enforcement, observers, legal counsel, observer program staff and fisheries managers would further enhance the value of such a workshop. This topic area would be tremendously valuable to IFOC participants and should be considered for a significant part of the next conference.

Regardless of the compliance roles for observers in any given observer program, law enforcement is a critical component that should play a continuous role to enhancing the safety of observers and ensuring their ability to collect high quality, unbiased data to meet the needs of fishery managers, policy makers and the public at large.

Conservation aspects of marine fisheries

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Abstract

All types of fishing operations produce adverse impacts on the marine ecosystem to a greater or lesser extent. Harmful effects range from subtle and difficult to quantify shifts in trophic systems resulting from the discarding of by-catch, to rigorous and highly politically charged effects like the incidental killing of cetaceans by drift nets. In terms of the persistence of the impact, this may range from minor ruts on sandy substrates caused by light trawling gear that may smooth over with the next tide, to long lasting consequences like the long term recovery of

dynamited coral reefs. This paper attempts to review the possible detrimental ecological effects of some common fishing practices including bottom trawling, purse seining, dredging, longlining, gillnetting, fry collection, dynamite fishing, and cyanide fishing. In addition, certain issues associated with commercial fishing such as discards, 'ghost fishing' by lost gear, and changes in trophic structure of fish communities are discussed. Finally relevant cessation and mitigation methods including technological advances, management measures, economic forces, and national and international legislation are provided in this paper. The effectiveness of these methods and measures are highly dependent on the participation of the fishing community and industry, international cooperation, and effective enforcement. In future, fisheries should be managed and developed within the context of a precautionary principle, adaptive management strategy, and ecologically sustainable development.

Introduction

All fishing activities have ecological impacts, which can be expressed in a number of ways: on the target species, on the physical structure of the habitat, on water quality, on non-target species, and on genetic diversity. This paper is to review the possible detrimental ecological effects of some practices including bottom trawling, purse seining, dredging, longlining, gillnetting, fry collection, dynamite fishing, and cyanide fishing. Issues associated with commercial fishing, e.g., the discarding of by-catch, 'ghost fishing' by lost gear are discussed. Relevant cessation and mitigation methods and measures are also discussed.

Impact of various fishing methods

Bottom trawling – Bottom or demersal trawling is one of the most widely used fishing methods with serious impact on the benthic habitat by demersal trawls since the gear is designed to maximise the net's contact with the substratum. The destruction of a habitat can have serious consequences on the balance of ecosystems, especially for those species that rely on these habitats as spawning and feeding grounds. The selectivity of trawling is low and very much affected by the mesh size in cod end. The abundance of non-target species are greatly reduced or disappeared because they are often killed as by-catch and discarded.

Dredging – The heavy weight dredger (~ 500 kgs) means about 80% of the scallops may be crushed and only 12 – 22% are retained as catch. Those damaged scallops left on the seabed are then subject to predation and disease. Post fishing mortality rate of scallops is reckoned to be 7 times higher than natural mortality.

Purse seining – Purse seining produces relatively low discard rates since the gear is designed to catch large aggregations of fish in mid-water and therefore have little or no contact with the seabed. Purse seines often target on pelagic species such as tunas, mackerel, herrings, sardines, and anchovies which form schools. The small mesh size makes the net wall acts as impenetrable fence to trap the catch inside.

Longlining – Longlining gear is composed of a main line with a series of branching lines, to which baited hooks are attached. There are three main types of longlining: (i) demersal – line lays on seabed with anchor, e.g., for Patagonian toothfish or halibut; (ii) semi-pelagic – anchored as well but with alternative floats and sinkers at regular intervals and; (iii) drifting – for tunas. However, seabirds and sea turtles are being incidentally caught in various commercial longline fisheries around the world.

Gillnetting – Gill nets are webbings of transparent microfilaments mounted on a floatline and a groundline. Gill nets are always joined together to form long fleets and deployed at areas where target species are active, searching for food or migrate. A drift net can be over 2.5 km in length (some up to 40 – 60 km) that is set adrift at the water's surface or in mid-water, and which enmesh, entrap or entangle fish and other marine fauna. Drift nets are employed mainly to catch squid, tuna, billfish and salmon. Drift net fishing is extremely non-selective with respect to the species that are caught.

Fry Capture – Juvenile fish (i.e., fingerlings or fry) are collected seasonally at various locations in Asian countries and are then sold to fish farmers. The fry are then grown out in mariculture cages until they reach a marketable size when prices are favourable. The demand for wild caught fry is high and this recruitment overfishing has serious negative impacts on the wild population, inevitably leading to stock depletion.

Blast fishing – Blast fishing is principally employed by small-scale subsistence fishermen

fishing on tropical reefs, but a large proportion of the population may be involved. Just a few sticks of dynamite can kill 2 tonnes of fish in a few seconds. Although blast fishing catch rates can be high, the method is totally indiscriminate and it kills targeted fish along with early life stage of fish and other reef organisms.

Cyanide Fishing – Each year hundreds of tonnes of cyanide are pumped into coral reef communities to catch food fish species for the valuable live reef fish trade, and to supply ornamental fishes for the aquarium fish trade. Target fishes are temporarily stunned by the poison to facilitate capture and sold.

By-catch and Discards – By-catches are the non-target species and obtained whenever fishing gear is unselective. The by-catch component has no commercial value and is thrown away as discard. Discarding causes the most serious environmental impact with an estimated 27 million tonnes annually.

Lost Gear and 'Ghost Fishing' – Lost and abandoned nets, known as 'ghost-fishing', made of durable synthetic materials will continue to catch and kill animals for many years. About 7,000 km of drift nets were lost every year in the North Pacific. A grapnel survey of Georges Bank yielded 341 lost trawl nets from 286 tows. This would be substantial and will have serious negative impacts on commercial stocks.

Recreational Fishing – Recreational fishing means fishing not for sale and other commercial purposes nor for employment, it just treats fishing more as a pastime. By-catch and discards, lost gear, lead sinker pollution, littering and over-use of chum bait are the ecological problems associated with this fishing.

Upsetting the Balance of Ecosystems – Most fishing methods deliberately target one or only a few species, thus increasing the mortalities of the target species and altering the balance of species at different trophic levels in the ecosystem. Also, over-exploitation may lead ultimately to the extinction of a target species.

Fishing or no fishing?

Even though most fishing methods and gears have adverse ecological impacts, as long as people demand seafood and protein derived from marine resources, fishing will still continue. Governments, as the stewards of our natural resources, have to maintain a balance between various costs and benefits within the context of ecologically sustainable development, and managing resources in order to maximise benefits at affordable costs. The following are some of the principles and measures that promote ecologically sustainable fisheries development, or can help to minimise or prevent the possible detrimental ecological impacts of fishing. The successfulness or otherwise of these ideas and methods are dependent on the participation of the community and the fishing industry, international cooperation and effective enforcement.

International instruments – Ecologically sustainable fisheries development conserves aquatic genetic resources, is environmentally non-degrading, technologically appropriate, economically viable and socially acceptable. Some of the principles that promote this idea are listed below:

- Principle 15 of the Rio Declaration of the UN Conference on Environment and Development promoted the precautionary approach to fisheries.
- General Principles and Article 6.5 of the FAO International Code of Conduct for Responsible Fishing was adopted in 1995, which provided guidelines for responsible approaches regarding fishing practices, selectivity and energy optimisation.
- The UNCED Agenda 21, Chapter 17, Section 46: use selective fishing gear and practices that minimise waste in the catch of target species and minimise by-catch of non-target species.
- Code of practices on the introduction and transfer of marine organism, 1994: to minimise the risk of pest, disease, and adverse genetic and ecological impacts associated with introduced and transferred marine organism.
- United Nations General Assembly (UN Resolutions 46/215) called for a worldwide moratorium on all high seas drift net fishing by December 1992.

By-catch solutions – The problem of by-catches and discards can be tackled or mitigated by methods: (i) imposing seasonal and area closure through fisheries management; (ii) gear control and fishing effort control to reduce by-catch and waste of energy; (iii) incentive and disincentive programmes; (iv) improving gear selectivity via technological advances and modification of deployment conditions; (v) increasing the fraction of by-catch that is released alive; (vi) imposing by-catch quotas; and (vii) maximising utilisation of the by-catch.

Conservation engineering – Adverse ecological impacts of fishing methods and gears can be mitigated or rectified by some technological advancements:

- Square mesh codends reduce fish by-catch from prawn trawls, this result in the reduction of numbers of prawns damaged.
- Use of stainless steel or aluminium rigid sorting grids inserted into the nets can give a sharper and more efficient selection than mesh selection alone.
- Installing trawl efficiency devices (TEDs) or some type of escape panel to allow incidental by-catch species (e.g., sea turtles) to exit before they enter the codend.
- Employing a semi-pelagic trawl instead can reduce damage to the benthic environment since the groundrope is towed above and off the seabed.
- Direct and indirect scallop mortality from dredging operations and seabed damage can be improved by changing the design incorporating a tickler chain and ring mesh.
- 99% reduction in the mortality of dolphins in the purse-seine fishery has been achieved from about 350,000 in the 1960s to 3,600 in 1993 through gear modifications by addition of a safety panel and the 'backing down' releasing techniques as well as relevant training and education of fishers.
- New bait casting machines, a setting tunnel and weighted branch lines can be employed on longliners for casting baited lines so that the baits sink before the birds can ingest them. Combining with the use of bird scarers or streamers off the stem of the vessels to prevent the birds from flying near the bait lines, has been shown to reduce albatross mortality by over 80%.

Trade instruments – Non-ecologically friendly fishing methods can be discouraged through the system of embargos, boycotts and tariffs:

- Live reef fish shipment should be tested for cyanide residues and the importation of cyanide-caught fish should be banned.
- Dolphin Bill: it was illegal to sell, purchase or transport to the USA tuna which was not dolphin-safe after 1 June 1994.
- The U.S. adopted a ban on the imports of fish caught with drift nets on the high seas.

Ecologically acceptable fishing methods – Destructive fishing methods should be replaced with more ecologically friendly fishing methods: (i) use hook and line or traps instead of cyanide and dynamite fishing for live reef food fish; or (ii) use hand nets and barrier nets in aquarium fish collection.

Aquaculture – Aquaculture contributes about 19% of total world fish production. Expansion of aquaculture can alleviate some of the fishing pressure expressed on wild aquatic resources and help to bridge the supply-demand gap generated by the declines of fishery production and continuous population growth. However, care should be taken to prevent possible adverse ecological effects, such as sedimentation, detrimental effluent, eutrophication, reduction of genetic diversity, diseases associated with the introduction of exotic species, and loss of genetic diversity on the culture populations and the possible adverse impacts on wild stock. Aquaculture that relies on wild-caught juveniles (like groupers) in growing out operations is unsustainable.

Observer sampling of rare species – WCGOP approach

Janell Majewski

West Coast Groundfish Observer Program – USA

The west coast groundfish observer program, or the WCGOP, observes fisheries off the west coast of the US, in the eastern Pacific Ocean. The WCGOP's goal is to provide fisheries managers with discard rates for a variety of groundfish species.

The primary fishery on the west coast, in terms of total catch weight, is the limited entry trawl fishery. This fleet is very diverse, with catches ranging from less than 0.5 metric tons to 18 metric tons per haul, vessel sizes ranging from 13 to 24 meters, and tow duration ranging from 45 minutes to 20 hours. The catch in the fishery is very heterogeneous, with hauls often containing over 45 different fish species, some of which are designated as overfished.

When caught by trawl fishers, the majority of overfished species are discarded at-sea. The discarding events of overfished species is rare, with six of the seven overfished species occurring in less than 8% of all observed trawl hauls. When the species are discarded, they make up a very small percentage of the total catch, ranging from 0.002% to 0.326% by

weight. As these species have very low optimum yields (Yelloweye rockfish, 2007 OY = 23 metric tons), accurately estimating their discard rate is of paramount importance.

However, estimating rarely caught species in trawl fisheries has been problematic. Typically, observers on trawl vessels sample total catch, estimating the percentage of each retained and discarded species in a haul. In contrast, WCGOP observer sampling protocols use a different approach by allowing groupings of 'like' species, which can be estimated independently. The primary grouping separates retained catch from discarded catch. WCGOP observers use vessel estimates of retained catch because west coast fishers land their catch at shoreside processing plants that produce fish tickets, which document the landed weight of each species or species grouping. The observer is then left with only the discard to sample. West coast observers break the discarded species into groupings based on their priority, size, how they are sampled, how the species is sorted on deck, or any other applicable factor. Each of the groupings weight is then estimated using one of the program designed protocols and species composition samples are taken from all or some of the groupings. The species composition samples may contain all members of the grouping or be a random subsample of members of the grouping.

This sampling design allows the west coast observer to sort the overfished species from other discarded species and estimate them using the most accurate method possible, actually weighing them. In 2006, 98% of observed discarded Yelloweye weight and 52% of observed discarded Canary weight used this most accurate method. In addition, if you look at the number of 2006 observed trawl hauls that contained a discarded overfished species, in the majority of cases, the observer has actually weighed all the discarded overfished species in the haul (Fig. P1.3).

Although this sampling design can be beneficial for rare species events, there are serious costs that should not be ignored. These include an increase in observer training duration due to the complexity of the sampling design, an increase the time required from data collection to public release due to the need to match observed data to fish tickets, and a potential for misuse and/or misinterpretation of the data by users who are unfamiliar with the sampling protocols and/or data structure.

Fisheries that rarely encounter sensitive species may benefit from an observer sampling protocol like that used by the WCGOP, as it greatly increases the probability of detection of rare species; thus also improving the precision of rare species estimates.

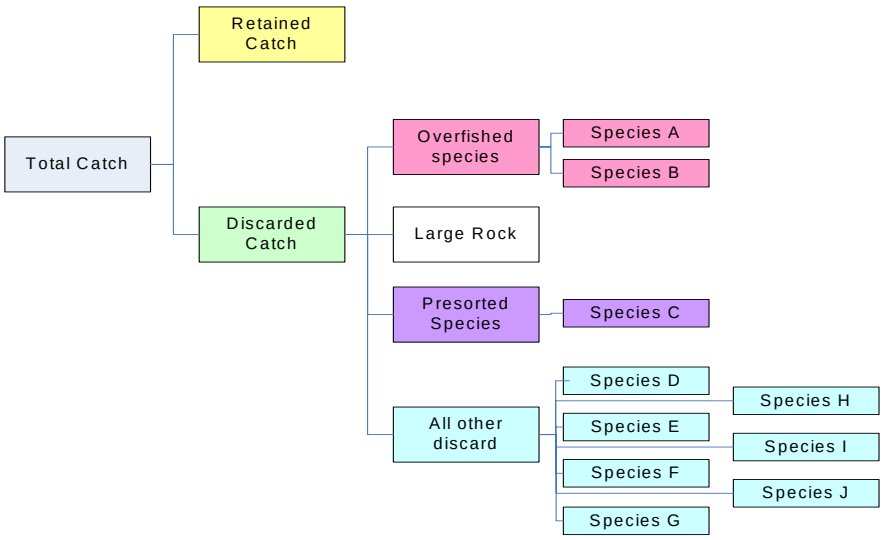


Figure P1.2: *Illustration of WCGOP grouping of discarded species.*

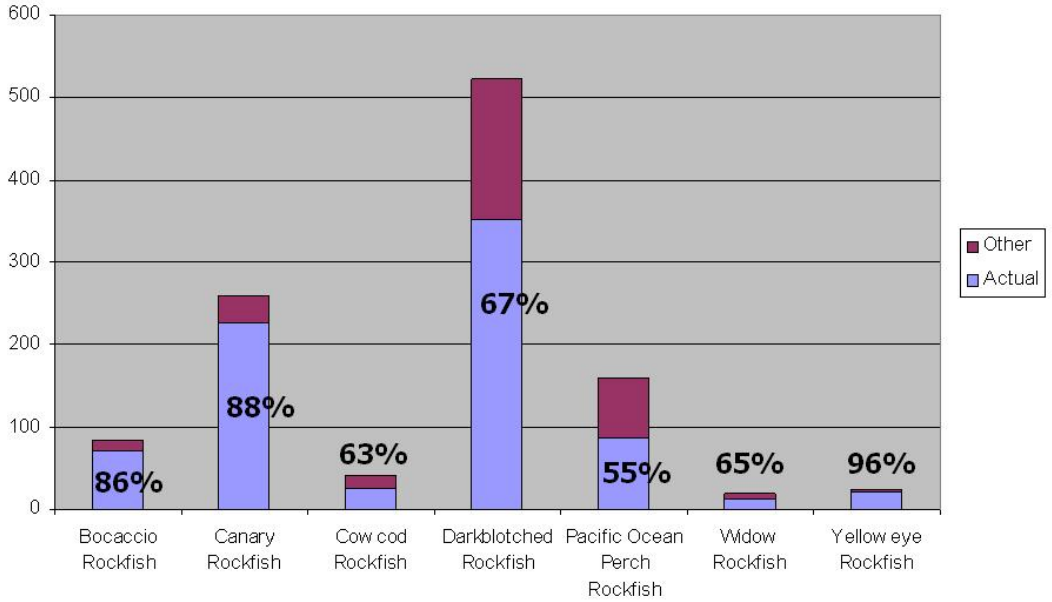


Figure P1.3: *Percentage of hauls where overfished rockfish were actually weighed.*

Questions & Panel Discussion – Session P2 –

Dennis Hansford (National Marine Fisheries Service) to Lisa Thompson

Comment / Question:

You mentioned that additional duties are added to your ordinary observer sampling regime and that the additional duties can bring some biases. How do you address bias in your samples and how are the costs of the additional data requests met?

Response:

Lisa Thompson – Bias is one of the most important issues to take into account – it usually flows from the original data set so we may go back to the data requester and work with them to eliminate the bias and collect the information that they need. The cost issue is a touchy subject – if the extra work is going to be a large cost to our program, we will generally suggest that it be started out as a 'special project' and the special project requesters will meet most of the costs associated with getting the project started. If it is something that is deemed necessary for our program, once it has been tested, the costs will get worked out and shared among our programs. This is where communication between data requesters comes into play. For example, if one group is asking for more sex-lengths, will another group working on stock assessments give up a few of their sex-lengths so we can continue to collect the same amount of data but share it between the different groups? We often have cooperation from the different groups like this.

Dennis Hansford – I also have a poster presentation here on vessel selection bias in the regional observer programs in the United States. The poster looks at the biases that can potentially be introduced in vessel selection when deploying observers and it has some of the recommendations we have come up with based on valid statistical mechanisms to look at those biases.

Steve Kennelly – There is also an excellent report available at the NOAA booth on this subject.

Dennis Hansford – Yes, it's the proceedings from the workshop on the vessel selection bias that we held last May (2006) in Woods Hole, Massachusetts. It is also available on our National Observer program web site (http://www.st.nmfs.noaa.gov/st4/nop/workshops.html).

Jerry Cygler (East West Technical Services) to Todd Dubois

Comment / Question:

With the increased effort in fishery management extending over the borders of the EEZ and sometimes globally, is there any kind of cooperation between the different law enforcement groups (e.g., Fisheries & Oceans Canada, the U.S. and other organisations) for a uniform approach for future observer activities internationally?

Response:

Todd Dubois – There is already some international cooperation and agencies are also working together with respect to law enforcement. For example, ICATT are dealing with tuna on the east coast and NOAA have expanded the Monitoring, Compliance and Surveillance (MCS) network internationally. I'm not sure how far we have come with an international observer program, but it is a growing area and we need to do more work to figure out how we can pull that together. I think we're going to see a lot more global working groups and global cooperation in areas such as observer programs and many other compliance areas as well as research.

Jerry Cygler – Without law enforcement, the recommendations that get issued by FAO rely on goodwill from our particular countries and organisations. Without the support of law enforcement, it is very difficult to implement those regulations and there can be a lot of wrong-doing in other countries without law enforcement. However, some governments don't have enough money to equip their vessels etc. – do you know if there are any law enforcement initiatives from the leading countries (United States, Canada or Australia) to address this?

Todd Dubois – Yes, the MCS network is a global law enforcement network and one of the aspects that is being addressed through this initiative is the sharing of information with law enforcement and joint operations between countries. However, there are jurisdictional issues. For instance, the United States cannot enforce the laws of another country in another country's waters, but this is possible through FAO, ICATT and other organisations and that is clearly where we are headed (i.e., towards globalisation and the development of treaties that would give the various countries enforcement authority over each other's vessels etc.). The sovereignty and jurisdictional issues are a challenge for all of us, but that is what the MCS network is designed to do and, in fact, we have just appointed a permanent MCS Liaison position at our headquarters to help to get it off the ground in the United States.

Glenn Quelch (European Commission) to Lisa Borges

Comment / Question:

You suggested there was going to be an imminent discard ban in the European community but I think it is important to clarify that. We've only just started discussions on this issue and, given the nature of the fisheries in Europe, it is a highly thorny issue and the conservation benefits of a discard ban are not yet clear. Given the decision-making process that takes place within the European Union, it is very unlikely that such a ban would be implemented within the foreseeable future.

Response:

Lisa Borges – Yes, the communication for reducing by-catch and eliminating discards is currently being discussed and we will be starting the process by implementing selected pilot studies. Fisheries for such pilot work will probably be chosen this year and put in place for next year, but, again the process is up for discussion within the European Union and everything could change. I'm not going to discuss, or go into detail about the conservation merits of this type of communication, only that it is in the public arena now and industry are including it in their discussions and, at the very least, there will be pilot studies to look at ways to reduce discards.

Georg Hinteregger (Observer) to Lisa Thompson

Comment / Question:

As an observer, I've often been asked to use new protocols and forms etc. but there is usually little feedback from the people that are doing the science. Sometimes we are collecting data that is no longer being used. Is there a protocol to insure that observer data is being currently used

and if not to remove it from the observer's workload?

Response:

Lisa Thompson – That is a big concern and problem within our program, and in fact I think it is one of our top five complaints from observers, so this is something our program has been putting more focus on. We've been working with all data requesters and special project requesters to provide feedback and there is a poster here on one of our projects (we asked the people from our Centre to present their results in a poster at this conference so all observers coming here could see the results). Also, some of the special projects are only two year projects, whilst others get implemented as part of standard collections.

Bill Karp (National Marine Fisheries Service) to Lisa Borges or Glenn Quelch

Comment / Question:

Given the discussions about potentially banning discards and making observer coverage mandatory and then hearing the presentation from Todd Dubois – how does this all fit in? Are you already thinking that it is important to engage the enforcement part of the European Union in the discussions, or has your perspective changed as a result of some of the ideas that Todd shared with you?

Response:

Lisa Borges – This is currently open for discussion and agreement in the European Union and I have personally heard a lot of discussion about enforcement and how it has changed. The proposed discarding ban as it currently stands is heavily based on observer coverage. Most of us realise that 100% coverage is impossible in Europe, or very difficult to reach because of the costs and human resources that are required, but I'm not sure how we get a discard ban without 100% coverage. I think that is why the discarding ban is seen as little more that a title but hopefully it will lead to the reducing of discards. I'm worried about the part scientific observers will play in Europe and how enforcement comes into play – there might be a change from scientific observers as we know them today to observers having more of an enforcement role. I find it difficult to understand how the enforcement will work in Europe, mainly because it is a voluntary program yet countries are obliged to sample. Also, the data are used for management, but it has to be public because of the *Freedom of Information Act*. There are a lot of issues that still need to be worked out and maybe this conference and the workshop will be the first step to solving this.

Kim Blankenbeker (National Marine Fisheries Service) to Lisa Borges

Comment / Question:

I have two follow-up questions. Firstly, with respect to the discard issue, you said that if a ban were to come into effect, it would apply to vessels operating in the EC waters. Presumably these would be EC flag vessels that are member state flag vessels but would it exclude vessels of the EC member states that might fish on the high sea fisheries?

Response:

Lisa Borges – I don't think so – I think it is all European fleets in European waters but, again, it is open to discussion.

Comment / Question:

You mentioned that in 2002 a new regulation was introduced to improve data. I was aware that the EC had put a lot of money into data collection but certain fisheries haven't seen a lot of benefit from that – has the focus of that effort been on particular fisheries as opposed to others?

Response:

Lisa Borges – The data collection regulation didn't specify particular fisheries and it was originally intended to estimate discards in all fisheries in European waters. However, the data collection regulation is limited to stocks that have landings and also, if discards are insignificant, then that fishery does not need to be sampled initially but must be sampled every 3 years. The data collection regulation of the EU will provide 50% of the funding for discard sampling, but the country has to fund the other 50%. A lot of countries don't have enough funding or human resources to cover all the fisheries, so we basically have to prioritise the fisheries based on the knowledge we already

have about their discards and what is physically achievable.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment / Question:

We're going towards ecosystem-based management but we don't know exactly what it is or how to do it except that it needs a lot of information. We don't have a clear understanding about what we need to monitor yet we are flooding our observers with hundreds of requests that range from compliance issues to these vague ecosystem issues that can become infinite. Also, once we start collecting data, there is a fear that if we stop collecting it, we may find out that it was the most important data of all to address some elusive objective. Is anybody asking questions ahead of time about what we need for ecosystem-based management? Can we come together on a few things that we think we all need, start doing those, and then make sure that the other special projects don't become permanent projects?

Response:

I-Hsun Ni – In my mind, the ecosystem approach is about the fishery oceanography that is, the environmental impact on fisheries. Therefore, fisheries oceanography can utilise satellite remote sensing (long-term and large areas) in relation to the distribution and concentration of each species. In the future we also need to incorporate the relationship between species (regime shift) in relation to environmental factors. We have already started doing remote sensing and the long-term analysis of *El Nino* and *La Nina* in relation to changes in tuna species dominance over time.

Steve Kennelly – There are predictive ecosystem-based modelling programs currently underway (e.g., at the University of British Columbia and CSIRO in Australia). Using these models we can work out where the data gaps are and what data need to be gathered. Right now we are all charged with trying to measure biodiversity which can apply to everything down to microbes – I once heard somebody define biodiversity as "*biological diversity with the logic removed*"! The ecosystem-based models being developed are meant to identify which particular data sets are more critical than others for ecosystem-based fisheries management.

Mike Tork (NMFS) to Lisa Thompson

Comment / Question:

Your presentation highlighted a common problem in all observer programs – "*build it and they will come, and come, and come….*". We don't currently have a formal process in the north-east to prioritise observer tasks, but we're looking at adopting one and I would appreciate if you could e-mail me a copy of your presentation. My question is, before you take on a new sampling or data collection request, do you do any analyses of the number of hours observers are currently spending to accomplish their existing tasks at hand?

Response:

Lisa Thompson – Most of our staff have been observers and many of us train observers so we're actively involved with this. We have debriefings and speak to the observers and therefore get a good feel for the amount of time they're spending on deck, the amount of time species counts are taking, etc. It is difficult to come up with a standard figure because there is a huge variance between vessels – our fleets range from 66 ft vessels to about 635 ft and from one observer on a boat for 30% of their time to three observers on a boat for 100% of their time. We know that if we ask our observers to take five more lengths that it can be a big deal and if we ask them to do five more lengths on ten different species then it is an even bigger deal because it involves species identification as well as lengths. Instead of having an influx of data requests to our program, we have created a funnel where there are one or two people that all divisional requests funnel into and who sit down and work out the details – this gets presented to us as a prioritised list which we work through to determine what is feasible for our observers in terms of the time they spend on deck.

SESSION P3

Industry Panel: What are the commercial fishing industry's perspectives on fishery monitoring programs and how they can be improved?

Moderator:	
Greg Workman	*Department of Fisheries & Oceans – Canada*
Speakers:	
Daryl Sykes	*NZ Rock Lobster Industry Council – New Zealand*
Wes Erikson	*Halibut Advisory Board, BC – Canada*
Paul Parker	*Cape Cod Commercial Hook Fishermen's Association – USA*
Lori Swanson	*Groundfish Forum – USA*
Mike Buston	*Leader Fishing – Canada*
Cyril Forward	*Teamsters Union/Seawatch – Canada*

Counting the beasts – vessel logbook programmes in New Zealand lobster fisheries

Daryl Sykes

NZ Rock Lobster Industry Council – New Zealand

Fourteen years on, industry-generated data collection programmes provide greater certainty to rock lobster fishermen and to fisheries managers in New Zealand.

In 1993, the New Zealand Fishing Industry Board (NZFIB), in association with the CRA 2 and CRA 8[1] fishermen, established a voluntary rock lobster logbook programme. Paul Starr (then consultant to the NZFIB) and Paul Breen (NIWA) developed the programme design based on an industry-generated data project operating in South Australia.

The rock lobster logbook is the longest running logbook of its kind in New Zealand. In the most recent seven year period, more than 200 commercial fishermen provided detailed biological information for more than 400,000 lobsters. Currently there are around 60 fishermen participating in contracted Logbook Programmes across three management areas and another 20 voluntary participants across two of the other six areas.

NZ Rock Lobster Industry Council (NZ RLIC) manages every aspect of the Logbook Programme as a part of a comprehensive multi-year research services contract with the Ministry of Fisheries (MFish).

The NZ RLIC is the national umbrella organisation for the consortium of nine commercial rock lobster stakeholder organisations (CRAMACs) and provides a range of administrative, management and advocacy services to those organisations and their constituents.

1 There are nine rock lobster fishery management areas in New Zealand, designated CRA 1 to CRA 9. CRA is the acronym used for rock lobsters (*Jasus edwardsii*) in the New Zealand Quota Management System (QMS).

Why a logbook?

Stock assessments rely on information about the size and characteristics of the catch. Data on the total catch weight and fishing effort of the rock lobster fishery are derived from the compulsory MFish catch, effort, landing returns provided by commercial fishermen.

However, information on the composition of the catch – for example the proportion by maturity and size class must be obtained through more detailed stock monitoring.

Traditionally, scientific observers have been employed to conduct intensive catch sampling onboard commercial vessels. Due to logistical constraints, such personnel usually sample a large proportion of the catch from a small proportion of fishing trips made by a small number of fishermen in each region.

Alternatively, fishermen can sample their own catch and record it in a logbook. Again, logistical constraints mean that each fisherman can usually only sample a small proportion of their catch on each day. However, the advantage of logbooks is that every day fished produces a catch sample. If that small effort is expended over the entire fleet, the net result is that a significant proportion of the catch is sampled from a large number of fishing days over the course of the season.

This type of extensive sampling is more likely to produce data that is representative of the fishery, particularly when there are large differences between the catch characteristics of different vessels. Logbook programmes also enable coverage in more remote or highly weather dependant areas, which can be expensive to sample using scientific observers.

Because the data is more representative, and because they collect it themselves, fishermen have confidence in the data when it is used in stock assessments or for management planning purposes. Logbooks are an efficient, credible and very cost effective information gathering option for the seafood industry.

What is recorded?

Logbook participants chose four of their pots, representative of their general fishing pattern. Each chosen pot carries an identification label. Fishermen record details of their activities during each fishing trip. The trip information recorded includes the date, the vessel used, and statistical area fished. When the participant lifts any of their labelled pots, they record the zone fished, depth and the length of time that the pot was in the water. For each potlift, any lobsters caught are counted, and up to twenty-five lobsters are sexed, staged and measured.

How is it used?

The data collected by this logbook programme is essential to the stock assessment process. The current stock assessment model is fitted separately to the catch size frequencies of males, immature females and mature females. These provide invaluable information to the model regarding the changes in the composition of the catch.

For example, in the stock assessment for the CRA 1 and CRA 2 stock, the logbook data showed a clear shift through time towards higher proportions of larger lobsters of both. This, as well as an increase in catch rates during the 1990s, was interpreted by the model to be a result of a period of higher than average recruitment in the early 1990s.

Summaries of the data are produced for individual participants at the conclusion of each fishing season. These include graphs of their catch rates, mean size of their catch and size frequencies. The data is summarised so that the privacy of individual fishers is not compromised.

Who has made the programme successful?

The logbook programme would not be possible without the commitment of participating fishermen. They have volunteered the time and effort to make a significant contribution to the monitoring of the stock and by doing so, provide the rest of the fleet and all quota owners with a great service.

The NZ RLIC and CRAMACs have long recognised the value of the contribution made by participants and have endeavoured to provide some measure of recompense by way of monthly lotteries and seasonal travel prizes. The current industry research programme includes provision for more tangible recognition for all participants, not just the lucky ones.

Also instrumental in the success of this logbook programme are the CRAMAC field technicians who provide the personal contact with the logbook participants. Simon Anderson/Lat37 Ltd. (CRA 2) and Gill Rowe (CRA 5 and CRA 9) have been invaluable in recruiting new participants and providing assistance and supervision in the field.

Since 1996 the programme has been coordinated and managed by the NZ RLIC. The NZ RLIC contracts database management and provides reports to fishermen. Leading consultant stock assessment scientist Paul Starr has been a stalwart for the programme and during his time at SeaFIC used the benefits of the rock lobster logbooks to promote similar initiatives for other commercial fisheries.

What is the future for logbooks?

The NZ RLIC recently commissioned a revision of the logbook programme that has included the redesign of the logbook datasheets, the database, data entry procedures and participant reports. This revision of the logbook was to improve the programme to cope with some recent developments in rock lobster fisheries.

Two of the potentially significant improvements to the logbook were the inclusion of zones and high grading information. Zones are 'sub-areas' which enable the trends in the fishery to be discerned on a smaller geographical scale than the much larger statistical areas, while protecting the exact location of any 'secret spots'.

High-grading (which is selecting catch on dollar value rather than weight/numbers) occurs in some management areas but was not recorded previously by the logbook or in MFish returns. Active high-grading, such as known to occur in several management areas in the mid to late 1990s, could distort the index of biomass derived from catch per unit effort information from compulsory MFish returns. Now the participants simply have to tick a box to indicate whether the rock lobster measured was kept or safely returned to the sea. Logbook data can now be used by scientists to adjust catch per unit effort data from MFish returns to provide a more accurate index of the stock biomass.

The NZ RLIC currently manages contracts to ensure that the rock lobster fleet provides sufficient Logbook coverage in CRA 2, CRA 5 and CRA 8 to meet or exceed the MFish standards and specifications required by the stock assessment process. The NZ RLIC also commissions sequences of intensive stock monitoring by trained observers in order to validate the information provided by Logbook participants.

Intensive catch sampling is still routinely undertaken in other regions under contract to the NZ RLIC but the opportunity exists for fishermen to participate in a more cost effective way to collect the data necessary for stock assessment.

As the need grows for more fine scale information about fishing activities the NZ RLIC is exploring the use of electronic recording and reporting as an alternative to existing Logbooks.

With acknowledgements to:

Dr Paul Breen, NIWA; Vivian Haist, Haist Consultancy; Paul Starr, StarrFish.

The British Columbian Fishery: A commercial fisherman's perspective

Wes D. Erikson

Halibut Advisory Board, BC – Canada

As an active commercial fisherman, it is a pleasure to finally be observing the observers. This could be the only opportunity I ever have. What I will tell you are my own personal recollections and views. It is difficult to sum up in seven minutes what has happened in our British Columbia fishery over the last twenty years and I was only just asked if I would address this conference. As I mentioned before, I came to turn the tables and observe the people who would normally be watching me.

Sectors of our industry have to be in a lot of pain before change is considered. Some fishing sectors could die a painful death because of their resistance to change. The participants of the sector will not let go of old attitudes and ideas in a changing world and the world is always changing. Our British Columbia salmon fishery has been in a lot of pain for a long time now. It

does not help a fishing sector to start blaming people, places and things for the state it finds itself in. The sector must move beyond denial and work towards solutions that will have a lasting benefit. In short, we need to stop dwelling on the problem, live in the solution, and lead by example.

The ideas start with one person, then two and four. Soon the idea takes hold. The idea was Individual Transferable Quotas (ITQ). The idea came from a fisherman, Ken Erikson, who belonged to an industry organisation within the halibut sector, the Pacific Coast Fishing Vessel Owner's Guild. The organisation presented the idea to the government, the Department of Fisheries & Oceans (DFO). DFO consulted with the public and industry to create an individual allocation formula and industry worked with DFO to develop a set of rules to manage the fishery. *Industry–Government–Public–Industry.*

The key word in ITQ is individual. An individual allocation of fish is needed in order to achieve individual accountability and responsibility. This was the beginning of the observer program in British Columbia. The fishermen required dockside monitoring in order to show the public that fishermen were being accountable within their individual quotas.

Let me step back a little. Getting to the actual ITQ fishery was not easy. Things had to get bad before there was an appetite for change and by bad, I mean painful. The halibut season was six days long (a four and a two day opening). During these periods, several million pounds of halibut flooded the market and the buyers could pay as little as they wanted. We needed to change. We needed to work through the pain. *"Through Pain comes growth"*. In spite of what I just explained, many fishermen were fundamentally and philosophically opposed to change. They simply could not let go of old ideas and attitudes. They said it simply could not be done. *"It does not work anywhere else in the world."*, *"Who is going to pay for the monitoring?"*, *"Crew will lose their jobs."* , *"Doctors, lawyers and fishing companies will buy up all the quota."*, *"What about the fish I want to take home and eat?"*. Some even said, *"Over my dead lifeless body will this ever happen"*.

Five years into the halibut ITQ fishery, nobody could honestly say they would like to turn back the clock and fish like they used to in a six-day derby fishery under sometimes dangerous conditions and receive a low price. Fishermen had worked through denial, anger and bargaining and had come to a place of 'acceptance'.

Years pass happily fishing halibut, encountering non-target species like rockfish and in many cases throwing them away. I thought, 'Wow, this is novel. Don't imagine we will be able to do this indefinitely.' Some of my fellow fishermen said there is absolutely nothing wrong with discarding lots of non-directed species in order to catch the directed species. *"There is lots of this by-catch stuff"*. *"We wouldn't keep catching it, if there wasn't a lot"*.

Then the public noticed. They didn't think it was novel. They didn't think it was acceptable. Some said we were evil killing machines, depleting the oceans, harvesting everything in our path, throwing away dead what we didn't want in order to make money. Fishermen said, *"These people don't know what they're talking about. They are misinformed. Ignore them. They will get bored and go away"*. They didn't.

The government listened to these misinformed people and asked us fishermen if we were really fishing this way. Most said, *"No, of course not."* Some said, *"Well, maybe a little, but it's not that bad"*. Government asked us to dispel these nasty accusations and prove ourselves innocent, so to speak. There was only one way. There was no way to verify our logbooks without 'observer coverage'.

Okay. Let's try and cover ten percent of the fishing fleet and we can make it voluntary. Surely, ten percent of the fishermen will volunteer for the good of the rest of the fleet. No one volunteered. Government (DFO) randomly selected vessels to take observers. Fishermen became very creative to avoid taking an observer. Some fishermen removed bunk beds and claimed they did not have enough sleeping accommodation. One fisherman removed his toilet. Some fishermen simply refused. Vessels that did get selected to carry observers changed their fishing behaviour. I know. I sure did.

So, for several years, we had partial observer coverage, 10 to 20 percent, but it was all perception. We could say, *"We have observer coverage"*. That worked for awhile. We were still fishing irresponsibly, when we didn't have observers, and our dirty little secret got out. Government (DFO) took action because of public pressure. The hammer came down:
There will be full retention of all rockfish. Industry will remain within existing catch limits (TACs) (difficult when you can't discard). There will be 100% monitoring and/or observer coverage.

They gave industry one year to prepare and consult before implementation of this 'Integrated Groundfish Strategy'.

Here are some of the things that were said: *"100% coverage is impossible because of the small vessels in the fleet."*, *"It will be too expensive. There is not enough money in industry to pay for this."*, *"Observers and electronic monitoring are invasive and violate my privacy rights."*, *"A female observer could ruin my marriage."*, *"No. We will not abide by your silly rules. DFO does not have the resolve to shut down the fishing industry."*

The key to the success of this 'integrated groundfish strategy' has been leadership in DFO and in industry. People prepared to make tough decisions and do what is right for the resource and the people who earn their living from that resource. Under this innovative new strategy, all our sets and hauls are video recorded. We keep accurate logbooks which are audited against the video footage. To reduce costs, only ten percent is audited. However, if the ten percent does not pass the audit's margin for error, then more audits will occur at the fisherman's expense. Therein lays the incentive. 'Hit us in the pocketbook' works every time.

After one year fishing under a fully integrated fishery, the majority of fishermen are in favour of this type of fisheries management. Our logbooks are used for fisheries management. I believe this is the only jurisdiction in the world where this occurs.

Some fishermen will chose this time in their career to retire because they cannot accept the changes that have occurred, but they are few. Most of the opposition is fading and acceptance is taking hold. I believe monitoring is keeping us fishing in this changing world. We are now accountable, responsible, sustainable, and we can prove it.

That's it in a nutshell!

Management of a multi-species fishery in transition from input to output controls: Monitoring, analysis and reporting solutions for discrete fleet management units

Paul Parker

Cape Cod Commercial Hook Fishermen's Association – USA

Fisheries management in New England is changing. For critical stocks like groundfish, monkfish and skates, there is growing recognition of the need for a change in course. Input controls like Days-at-Sea (DAS), which have formed the backbone of the management plans, are not only failing the fish, they are failing the fishermen. The transition to output controls has already begun: hard catch limits are currently in place for transboundary management with Canada, various Special Access Programs, and two existing community based (Sector) allocations for Georges Bank cod.

In the meantime, however, New England finds itself in a difficult transitional phase, with management resources spread thinly across two regimes. At the same time, these existing catch limit programs have served the region with fair warning that there are serious leaks and inadequacies in the existing monitoring infrastructure. Applications were recently submitted to the government by industry groups who seek the creation of ten new Sectors with allocations of all groundfish species. It is clear that all Sectors will need to take an active role in cooperative monitoring and management, working with existing government resources and contributing their own to develop additional monitoring capacity.

The Cape Cod Commercial Hook Fishermen's Association (CCCHFA) is a non-profit organisation of commercial fishermen working towards marine conservation. CCCHFA manages two Sectors, and has worked to develop this additional monitoring capacity for those entities. In fishing year 2007, this will consist of an internally managed program using a combination of electronic monitoring, electronic catch reporting, and at-sea observers. However, CCCHFA is working to test the concept that improvements in economy, efficiency, and consistent standards may be gained through the privatisation of this extra-regulatory monitoring, especially if additional Sectors pool resources and seek to contract their programs together.

Opportunities and challenges for observer programs in rationalised fisheries

Lori Swanson

Groundfish Forum – USA

Groundfish fisheries in the United States Bering Sea/Aleutian Islands (BSAI) have a combined harvest of 2.0 million metric tons of biomass per year. This is well below the total 'allowable biological catch' and has proven to be sustainable. Of this amount, about 75% (1.5 million metric tons) is taken as pollock by vessels which qualified under the *American Fisheries Act* (AFA) in the late 1990s. The other major trawl catcher-processor sector is the 'non-AFA' trawl catcher-processors – also known as the 'head and gut' or 'H&G' sector. This sector is facing rationalisation with an accompanying increase in observer and monitoring requirements.

H&G trawlers are typically smaller than the pollock trawlers, and fish an array of non-pollock species including flatfish, cod, Atka mackerel and rockfish. They do limited processing onboard, as the sector name suggests. H&G vessels do not have fish meal plants onboard, and in most cases could not install these plants due to size and vessel age restrictions.

Because they do not have meal plants, any fish which are not suitable for the H&G market are discarded over the side. These discards have long been a concern to the North Pacific Fisheries Management Council (NPFMC). Although the rate of retention has increased steadily since 1995, the Council has continued to explore other means of forcing these vessels to reduce their discards.

In 2003, the NPFMC approved 'Amendment 79' to the Bering Sea/Aleutian Islands Fisheries Management Plan (BSAI FMP). Amendment 79 will, among other things, require vessels in the H&G trawl sector to retain gradually more of the total catch over a series of years, culminating in 85% retention in 2011. This will be difficult for many vessels and impossible for some of the smaller operations where freezer space is limited. The NPFMC acknowledged the difficulties associated with their action, and continued to work on a plan to rationalise the sector.

Rationalisation – which apportions the allowable catch to a limited number of vessels – when combined with the ability to fish cooperatively provides the tools for fishermen to operate more slowly and efficiently. Since they no longer have to race against other fishermen, vessel operators can take steps to both control the amount of undesirable fish they catch, and to better utilise everything that comes onboard. The motivating force changes from 'dollars per day' to 'dollars per fish.' The Council recognised that rationalisation could provide the tools the H&G sector needs to meet the groundfish retention standard.

In 2006, the NPFMC approved 'Amendment 80' to the BSAI FMP. This action allocates a percentage of the allowable catch of Atka mackerel, Pacific Ocean perch (in the Aleutian

Islands), three flatfish species and Pacific cod to the H&G sector. It also establishes separate caps on halibut and crab for this sector (prohibited species which must be discarded), and allows participants to combine allocations and fish them cooperatively. Further, under Amendment 80, the retention standard established by Amendment 79 is applied at the cooperative level. The new management should also help the fleet absorb the increased costs of observer coverage which the Council deemed appropriate.

Prior to Amendments 79 and 80, vessels greater than 125 feet in length were required to carry one observer at all times, while vessels under 125 feet carried observers 30% of the time. Following implementation of Amendment 80 (scheduled for January of 2008), vessels will have an array of new observer requirements, including:

- Two observers onboard at all times.
- A certified observer sampling station (meeting size and other requirements).
- Motion-compensating scales for weighing samples.
- Flow scales for weighing entire catch.
- No mixing of hauls in fish bins.
- No fish on deck outside the codend.
- Only one conveyor from the flow scale to the observer station.
- Fish bin monitoring requirements (video option).

These changes are estimated to cost up to $400,000 per vessel.

New equipment will make observer data more accurate and easy to obtain. Flow scales, for example, should provide a more precise measurement of landed catch than previous estimates taken by measuring the codend to calculate volume. Vessels have also begun experimenting with video systems to monitor activity in the fish bins, as required under the new regulations. These systems allow observers to see what is happing in the bins using a monitor positioned at the observer station.

In addition to placing cameras in the fish bins, some vessels are now using cameras on deck and at other positions in the factories. The ability to watch deck activities, in particular, has promise for future refinements in observer monitoring. Previously prohibited activities, such as sorting on deck, may be feasible if they can be observed. This could allow for much better survival of prohibited species (such as halibut and crab) which must be discarded.

In summary, the mandate to reduce discards has led, ultimately, to rationalisation of the non-AFA (H&G) trawl catcher-processor fleet in the Bering Sea/Aleutian Islands groundfish fisheries. With rationalisation has come increased observer coverage and new equipment requirements which will be very costly. However, the new requirements will also provide better data for fisheries management, and present opportunities for further development of observer monitoring and, perhaps, better handling of species which vessels are required to discard.

How BC groundfish bottom trawl fishery monitoring program can be improved

Mike Buston

Leader Fishing – Canada

BC groundfish bottom trawl fishery monitoring framework

- Hail requirements:
  - Third party contractor selected and funded by industry.
  - Vessels hail out their plans to fish and to request an observer and hail in their landing time, location and estimated catch and request a Port Monitor.
- Logbook requirements:
  - Costs of logbooks funded by industry.
  - Vessel skipper records all fishing information.
- 100% at-sea observer coverage:
  - Third party contractor selected by DFO.
  - Funded by industry (license holders invoiced directly by Contractor for observer time used).
  - Observer estimates retained and released catch by species and area; records trawl locations and duration; takes biological samples; estimates total mortality.
- 100% dockside monitoring of landed catch:
  - Third party contractor selected by industry.
  - Funded by industry (license holder invoiced directly by contractor for port monitoring time used).

- Port Monitor records total weight of catch by species.

- Fisheries Operating System (FOS) is the computer system that manages all of the data collecting by the monitoring program and is primarily funded by DFO (includes programming, data entry, data editing, reports).

Meeting government, industry and public needs

- Both government and industry share the objective of a well managed sustainable fishery.
- Government is more focussed on conservation and less on the economic realities of the fishery and industry.
- Industry is also concerned about the economic viability since they are paying for most of the monitoring costs (approximately $3 million each year). In the last three years fuel prices have doubled and the landed price of groundfish has fallen 30% (due mostly to changes in exchange rates and the influx of substitutes such as tilapia).
- Changing public awareness and requirements regarding the responsible use of products from sustainable industries (i.e., traceability and eco-certification).

Fundamental requirements

- Determine the basic monitoring needs (you don't need a Porsche when a Ford will suffice).
- Ensure industry is involved closely in a meaningful way in program design, contractor selection, implementation, ongoing evaluation and revision.
- Always be looking for ways to increase economy of scale, improve program efficiency and reduce delivery costs without compromising basic program needs and product quality.
- Ensure the program is dynamic and can change with market, harvesting, and fisheries management requirements.
- Total monitoring program costs should be reasonable or the fishery won't be viable (they must be considered in line with all costs and revenues).

Possible improvements to the BC groundfish bottom trawl monitoring program

- At-sea electronic data entry
  - To reduce paperwork, errors and improve overall data entry efficiency
- Electronic monitoring
  - For vessels that are willing to fish in a single area and only release prohibited species
- Electronic logbooks
  - Reduce logbook costs, data errors, and improve overall efficiency.
- Establishment of a Government/Industry monitoring committee that meets regularly to review program activities and costs and consider and develop program improvements.
  - Should meet 3 – 4 times a year.
- Greater utilisation of program for collecting science data (bio-sampling, CPUE, stock assessment surveys).
  - Program focus has been largely on TAC and ITQ management and compliance requirements.
- Vessel Owners to have direct access to their vessel's ITQ information over the computer to make transfers and view holdings.
  - similar to current computer banking.

BC groundfish bottom trawl fishery monitoring program – industry perspective

- Didn't want it at first – but realise the need for it now.
  - It's important for the operation of the ITQ program and the sustainable management of groundfish.
  - Significantly improves overall program compliance and confidence.
  - Allows for greater management and operational flexibility (i.e., overages/underages, area closures, gear requirements, at-sea releases).
  - Provides information that can be used to properly identify the impact of the fishery (i.e., stock specific mortality, coral and sponge by-catch, trawl area coverage).
- Need to make sure that program costs don't get out of line with the economic realities of the fishery and that the program is responsive to industry needs.

Better communications for harvesters

Cyril J. Forward

Teamsters Union/Seawatch – Canada

Over the past 25 years as a fisheries observer I have learned quite a lot, and I am still learning. We as observers, the harvesters, the producers, and our respective governments have a duty to work together to protect and enhance the oceans resources and to learn as we proceed.

I want to start with a quote that sums up my presentation much better than I could: *"education is the key stone to progress. For the individual, the doors to a schoolhouse, to a library and to colleges, lead to the richest treasures of our society, to the power of knowledge, to the training and skills necessary for productive employment, to the wisdom, to the ideals and the culture, which enriches life, and to the creative self-discipline and understanding needed to form good citizenship in today's changing and challenging world"*.

For the most part, fisher persons want to cooperate, understand, and help make a better future for all. Over the past months I have listened more intently and questioned more intently these fisher persons and I have asked questions in non-official interviews.

I have found that attitudes from the harvesters have changed tremendously over the past 25 years. In our waters now, some harvesters are fishing what, in years past, would have been considered a nuisance fish, the Atlantic hagfish or as we refer to it, a slime eel. I was surprised that this harvester was well versed in the medical research being carried out on this slime eel and its great potential as a cancer curing agent. I was given a lesson, not only in the medical research, but what I must do to better equip myself for my job, and that is, to train and retrain and learn as much as I could at all times.

The harvesters want openness and feedback, especially with regards to information gathered by the observer, where this information finally ends up and how it is used. It is becoming clear that the harvesters expect more from the observers and they want more coverage, realising that the ocean is their chosen future which must be protected.

Over the years, the observer was looked upon as a threat to harvesters, a person who was out to get them. Thankfully, that attitude has changed, not in all, but in the great majority. In recent years, in our little corner of the world, harvesters have even requested that observers accompany them on certain type trips. Trips that may be a little out of the ordinary, trips beyond the normal activities of that harvester or when DFO have requested special information.

Openness, frankness, feedback and cutting off problems at the ship if possible, through discussion, education and training and retraining for all, including the observers, harvesters and producers is a necessity. Rehash the old, learn the new, be honest and forthcoming with all and strive to help rather than hinder. Share information with all, keeping, of course, within your authorised guidelines according to your briefing instructions and other information that we gather.

Ongoing training for observers, feedback to the industry, cooperation on the sea and on the land and professionalism at all times, will help lead to a better understanding of the oceans and their contents. During one of my trips in a conversation with a captain he said to me *"when I am fishing I look at that fish as my enemy. I have to do all in my power to catch and destroy him"*. That statement stuck with me over the years and thankfully that attitude is changing and most everyone now is thinking conservation. In 1860, when American president Abraham Lincoln was running for office, he was asked *"and sir, what will you do about our enemies?"* Lincoln replied, *"I will destroy them. I will destroy all of my enemies….I will make them my friends"*. My fellow observers, lets, through education of ourselves, education of the harvesters and education of all of the industry, make the ocean and its resources our friends. In this way industry will eventually understand the importance of our work.

My opening quote was by President John F. Kennedy of the United States to the 29th Congress of the U.S. on January 14th, 1963. Forty-four years have passed since then and his words are more so true today, as they will be in 10 years, 20 years, or 100 years from now. We as observers stand at the threshold of a very challenging and changing world. A world becoming more difficult to understand, more complex. The oceans are more complex.

Governments and authorities must take heed to the work we do, the information we bring back, and put this information to good use. We must make ourselves aware of what's happening in the oceans, and we must continue to train and upgrade our education.

The observer plays an important part for the fishing industry. Let's continue to learn and do so.

Questions & Panel Discussion – Session P3 –

Bill Karp (National Marine Fisheries Service)

Comment / Question:

The whole environment of fisheries management and monitoring is changing and this leads to changes in observer roles and responsibilities. I would like to hear the panel's thoughts on how we can work better together to come up with the right solutions – what are the guidelines for the appropriate roles of industry, government agencies, private contractors, and how can we make sure we maintain the right balance of roles relative to the changes?

Response:

Mike Buston – I think honesty is the first policy. In the beginning of our program there was an attitude from a lot of people to hold back their information and that was a huge problem. As we developed through the program and fishing was still being stopped, a lot of those people realised that they needed to be forthright. Secondly, I think the continuity we have with the people that we have worked with in DFO has also been an important factor.

Paul Parker – I agree with one of the comments made earlier by Wes Erikson that fishermen respond well to money. Fishing is a business, so we need to align conservation with cash. I think this is an important tip in terms of how to motivate industry and I think it is something that is easier to do at a local level (i.e., whether it is community of interest or community of geographic space).

Lori Swanson – The need for the information collected by observers needs to be understood and credible from industry's perspective – i.e., why do we need the data, how will the data be used, etc. We also need to provide an assurance that the data that are collected remain confidential (e.g., the factors that give a particular vessel an edge over another vessel – like the best fishing spot; a particular fishing technique; etc. – but at the same time ensure that we can extract the relevant scientific information.

Amy Van Atten (National Marine Fisheries Service) to Wes Erikson

Comment / Question:

Since you bought up money, I was wondering if your program in British Columbia is industry-funded?

Response:

Wes Erikson – It is mostly industry-funded but the federal government also contributes a percentage – but I can proudly say that we cover most of our costs.

Amy Van Atten – Do you think there would have been as much involvement from fishers in terms of the time they committed to work out the details of the program, had it not been industry funded?

Wes Erikson – We had fishermen interest because we had a hammer above our heads – they basically said "here's the destination, you tell us how to get there, or else" – that's how government got us going.

Jerry Cygler (East West Technical Services) to Lori Swanson

Comment / Question:

Who pays for the flow scales and other expensive items that are onboard and is it a requirement for such equipment to be onboard?

Response:

Lori Swanson – Industry pays for all the equipment that is required and also for the observers. We pay observer contractors for observer time (about $350/day), plus the cost of the equipment, the installation and maintenance of that equipment.

Jerry Cygler – But does the industry have to implement the equipment to comply with the regulations and be able to fish?

Lori Swanson –Yes.

Jerry Cygler – How many vessels participate in that fishery?

Lori Swanson – We currently have 23 vessels in that sector but it is likely that some vessels will drop out – partly because of the expense and partly because of the difficulty in fitting the equipment onboard some of the smaller vessels.

Jerry Cygler – Some of this equipment is very expensive, for example the certain scales are over $20K and the float scales are even more expensive.

Libby Fetherston (The Ocean Conservancy) to Wes Erikson and Paul Parker

Comment / Question:

Wes' comments struck a note with me because we are at that stage in the Gulf of Mexico that you described, which is the crisis/dying fishing stage. It concerns me greatly and I think monitoring data is the key to solving that. I also think Wes and Paul are at opposite ends of the spectrum – Wes talked about the hammer and Paul talked about the voluntary effort of the sector. Do you have any advice on how to work with our fishers to get them to embrace the kind of monitoring that I think is crucial for a successful fishery?

Response:

Wes Erikson – What actually got the public interested was a publication from an NGO at the Sierra Club which contained misinformation but we had no way of proving it was false. We needed a database to show the public what we were really catching.

Paul Parker – We also had a kind of hammer from our community and there were two options: go out of business or declare into a sector. The rules were going to make it so inefficient that we couldn't turn a profitable trip so there really wasn't any alternative for our fleet and, although there wasn't a report by an NGO, there was leverage.

Daryl Sykes – If you're having difficulty communicating with the fishers themselves, my experience is that you need to choose an example that is commensurate with their scale of fishing. For example, the fishers in an inshore, single species, single method fishery would not be interested in hearing solutions based on a mixed species, mid-water or demersal trawl fishery. You need to find examples from elsewhere that are most similar to the ones you're trying to help.

Liz Mitchell (North Pacific Groundfish Observer)

Comment / Question:

I see three major trends that can affect observers: the rationalisation of the resource, electronic monitoring and public access to the data for independent review. Electronic monitoring obviously has its place in some fisheries but I can see it becoming inaccessible as a data source for the public. For rationalisation, quotas are based on observer data which will place increased pressure on observers. With public access to the data, I see increased cooperation between the government and industry, but there needs to be independent scientific review of the data to gain public confidence in the data. It seems there is a trend toward making the data more inaccessible to the public and the misinformation that some of you have talked about could be a result of that – there needs to be greater public access to the data for independent review but there are also privacy issues related to the data.

Response:

Wes Erikson – In our fishery, there isn't an issue with allowing the public to have access to general data such as catches for a fleet, area, etc., however, we are concerned about specific data such as individual sets, times and places. That specific information is the heart and soul of a fisherman and we are concerned about how that information could be used.

Mike Buston – The Department of Fisheries & Oceans has a process for the trawl fishery and other fisheries, which involves them reviewing a lot of the data in an open public forum. There is a lot of public information that comes out of our fisheries, especially for the survey data and stock assessments.

Daryl Sykes – There is a very open and transparent process for all fisheries in New Zealand, including inshore, mid-water and deep-water fisheries. It starts at the research planning stage with the confirmation of information needs for management. At every step of the scientific working group process, there is a very open, and sometimes quite contestable, peer review process with representation from the commercial and non-commercial sectors, including environment and conservation interests and customary and indigenous representatives. So, the idea that rationalisation will somehow move to a rights-based regime and close up the relationship between the rights holders and government, need not compromise the integrity of independent peer-review, in fact, it probably requires more in order to have integrity as a process.

Lori Swanson – The industry does not provide the information for our TACs – it comes from government surveys. As part of the responsibility that goes with rationalisation, I think we're finding that there is much more data available to the public and our concern is the level of detail that is provided (i.e., the fineness of data that is provided on a vessel-by-vessel basis).

Liz Mitchell – There is a rule in the North Pacific where, if there are three or fewer vessels in a certain area, then those data are not accessible.

SESSION P4

How can industry play a role in monitoring fisheries?

Moderator:	
John LaFargue	*National Marine Fisheries Service – USA*
Speakers:	
Jason Scherr	*Archipelago Marine Research Ltd. – Canada*
Amy Van Atten	*NOAA Fisheries – Northeast Fisheries Observer Program – USA*
Michael Palmer	*National Marine Fisheries Service – Northeast Fisheries Science Center – USA*
Martin Loeffled	*NOAA Fisheries – Alaska Fisheries Science Centre – USA*
Vanessa Tuttle	*NOAA Fisheries – Northwest Fisheries Science Centre – USA*

Industry leading the way to monitoring solutions: The area 'A' Dungeness crab fishery in British Columbia

Jason Scherr[1]*, Bryan Rusch[2] and Geoff Gould[3]

[1] *Archipelago Marine Research Ltd., BC – Canada*
[2] *Rusch, B., Department of Fisheries & Oceans – Canada*
[3] *Area 'A' Crab Association – Canada*

The Area 'A' Dungeness crab fishery in northern British Columbia involves a fleet of about 50 vessels primarily fishing the waters of Hecate Strait and Dixon Entrance. The fishery markedly intensified in the 1990s with high catch levels bringing more vessels to the area. There was a dramatic increase in the number of traps in the area. Fishery participants began to experience a serious and costly problem of gear vandalism and catch theft, largely by other Area 'A' fishing vessels. Gear loss averaged between 20 – 30% which equated to a value of approximately $60,000 per vessel per year. With catch theft, fishers estimated that up to 30% of their gross production was being lost, approximately $100,000 per vessel per year. There were reports of vessels fishing with no bait nor any traps of their own.

The theft and vandalism could not be adequately addressed by conventional enforcement measures. Fishers had approached the Department of Fisheries & Oceans and the RCMP. Neither had the ability to monitor or enforce activity on the fishing grounds. By the late 1990s, the fishery was at a crossroads. There were an increasing number of traps being fished and management reforms were about to be implemented to limit the number of traps in the fishery. However, loss and damage to property and catch theft was causing a loss of income to fishers. The inability to monitor the fishery or to catch or prosecute those responsible led to mistrust amongst the fishers and a potential for violence.

Led by industry, the Area 'A' Crab Association was formed in 1997 to represent the collective interests of the fleet and establish controls in the fishery. The fishers had realised that to solve their problems, they needed to act as a collective group and create solutions. The mandate of the Association was to represent all fishers and to work towards a collectively managed fishery. The board of directors was elected from the membership and looked to include all sectors of the fishery (i.e., big and small vessels; fishers from Prince Rupert and those from the Queen Charlotte Islands; Asian, native and Caucasian fishers). The most immediate issues for the fishers to deal with were moving from longline gear to single buoyed traps, limiting the

numbers of traps fished, and to solve the theft and vandalism.

The fishers discussed an idea to place cameras on the vessels. The Association contracted with Archipelago Marine Research Ltd. (AMR) to implement 100% monitoring for all vessels in the fishery using video-based electronic monitoring (EM). The fishers in Area 'A' would be piloting innovative new technology and funding the entire cost of the monitoring program. It was a significant amount of money to adopt EM during some very poor fishing years. However, the fishers felt there was no other method to solve the problems and in July 2000, the fishery opened with 100% of the vessels participating in the EM program.

From its inception, the monitoring program in the Area 'A' crab fishery was a success. The primary reason being the buy in from the fishers and the cooperation to make sure the system worked. There was vision and commitment by the fishers and the directors of the Board to adopt EM and to deal with the issues arising in the fishery. The outcome of the monitoring program was a level playing field, a manageable level of traps, the elimination of theft and vandalism, order and cooperation.

The Association was the key to the development and delivery of the monitoring program. It was the Association that laid out the organisational framework and rules for the fishery. As a collective the fishers, through their Association, maintain control of the monitoring program and ownership of the data. Fees from the fishers are collected by the Association and contracts are negotiated directly with the service provider with the cost being reduced by acting as a collective group. The Association also acts as an information broker providing feedback to the fleet and reporting to the Department.

The Association is directly involved in the management of the Area 'A' crab fishery, working closely with the Department of Fisheries & Oceans on enforcement and management issues, and by providing direct controls on its members using a variety of administrative penalties. Standards and targets are set for compliance and the Association works with the membership on addressing the issues. The Association provides advice to the Department, working towards co-management of the fishery.

With the success of the EM program, the Area 'A' fishers were able to proceed with a number of changes to their fishery. A ban on the retention of soft-shell crabs was introduced. A soft-shell monitoring program was established to collect biological data from the crab population. A stray trap recovery program was used to remove lost gear from the fishery. Graduated closures enabled longer access to the spring fishery and an area trap limit was established in McIntyre Bay to cut down on gear congestion.

There have been a number of significant challenges overcome since the formation of the Association. However, the Area 'A' crab fishers continue to work together for the betterment of the fishery. There is strong support for the monitoring program by the fishers. The program is still entirely funded by industry and there is widespread feeling that the EM system provided a significant deterrent, creating an unprecedented degree of order and cooperation in the fishery. There are further challenges ahead. Hecate Strait is being examined for wind farms and there is potential for oil and gas exploration and development. The fishers are looking for more science to understand their fishery. Marketing and potential MSC certification are being explored. The fishers came together, have stayed together, and continue to work together to meet these challenges.

Comparison of fishermen catch reports to observer data

Amy Sierra Van Atten

NOAA Fisheries, Northeast Fisheries Science Center, Northeast Fisheries Observer Program (NEFOP) – USA

In certain special management programs in the multi-species fishery in the Northeast U.S., fishermen must report their daily catch of some regulated groundfish species, such as Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aelefinus*), winter flounder (*Pseudopleuronectes americanus*), and yellowtail flounder (*Limanda ferruginea*). Amendment 13 and subsequent Frameworks to the Multi-species Fisheries Management Plan established commercial trip limits, landing limits, total allowable catch (TACs), and Incidental Catch TACs. If TAC levels of any

species are met, entire special management programs may be closed until the following fishing year. Observer coverage is required on a percentage of the trips participating in the special management programs. Observers collect information on weights of kept and discarded catch on a haul-by-haul basis. In some programs, fishermen must report weights of kept and discarded catch on a daily basis through their Vessel Monitoring System (VMS). I have compared the catch reports as reported by the fishermen to the data collected by observers on the same trip. I have also compared the discard ratio (as estimated from captain reports) when there was an observer onboard and when there is no observer at sea.

The U.S./Canada Management Area is a fishery management area that has a transboundary resource between the United States and Canada. There is a quota sharing agreement and all catch must be reported and assessed, both landed catch and discarded catch at sea. There is a national allocation for Georges Bank cod, Georges Bank haddock, and Georges Bank yellowtail flounder, among others. There are eight management areas with the U.S./Canada Management Area, but this presentation will concentrate on the Eastern Area(s). The Eastern Georges Bank stock 2007 U.S. TAC was 494 metric tons (mt), which was 26% of the share. The haddock Eastern Georges Bank stock 2007 U.S. TAC was 6,270 mt (33% of the share). The yellowtail flounder Georges Bank stock 2007 U.S. TAC was 900 mt (72% of the share). See the Transboundary Resource Assessment Committee reference documents at http://www.mar.dfo-mpo.gc.ca/science/TRAC/trac.html

Observer catch reports of cod, haddock, yellowtail flounder, and winter flounder (pounds kept and discarded) are transmitted electronically by the observer to the NEFOP office within 24 hours of trip landing. Preliminary data are then emailed to the Northeast Fisheries Regional Office (NERO) on a daily basis. Data are verified when paper trip logs are received at NEFOP office within 3 – 5 days of trip landing, and the final verified data are provided to the NERO.

The TAC is monitored in-season by Fisheries Statistics staff at the NERO. A discard ratio is calculated for each of the regulated species, by dividing the observer discarded catch by the observer kept catch. A 35-day rolling ratio is used, to adjust for seasonal variability, averaging the observed discard ratio within. The rolling ratio is reset at any significant event that would change fishing behaviour, such as a new gear requirement, or change in trip catch limits. The discard ratio is then applied to the captain's kept reports. A correction factor is estimated for each species by comparing landings from dealer data and other potential sources of errors (confusion between dressed and/or round weights, missing VMS data) (Methodology for Evaluating U.S. Catch in the U.S./Canada Shared Resource Area, D. Caless, K. Wilhelm, and S. Wang, In progress). Catch rates are summed weekly and posted on the NERO website (http://www.nero.noaa.gov).

In 2006, the achieved observer coverage in the Eastern U.S./Canada area was 18.3%. Out of 46 observed trips in the Eastern area, 31 trips could be compared to the captain catch reports (15 trips could not be matched due to missing captain catch reports).

The total cod discarded, as reported by observers was 58,000 pounds, the captain discards were 63,000 pounds. The total haddock discarded, as reported by observers was 49,000 pounds, the captain discards were 45,000 pounds. The total yellowtail discarded, as reported by observers was 3,400 pounds, the captain discards were 1,300 pounds.

The discard ratios, as calculated from the captain reports (captain discard/captain kept), for cod, was 1.19 when there was an observer onboard, and 0.37 when there was no observer onboard. The discard ratio for haddock was 0.3 when an observer was onboard and 0.2 when an observer was not aboard. The discard ratio for yellowtail flounder was 0.01 when an observer was there and 0.007 when there was no observer on the trip.

In summary, the data were similar between observer-collected and captain-collected weights for kept and discards when an observer was onboard. The captain catch reports were under-reported when there was not an observer onboard. Under-reporting appears to be more prevalent for species that were expected to exceed the TAC (i.e., cod and yellowtail flounder).

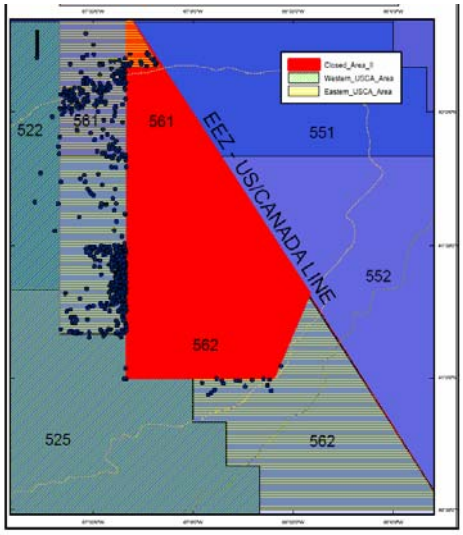


Figure P4.1: *Observed towns in the eastern U.S./Canada shared resource area for 2006.*

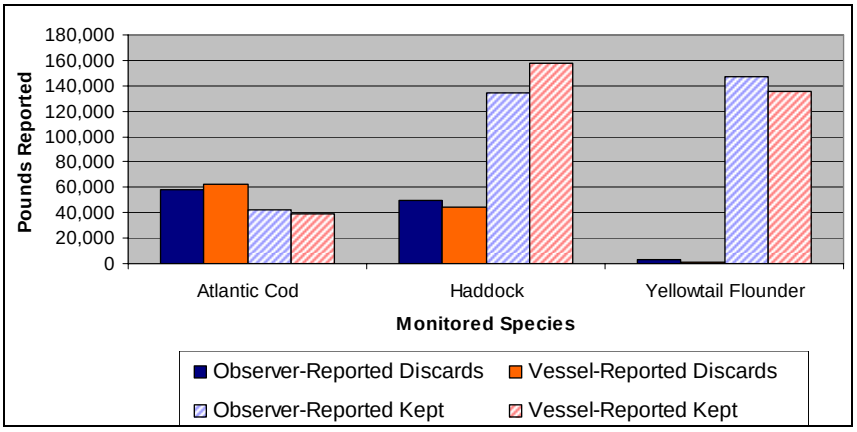


Figure P4.2: *Reported catch in the eastern U.S./Canada shared management area in 2006.*

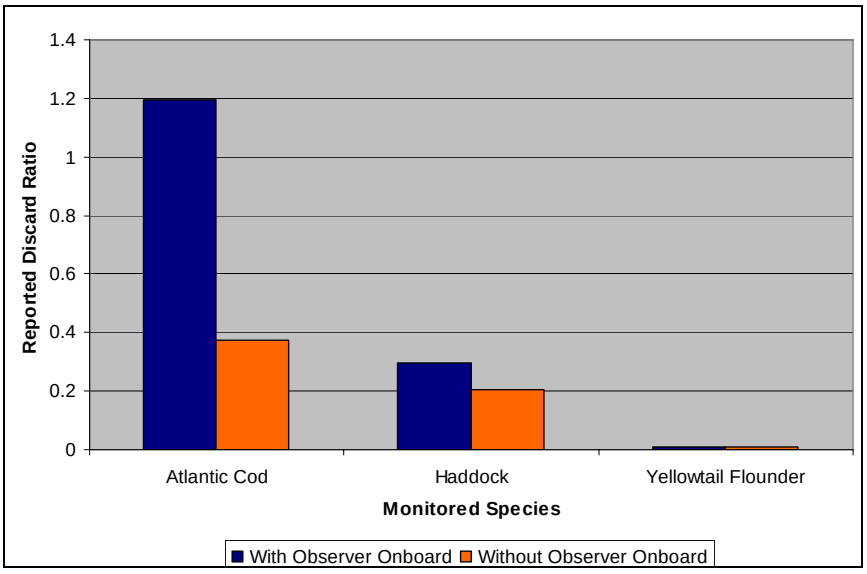


Figure P4.3: *Vessel daily catch reports in the eastern U.S./Canada shared management area in 2006.*

The potential reasons for causing this disagreement between the two data sets include technological malfunctions (VMS catch reports not being transmitted), user error (captain not understanding how or when to submit the reports, lack of training (captains not trained to estimate discards), and setting priorities onboard (captain must be paying attention to safety of the vessel and crew and leading the fishing operations – when there is no observer onboard, the catch reports may take a lower priority and be less accurate). From the observer program's angle, there may be subsampling errors and data submission errors, although there are data quality controls in place to identify such problems.

In conclusion, a variety of reporting methods must be used for verifying data from the various sources. Caution should be taken not to overburden captains or observers with reporting requirements, particularly if the source is determined to be unreliable. Haul-level information may be better collected through a scientific-based electronic reporting (study fleet or cooperative research) approach rather than through a compliance-based VMS system. Observer programs should be included during the development of monitoring programs and reporting regulations, so the proper data collection methods can be addressed. The observer program should promote industry access to aggregated data summaries so the fishermen could use the summaries for individual accountability and could voluntarily adjust their fishing operations.

Cooperative study fleets as a mechanism for fisheries monitoring

Michael C. Palmer* and John J. Hoey

National Marine Fisheries Service, Northeast Fisheries Science Center – USA

Abstract

The Northeast Fisheries Science Center (NEFSC) administers and coordinates a cooperative study fleet research program in the northeastern USA in which commercial fishing vessels provide more accurate, more detailed (temporal and spatial), and more comprehensive data than would be obtained without deploying fishery observers. The study fleet concept focuses on using electronic reporting mechanisms for recording haul-based data, as compared to trip or sub-trip paper records typical of vessel logbooks in the northeast. Study fleet vessels are equipped with an electronic logbook (ELB) system that allows fishermen to record fisheries-dependent information at scales equivalent to those in the Northeast Fishery Observer Program. The ELB system comprises: (i) a software application in which fishermen enter trip, effort, and catch information; (ii) a gear-mounted temperature-depth probe; and (iii) a GPS unit used to track the precise time and location of fishing effort. Study fleet fishermen receive training on the use of the ELB system and on proper catch reporting protocols. Incoming data are monitored real-time for quality assurance, and NEFSC scientists conduct regular 'refresher' trips with participating vessels to ensure adherence to all protocols.

Introduction and program history

A study fleet is a sample of vessels from a defined fleet sector, which provides detailed-self-reported fisheries data to address specific scientific needs. The NEFSC Study Fleet Pilot Program was initiated in November 2002 with the dual objectives of: (i) developing and implementing electronic reporting hardware for the collection, recording, and analysis of more accurate and timely fishery-based data; and (ii) assembling a study fleet of commercial vessels capable of providing high resolution (temporal and spatial) self-recorded data on catch, effort and environmental conditions while conducting normal fishing operations (GOM, 2001). The program is intended to provide more precise and accurate fishery-dependent data for stock assessments, and to enhance understanding of catch rates and species catch assemblages to facilitate the development of improved models that incorporate variables such as time of day, temperature and depth.

Fishermen are trained to record detailed data similar to that collected in the NEFSC Northeast Fishery Observer Program (NEFOP). For each haul, data are recorded on gear characteristics (e.g., mesh size, mesh type, sweep length, mainline length, number of hooks, number of pots, etc.), fishing location (e.g., latitude and longitude, statistical area, fishing depth), time of

fishing operations (e.g., time of day, tow duration, etc.), and catch (retained/discarded, species, and quantities). Unlike fisheries observers whose primary responsibility is to record such data, fishermen must collect this information in addition to their normal fishing duties. Electronic logbook (ELB) systems facilitate this potentially burdensome data acquisition and recording process by automating much of the data entry process. Additionally, because data collected by ELB systems are already in electronic format, the system takes advantage of satellite communication systems onboard the vessel (e.g., VMS) to transmit the data in near-real time fashion.

To date, over 1,200 trips have been taken by 32 different vessels in the Study Fleet Pilot Program. A phased approach has been used to develop the technology and standard protocols to support the data acquisition and recording elements of the Program. Phase I involved 15 participants and focused on developing the ELB software and testing the necessary hardware. Beginning in September 2004, Phase II expanded the pilot fleet to 32 vessels and focused on the continued testing and refinement of the ELB technology. Particular emphasis was placed on developing satellite communications and perfecting the ELB software. Phase III, which was initiated in September 2005 with six vessels, is focused on refining and finalising standard recording protocols for self-reported study fleet fisheries data.

Technology and protocols

A stable electronic recording system has been developed and field tested (Fig. P4.4). Central to the system is the ELB application, FLDRS (Fisheries Logbook Data Recording Software). Fishermen enter trip, haul, and catch information into the ELB software, which provides detailed haul-by-haul information on the location and timing of commercial catches. At the end of a trip, ELB trip data files are exported to the NEFSC using a vessel's VMS; raw trip data are available for analysis less than an hour after the end of the trip. In the background, the ELB software polls the vessel's GPS unit at high-frequency intervals (> 1 fix/30 seconds). Vessels are also equipped with gear-mounted, temperature-depth (TD) probes, which collect high-frequency (> 1 observation/2 minutes) data on gear depth and water temperature. These data elements are collected from the vessels by field staff approximately once per month. Post-processing of these data provide high-resolution information on the location, timing and duration of fishing effort, and the resulting catches (Fig. P4.5). In addition to near-real time data monitoring by NEFSC staff, automated database-level audits are conducted and potential data quality problems are identified and flagged. Data are not considered final until study fleet participants have logged onto a web-confirmation system to address any detected data quality issues and to confirm that the received data are correct.

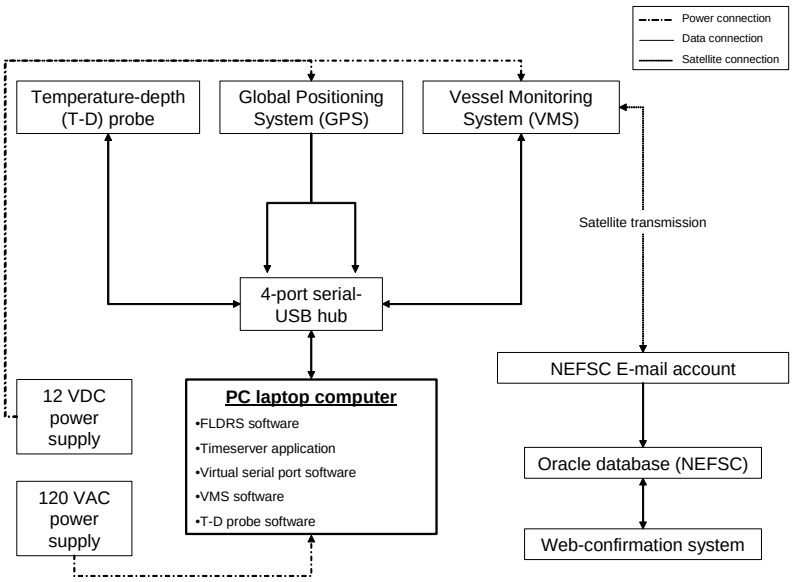
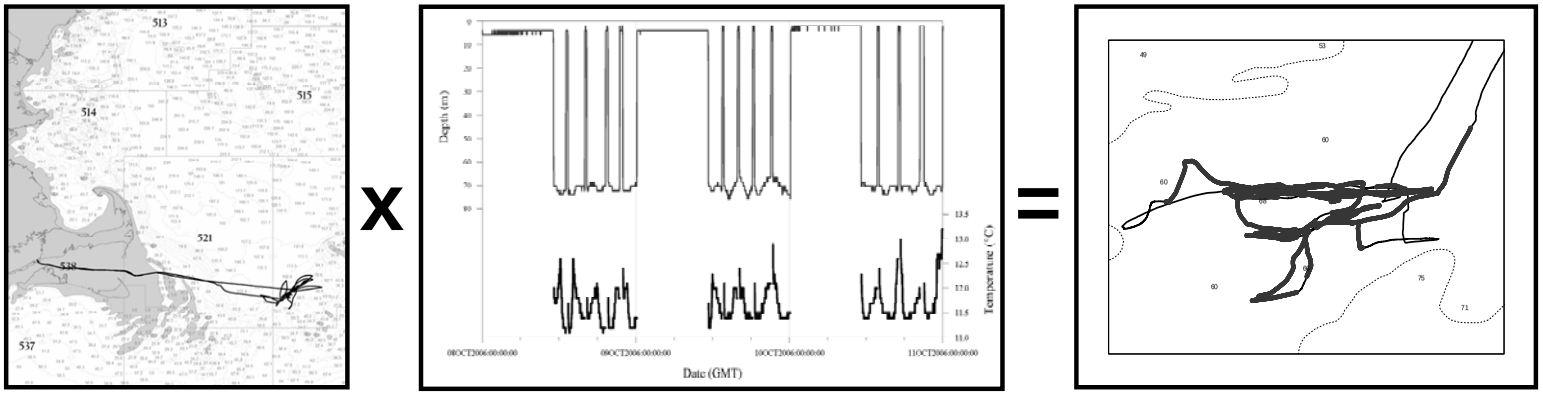


Figure P4.4: *Schematic diagram of the electronic reporting system deployed on vessels involved in the Northeast Fisheries Science Center's Study Fleet Pilot Program.*



Effort number	Effort start time (GMT)	Duration (h)	Distance fished (km)	Average speed (km/h)	Average depth (m)	Average temperature (°C)	Principal kept species	Retained amount (kg)	Principal discard species	Discarded amount (kg)
1	10NOV2006:11:11:30	1.9	11.1	5.9	50.2	11.8	Haddock	250	Spiny dogfish	400
2	10NOV2006:13:27:00	2.6	15.1	5.8	60.3	11.7	Yellowtail flounder	800	Spiny dogfish	600
3	10NOV2006:16:22:00	2.9	17.1	5.9	62.2	11.5	Haddock	1000	Little/winter skates	1200
4	10NOV2006:19:39:00	1.8	9.7	5.4	62.8	11.6	Haddock	520	Spiny dogfish	800
5	10NOV2006:21:58:30	2.2	14.1	6.5	60.8	11.5	Yellowtail flounder	230	Spiny dogfish	100
6	11NOV2006:11:22:30	2.1	12.0	5.7	60.0	11.7	Winter flounder	400	Little/winter skates	60
7	11NOV2006:13:46:00	2.1	12.4	6.0	59.4	11.6	Winter flounder	440	Spiny dogfish	200
8	11NOV2006:16:12:00	2.0	12.3	6.1	58.4	11.6	Haddock	670	Spiny dogfish	60
9	11NOV2006:18:33:00	2.5	15.2	6.0	62.2	11.7	Haddock	390	Haddock	140
10	11NOV2006:21:25:30	2.7	14.6	5.4	60.4	11.6	Yellowtail flounder	160	Little/winter skates	40
11	12NOV2006:11:15:00	2.5	15.3	6.2	61.4	11.6	Winter flounder	350	Little/winter skates	50
12	10NOV2006:11:10:30	3.0	17.5	5.9	61.6	11.6	Atlantic cod	400	Spiny dogfish	50
13	10NOV2006:11:10:30	3.0	20.8	6.9	60.4	11.6	Haddock	600	Little/winter skates	80
14	10NOV2006:11:10:30	3.0	19.3	6.7	61.8	11.9	Haddock	450	Spiny dogfish	120

Figure P4.5: *Example of the application of GPS polling data and temperature-depth probe data to provide high-precision estimates of the location and timing of fishing effort. These data can be matched with the self-recorded catch data entered into the electronic logbook to determine the temporal and spatial occurrence of each catch and its associated environmental correlates. *Note: data have been manipulated to protect vessel confidentiality.*

Since Phase I, the Study Fleet Pilot Program has principally focused on the development of electronic logbook technology to facilitate the collection of self-recorded haul-by-haul data, with less emphasis on developing standard recording protocols. Analyses of catch data collected in Phases I and II indicated that while Study Fleet catch data represented an improvement over that provided in the mandatory paper logbooks, fishing vessel trip reports (VTRs), the data were still not comparable to the data collected by the NEFOP (Palmer *et al.,* 2007). To address this shortcoming, Phase III activities have focused on working cooperatively with study fleet participants to develop and implement standard catch estimation protocols. Field personnel have conducted initial time-in-motion studies to observe the flow of fishing operations onboard various vessels and have discussed viable catch sampling and sub-sampling procedures with captains and crew. Additionally, technicians have performed baseline catch sampling that can be compared to the fishermen's self-recorded estimates. The level of agreement between technician and self-reported catch data is being used to establish a baseline with which to asses the efficacy of any standard protocols which will be implemented.

Potential applications

The NEFSC is currently considering options for small-scale production-level deployments of the Study Fleet Program. Study fleets may have particular utility when applied to small, directed fisheries, lacking sufficient observer coverage. The golden tilefish, *Lopholatilus chamaeleonticeps*, fishery in the Mid-Atlantic region is primarily conducted by a small demersal longline fleet (< 10 vessels), with virtually no observer coverage. Furthermore, the tilefish stock lacks a fishery independent index of abundance, and hence the surplus production model used to assess the productivity and status of the stock relies entirely on commercial catch per unit effort (CPUE) data derived from VTRs. The most recent peer review of the tilefish assessment (41st SAW, 2005) indicated that *"the effort metric (days absent) in the Weigh-out and VTR CPUE is a crude measure of effort and could be improved by collecting information (number and size of hooks, length of main line, soak time, time of day, depth fished and area fished) on a haul by haul basis and not by a trip basis"*.

Government and industry collaboration in the use of observer data to manage North Pacific Groundfish Fisheries

Martin Loefflad*, G. Campbell and William Karp

NOAA Fisheries, Alaska Fisheries Science Center, Fisheries Monitoring & Analysis Division – USA

The North Pacific Groundfish Observer Program provides a model of how the fishing industry and government can both use the information provided by observers to monitor fisheries managed through catch limits. The North Pacific has extensive observer coverage on vessels larger than 60 ft, with 100 percent coverage, an observer on every vessel, over 125 ft. Unique to the U.S. system is the fact that the North Pacific industry pays the majority of costs of the observer program.

Two industry roles are critical to this monitoring system:

Role 1 – Industry pays a large part of the cost of the Observer Program.

- Industry pays $13 Million annually.
- Agency pays $4.8 Million annually.

Role 2 – Industry cooperates by taking the observer and facilitating their work.

- Minimise harassment.
- Provide a safe work environment.
- Provide reasonable assistance to collect and transmit data.

Following is an example of fisheries management collaboration built on the building blocks noted.

Observers collect data on catch quantity and composition and transmit it to the agency as necessary for management. NMFS has worked to enable industry access to the observer data thereby enabling them to also monitor catch and by-catch. In a recent fishery example from the fall of 2006, industry organised to use the information provided by observers to optimise the catch of a target species managed under a very tight halibut by-catch cap. The agency would have had to close the fishery early to stay

within the cap. The industry set up a cooperative agreement among fishery participants which established company level limits of halibut which they enforced contractually. Industry hired a third party to monitor the observer data for compliance with their contractual agreements. The government enabled this by: (i) not closing the fishery pre-maturely; (ii) making observer data available to the third party monitoring for industry; and (iii) asking observers to increase the frequency of their reports to ensure they were available when needed. This arrangement enabled the fishery to progress with individual company tracking and accountability for their catch at a finer scale than the government managers could support. The industry managed their members and individual companies ceased fishing when their contractual limits were reached. The fishery cap on halibut was not exceeded. This is one of many industry quota monitoring examples that exist in Alaska and they are particularly prevalent in limited access programs where there are boat- or group-specific catch limits.

The example illustrates a third key industry role.

Role 3 – Industry takes an active role in fishery monitoring to stay within quotas or to limit by-catch.

In this role, the industry has the main responsibility to monitor and manage quotas and the agency has responsibility to oversee and ensure quotas are not exceeded. This can be done cooperatively, as in our example, or through regulated limited access programs.

Elements for success include:

- Agency was open to collaboration and willing to have industry in this role.
- Agree on a common data source – observers in our case.
- Agency assisted by making information available to industry.
- Electronic reporting systems to enable information sharing.

Positive aspects of industry monitoring include:

- Better quality control as more people use the data.
- Attention on the data keeps observer in an active role.
- Industry and agency collaborate.

Potential negative aspects include:

- Time pressure can increase on multiple issues.
- Industry may start directing the observer.
- Data quality issues can be contentious.

Summary

The North Pacific provides a stable observer system, funded by industry, enabling an active industry fishery monitoring role. Industry and agency both monitor catch and by-catch through a common data source.

So, what is industry's role in monitoring fisheries in the North Pacific groundfish fishery?

Role 1 – Industry pays for the cost of placing observers.

Role 2 – Industry cooperates by taking observers and facilitating their work.

Role 3 – Industry takes an active role in monitoring to stay within quotas or to limit by-catch.

Increasing industry involvement in fisheries monitoring as the stakes rise

Vanessa Tuttle

NOAA Fisheries, Northwest Fisheries Science Center – USA

New fishery by-catch limits for several rockfish species of concern were instituted starting with the 2005 Pacific hake fishery. These by-catch limits have the potential to end the season before the optimum yield for hake has been reached. In April 2005 the At-Sea Hake Observer Program met with industry representatives to discuss the upcoming season. The result of this meeting was an informal agreement between the observer program and the vessels to work together to improve data collection on species of concern.

Four basic tenets came out of this meeting. First was the pledge from the vessels to do what was necessary to help the observer avoid taking small species composition samples for species of concern. Although small samples can be adequate when viewed over time, on a single haul basis, small samples have the potential to be unrepresentative. In support of this

agreement, the vessels agreed to provide a 'helper' to assist the observer in any way needed (i.e., another pair of hands to help lift, carry and sort). Agreed upon qualifiers for this helper were the person was to be readily available, free of other duties, consistently the same person, and able to understand and speak English. Third, the observer program agreed to request that the observers increase species composition samples to 50% of each haul whenever possible. Fourth, was conducting pre-cruise by-catch meetings onboard the vessels just prior to the season with key vessel personnel, the observers, and the observer program in attendance to discuss by-catch issues and outline how and who the observer could get assistance from.

In 2005 and 2006 the hake season did not experience an early closure because of by-catch issues. By allowing industry the chance to voice concerns and make suggestions directly to the observer program, a new partnership has been fostered. This allows the stakeholders to have some involvement and input in the monitoring, but maintains the separation of interests on both sides. Overall the results of this agreement have been positive. Most of the feedback from the observers has been positive, although the increased work load and the perception of the vessel having more say in sampling matters has caused some concern.

Questions & Panel Discussion – Session P4 –

Bob Trumble (MRAG Americas)

Comment / Question:

We have heard a lot so far at this conference about the depths of despair from industry and their moves to develop observer programs in order to save their livelihoods. It would be good if we could get the same self-interest of the fishermen to move in this direction before they get to the point of virtual collapse. I think one of the key ways for industry to get involved is to work with fisheries management and the managers of observer programs to understand how they can benefit from monitoring and observer programs. Does anyone have any comments on how best to do that?

Response:

John LaFargue – There is often a big disconnect between managers, biologists and the fleet. The observers and coordinators may deal with the fishers on a day-to-day basis but there needs to be more outreach between the different programs to see where the industry partners can play roles.

Martin Loefflad – When you're dealing with a problem, one of the first things you need to do is recognise that you have a problem and that is often part of the problem. My experience is that industry is often reactive to the problems that are in their face at the time so the question is about how to foresee the problem. Every region around the country and around the world has some process for the involvement of fishers in management processes. In the North Pacific we have the North Pacific Management Council which meets several times a year to identify and solve problems. The question is how to develop processes for engagement, particularly as you move into those smaller vessels that might not be as attuned to what the potential problems are.

John LaFargue – At council meetings there are a few people are very outspoken and play large roles but those people don't necessarily represent the fleets. Also, there tends to be less participation at the council level for our smaller fisheries and many fishers are frustrated with the councils and don't want to go to council level. We've done a few port meetings to talk to fishers and some of those have been very effective and I think we need to do more outreach like that.

Jason Scherr – In terms of the crab fishery in BC, there are number of fishers in Area A and in the other crab management areas that are looking for a long term vision for their fishery before it gets to a crisis level so they've approached the department on creating a vision statement. It has taken quite a while for the department to realise that there are some issues coming up so the fishers are trying to work with the department to craft a long term vision for their fishery.

Amy Van Atten – I was trying to think of some examples of fisheries in the north-east United States that aren't in some kind of crisis mode. I thought of the quahog fishery, clam fishery and the lobster fishery, but we don't have a lot of

observer coverage in these fisheries and it is probably because a lot of the funding gets sucked-up by the crisis fisheries which need observer coverage to exist. We have low coverage rates and voluntary compliance from fisheries that don't generally have a problem. They don't really mind taking us on voluntarily, but if they have an issue that they're trying to hide, then it becomes more difficult for us to get onboard their vessels and we don't have the mandatory regulations in place to start that collection method. Also most of our observer coverage is in line with the latest council priorities and actions but I think our observers are also over-burdened.

Tracey Mayhew (Alaska Fisheries Division – UIW) to Vanessa Tuttle

Comment / Question:

I'm interested in hearing more about the placement meetings that you have with the observers and captains and the at-sea program – the effectiveness of that and what effect it has had on the relationship between observers and industry.

Response:

Vanessa Tuttle – Mostly I think they have been very successful and, if it is any indication of their success, we haven't had much canary by-catch in the last two years. Some of the vessels are very serious and cooperate with the observers but there are a couple of vessels that are a little less sincere but go through the motions anyway. Generally, the captain is serious because, ultimately, it is a result of his actions if a fishery gets closed because he is the one that puts the net out there. Observers like it because it opens up the lines of communication – normally they would board the boat and have to seek out the captain themselves, whereas here we have a set meeting time where everyone gets introduced and talks about by-catch issues.

Lisa Borges (European Commission)

Comment / Question:

I thought this panel was very important and interesting and shows us how industry can play a role in sampling. I was talking some more this morning about what Wes said and how we can get industry involved in programming. I think one of the objectives of the discarding ban in the European Union was to set up a process for fishers to work with us and I've actually seen some changes in only a month where fishers have been willing to cooperate and put a program together. It is similar to a pilot study or a study fleet, where we work with industry to try to get some specific data. There is a lot of future in that, particularly in those European areas where there is no funding. I've always been very keen on self-sampling programs, but I know there are a lot of issues (e.g., data quality) and maybe some of you would like to comment on that.

Response:

Michael Palmer – We've walked a tight-rope in our program where we have been trying to get industry involved in these programs but also trying to convince scientists that these data can be used for stock assessments. I think we can overcome this if we ensure the data adheres to some minimum data quality standards and quantify the uncertainty of those data. Also, Amy Van Atten made a good point that there may be certain elements of self-recorded data that aren't appropriate to collect and so we need to make sure we only ask for those data elements that are used.

Georg Hinteregger (Observer) to Michael Palmer

Comment / Question:

What is the mechanism for addressing the potential conflict of interest for vessels? By-catch data that would create potential problems for the vessel or the fishery could be suppressed without an observer onboard. How do you expect the public to have confidence in the data if there is a conflict of interest for the vessel to record data accurately?

Response:

Michael Palmer – We currently have field technicians who go onboard these vessels and work with the vessels' captain and crew to establish data reporting protocols. Most of our field technicians are former trained observers, so they bring a level of competence to the field and can work cooperatively with the captains to figure out which sampling or sub-sampling protocols are best to deploy in their

circumstances. We then implement those protocols and monitor the data that is coming in on a real-time basis and if we detect any data quality issues, we contact the fishers and try to resolve those. We are also planning to deploy our field technicians at regular intervals to conduct independent estimates of catch that we can use to verify the quality of the data. It is similar to some of the video monitoring programs that have been discussed here in that there is an independent estimate that you can use to verify the self-reported data. I think that is critical; you need a way to ensure the data are accurate so you can get the public to buy into the data that come from these self-reported resources.

Tom Rudolph (Cape Cod Commercial Hook Fisherman's Association) to Martin Loefflad

Comment / Question:

The regulations that you have in Alaska that, for example, prevents a fisher from hiding a prohibited species or trying to subvert an observer, did they come from the Council level or from the agency via the regional office?

Response:

Martin Loefflad – There are two sets of rules and regulations – one that applies nationally that sets some basic ground rules (e.g., not harassing observers) and applies to everyone in the United States. Then there are a whole suite of rules and regulations that have been developed in Alaska through the Council process. Virtually all of the regulations we have developed in Alaska have been run through the Council and have included a period of public comment.

Tom Rudolph – I'm also referring to something much more specific regarding the flow of fish on the deck. Are there certain mandates that started at the Council level that describe how fish are to be moved on the deck so that observers have full access and to prevent things from being hidden?

Martin Loefflad – There are a variety of regulations and I would need to walk you through them to show you where the specific parameters are. For example, the FA Fleet has a requirement to weigh all their catch and to provide an observer sampling station. It is all outlined in the regulations and I can give you a reference for that.

Amy Van Atten – Vanessa talked about offering training to fishers and we have also been looking at doing this in the North-East Fisheries Science Centre in relation to how fishers can help or cooperate with the observer to collect the data that gets used to manage their fishery. Perhaps this is something to think about for the next conference, or even a working group. We could get some people together to talk about how we can get fishers into voluntary training (including captains and crew) and work out what the carrot would be to bring them to that kind of training. Obviously it wouldn't be a requirement for fishers, but we would need them to be interested in it. It would be great to offer education that would be beneficial to fishers as well as observers.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment

I'm a strong believer in individual responsibility and I think you need to select the fishers that can learn and have the ability to learn. For example, in the tuna/dolphin case I argued very strongly against global catch limits, because the good and the bad stop fishing on the same day and it doesn't make any difference; whereas individual vessel limits have resulted in tremendous selection within the fleet. Individual vessel quotas provide an incentive and the skippers and crew think about what they can do better than the other vessels and then they get rewarded for that, rather than everyone paying the price. I think we should avoid these global things and allow natural selection (the best process that we know) to improve our fishing activities.

Amy Van Atten – I know Mike had a fairly vigorous selection process to select the vessels for his study fleet and they tended to be the fishers that were more involved and interested in the Council process and collecting the data.

Michael Palmer – Yes, we don't have a broad spectrum of vessels to select from and we tend to work with the same vessels over and over again. I think this is one of the reasons we're still in the pilot phase and haven't been able to get beyond systems development and into the production level and actually deploy study fleets

at the fleet level. We are now beginning to focus on the small fleets because we can get near-census coverage of the fleets, which I think is the best way to work away from the global approach and towards individual vessel catches. [Additionally, working with the small fleets helps ensure that the data collected are of a more immediate benefit to the understanding and sustainability of their fishery].

Amy Van Atten – Unfortunately they don't get any benefits though – they still have to do all the regular government reporting as well as the study fleet reporting. If you could have them do 'either / or', you might get more involvement.

Martin Loefflad – From my perspective, the individual quotas really enable individual responsibility. Industry can be extremely industrious when they have the ability to control their particular problems. But in our region, moving from traditional systems to individual quota systems is a political process and we don't control it ourselves but we participate in it.

Jason Scherr – For the area 'A' crab fishery, each fisher has a report card to record their soak times, catches, etc. This year, there were several vessels that had very poor compliance with soak times and, at a meeting on Monday, the Department put forward a recommendation for a full closure of the area during winter. The vessels that were in the room that had very good compliance felt very strongly that they shouldn't be penalised for those that had not complied with the soak times and were actively persuading the Department to pursue charges against those vessels that were in breach of the conditions of their licence rather than enforcing a blanket closure for the whole fleet.

Bill Karp (National Marine Fisheries Service)

Comment / Question:

Vanessa's example of the canary rock fishery and whiting catches is similar to the canary in the coal mine scenario. There is a signal that gives rise to some concern as well as some examples of how to address that concern but they revolve around management systems that have information needs that are very difficult or impossible to meet. There is a tendency to make significant decisions based on inadequate information and/or not recognise the uncertainty associated with the information that we're bringing forward and so we run the risk of developing further programs based on the inadequate information and creating subsequent problems. As we start putting new management systems in place that depend on observer data and other kinds of data, we need to look very carefully at how much and what kind of information is really necessary to support decision making and be sure that we can achieve that before we put the programs in place. Otherwise we're going to see unfortunate things happen, such as the inappropriate interactions between observers and vessel operators when the observer sample becomes the deciding factor in whether a fishery stays open or is closed. Do any of the panel members have any comments to make in that regard?

Response:

Martin Loefflad – How do we match up the expectations of the program with the reality of what can physically be collected? Vanessa's example is a great one because they put effort into getting good data on canary but when an extra couple of species gets added it is suddenly beyond your capacity to meet the needs of the sampling program. We had a similar example in Alaska where we put a lot of effort into getting data on cod for a particular fishery and then industry came back with an argument that we had bad data on flatfish because we had put all our efforts into collecting good data on cod. We've only got so many people out there so there are limits with what we can do.

Teresa Turk (National Marine Fisheries Service) to Vanessa Tuttle and Martin Loefflad

Comment / Question:

What steps were taken (or do you plan to take) to shield the observer from undue influence and are there steps you have laid out to ensure the observer is still a good third party onboard a vessel?

Response:

Martin Loefflad – In limited access programs such as these, the pressure is a reality and the least you can do to try to control it is to make sure that the expectations are very clear between the agency, the vessel master and the observer. Vanessa talked about pre-cruise meetings, which

are a very effective tool to make it clear what the expectations are and then making sure you have an effective compliance mechanism if things do get out of control.

Vanessa Tuttle – I try to stress to my observers that it is not their fault and that it is the data. All the observer has to do is collect the samples. Also, the fleet of vessels we work on are beautiful big boats with lots of people on them and they typically don't have by-catch problems – so we're pretty fortunate in that way. The vessels are also making efforts, for instance, I had a slide which I didn't present (see Fig. P4.6) which shows a huge decrease in rockfish catch since all this started happening and it has happened because the vessels are trying to avoid them (e.g., by not fishing at night) which shows they can do something that is in their control.

Bob Trumble (MRAG Americas)

Comment / Question:

I use to be a very strong proponent of individual by-catch quotas but in the North Pacific we witnessed the absolute failure of any mechanism to implement that. Now I'm in favour of the co-op system because I think fishers are a lot better at figuring out ways to do things than fisheries managers. If fisheries management comes up with things that the fishers don't like, the fishers will find ways around it, but if the fishers come up with the ideas themselves then they are more likely to act on them. The co-op system seems to be the best way to move that process forward.

Response:

Amy Van Atten – Yes, we've had great experience with the sectors in the north-east and I'm really glad they have invested their time and interest at this conference too.

Jason Scherr – The area 'A' crab fishery would not have come to fruition without industry acting as a collective.

Martin Loefflad – I've seen an interesting process occur with co-op allocations where there is an internal decision by a co-op to implement a quota to the group co-operative which gets passed out to their members. The co-op acts as a mid-level filter to take action, so there is individual responsibility without the government having to implement it.

Paul Parker (Cape Cod Commercial Hook Fishermen's Association)

Comment / Question:

I've been engaged in a number of different fisheries, and I'll be the first fisher to stand up and say that not a single fishery that I've participated in is clean and not one of them is without by-catch. You can minimise by-catch but there is always by-catch in a fishery. Whenever someone stands up and says they have a totally clean fishery and that they never have by-catch or by-catch problems, they're just not telling the truth. It is a matter of figuring out what protocols and which assessment tools they're using to cover the facts. You need to look beyond the boxes that their filling out and ask if there should be a different box on the form. We have some serious problems in our fisheries that need to be addressed and they're not addressed when we paper over them.

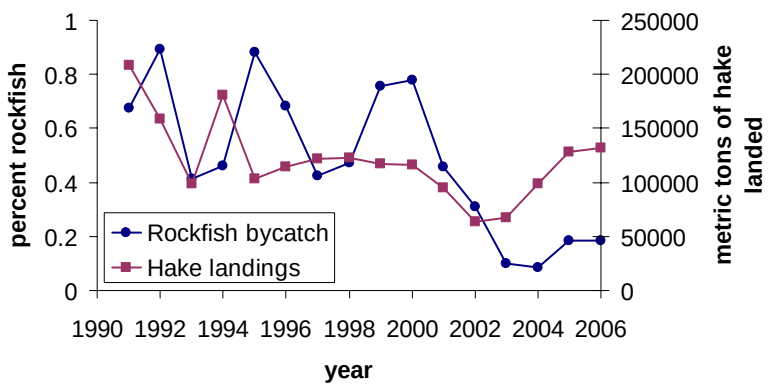


Figure P4.6: *Total hake catch and rockfish by-catch as a percent of total catch.*

SESSION P5

What is the role of non-governmental organisations (NGO's) in fishery monitoring programs?

Moderator:	
Teresa Turk	*National Marine Fisheries Service – USA*
Speakers:	
Sharon Young	*The Humane Society of the United States – USA*
Elizabeth Fetherston	*Ocean Conservancy, Southeast Regional Office – USA*
Elizabeth Griffin	*Oceana – USA*
Scott Wallace	*David Suzuki Foundation – Canada*
Adam Bailey	*NOAA Fisheries, Pacific Islands Region Observer Program – USA*
Keith Symington	*WWF – Vietnam*
Kim Dietrich	*Washington Sea Grant, University of Washington – USA*

The role of non-governmental organisations in shaping observer programs

Sharon B. Young

The Humane Society of the United States – USA

Fishery observer programs are critical to understanding the nature and extent of interactions with both fish and protected species. Representatives of non-governmental organisations (NGO) often play a key role in how these data are gathered, interpreted and translated into policy.

An example of the role of NGOs in shaping observer programs is illustrated by the multi-stakeholder groups charged by the National Marine Fisheries Service (NMFS) with reducing by-catch of marine mammals. The U.S. *Marine Mammal Protection Act* (MMPA) mandates these so-called take reduction teams when by-catch exceeds levels deemed biologically sustainable. The NMFS has convened seven take reduction teams for species and fisheries including various pelagic dolphins, pilot whales, harbour porpoise and large endangered cetaceans interacting with gillnets, longlines, trawl gear and trap/pot gear. The take reduction teams are asked to arrive at a plan for reducing by-catch to MMPA-mandated levels within 6 months.

Observer data are the basis for determining the times, areas and extent of interactions of fisheries. NGOs and other team members often recommend additional observer coverage to address deficiencies in our understanding of the extent and nature of the interactions. Observer data used by the teams are also critical in shaping the mitigation measures chosen by the team. Whether modification of gear and practices is the most appropriate strategy, or whether time and area closures are needed, is often indicated by the data that the team reviews. The team may also recommend additional research that mandates either additional observer effort or requesting that onboard observers collect additional information on by-caught species. In this way we help shape the role of the observer program. NGOs often lobby for additional funding to help achieve the observer coverage necessary to attain the team's goals.

Because the MMPA charges fisheries to reduce both mortalities and serious injuries of marine mammals, accurate observations by observers is

key to understanding the degree of injury sustained by an entangled animal. NGOs have also participated in workshops designed to inform the nature of serious injuries and the data and format of data that observers should collect to allow determination of the degree of injury.

One example of the use of observer data in shaping management and policy, and the involvement of NGOs in this process can be seen in the harbour porpoise take reduction team. In the 1990s, gillnet entanglement of harbour porpoise was resulting in the deaths of over 2,000 harbour porpoise a year even though the maximum potential biological removal level set by the MMPA (called PBR) was only 483 per year. The team recommended time and area closures during peak migration times and the use of acoustic deterrents ('pingers'). Subsequent to the plan's implementation, observer data indicated that the by-catch had declined to 270 per year by 1999. But over the past 5 years, it began to rise again, with an annual average of 734 mortalities. There were 1,100 mortalities in 2006 alone. Observer data indicate that the increase in by-catch is the result of non-compliance with closures and 'pinger' requirements, and because fishing effort has shifted to other areas in which no mitigation is required. The team is slated to meet again later in 2007 to discuss how to remedy this situation. Observer data have been critical to understanding patterns of by-catch, and the data suggest mitigation measures that might be used. In 2002 little information was available in portions of the mid-Atlantic due to as shift in observer effort to monitor turtle interactions. The NGOs, and their partners on the team, argue for adequate levels of observer coverage to assure more precise estimates and understanding of the interactions.

Similarly, patterns of stranding often indicate deaths occurring in unobserved fisheries, and NGOs may argue for increased or re-configured patterns of observer coverage to better understand the interactions and/or the re-classification of fisheries such that observer coverage can be mandated rather than being voluntary.

As environmental NGOs we strive to reduce the deaths of protected species. We do this in a number of ways. Although many fisheries see NGOs as opponents who litigate to protect animals, we prefer more meaningful solutions than courts can generally offer. Observer data are critical to us to assist in understanding when, where, how and to what extent harmful interactions occur. We rely on the data to suggest solutions that save animal lives and yet allow fisheries to operate profitably. Without accurate data we are forced to guess at what may be occurring and this may result in our advocacy for the simplest solution: broad-scale time and area closures. This creates an adversarial situation with fisheries and often leads to litigation by one side or the other. As NGOs we participate in stakeholder negotiations that both use observer data and suggest ways that fishery managers can make observer programs more effective in meeting informational needs of regulators and stakeholders. We lobby legislatively to obtain funds to assure a robust program. In the case of fishery regulation, ignorance is not bliss, and we environmental NGOs do whatever possible to assure that decisions can be made based on the best possible data.

Sustainable fishery management in the southeastern United States: The importance of by-catch reporting and total mortality accounting systems

Elizabeth Fetherston* and C. Dorsett

The Ocean Conservancy, Southeast Regional Office – USA

The role of the environmental non-governmental organisation (ENGO) in the Southeastern United States has traditionally been to identify shortcomings in marine management (of turtles, fisheries, ecosystems, etc.), to discover innovative solutions (often adapting successful measures from other regions/nations), and advocate for change. The realm of data collection and observer programs is no exception. A major shortcoming in marine management in the region is the overfishing of important commercial and recreational fish species. The failure to achieve sustainable fisheries in the multi-species reef fish complex, for instance, can be attributed in part to a management system that does not adequately incorporate all sources of mortality, relies

primarily on self-reported by-catch data, and consistently struggles to achieve 1% observer coverage in the commercial fleet. While a number of converging factors have influenced the decline of Southeastern reef fish fisheries (setting catch levels above scientific recommendations and allowing mortality rates above those needed to achieve maximum sustainable yield to name but two), many of these have their root in the sparsely apportioned data collection systems.

The reef fish management system in the region primarily relies on keeping fishery landings within a total allowable catch (TAC) limit on an annual basis. Landings are tracked through dealer reporting and recreational fishing surveys. By-catch – reported from spotty observer coverage (< 1%) and a variety of self-reporting mechanisms such as logbooks and the MRFSS survey – is not explicitly accounted for in this system, but is instead incorporated within the stock assessment process. The shortcomings of this methodology are evidenced by the number of species in the region that are experiencing overfishing – fifteen in total for the Gulf of Mexico and South Atlantic Fishery Management Councils. Merely tracking annual landings fails to account for the substantial numbers of fish killed as by-catch in these fisheries. While information on by-catch is collected, the estimates are not compared to allowable limits on a routine basis. This methodology has not only failed to ensure an end to overfishing, thus jeopardising recovery of depleted species and potentially pushing rebuilding time frames further out into the future, it also fails to provide incentives for by-catch reduction. The current system provides no incentive for independent reporting of by-catch, offers no tangible penalty for fisheries with high by-catch mortality levels and creates no incentives for fishermen to avoid or reduce by-catch and by-catch mortality.

One example of how the combination of data collection consisting primarily of self-reporting and management failing to explicitly account for by-catch can be seen in the Gulf of Mexico gag grouper stock. Once thought to be healthy, the Southeast Data Assessment and Review stock assessment number ten (SEDAR 10) revealed that severe overfishing is occurring and deep cuts in catch are required. Recreational discards are estimated as the cause of over half the mortality the stock has exhibited in recent years. This rather extreme example of the pitfalls of managing for landings has shed much-needed light on the merits of total mortality accounting systems (See Fig. P5.1).

In evaluating past performance of management measures undertaken by the Gulf of Mexico and South Atlantic Fishery Management Councils, the Ocean Conservancy sees little to gain from continuing the Total Allowable Catch management system for the region's reef fish resources. Indeed, the U.S. Congress recently re-authorised the nation's overarching fisheries law – the *Magnuson-Stevens Fishery Conservation and Management Act* – requiring the regional councils to ensure a swift end to overfishing, set annual catch limits that prevent overfishing, and develop accountability measures to ensure mortality stays within limits. In order to meet these new legal mandates and ensure sustainable fisheries, the Southeast Region must develop a methodology to establish total mortality limits that track not only landings versus the allowable catch, but monitors a total mortality limit that openly includes landings and by-catch.

Ocean Conservancy and other ENGOs in the region are actively working to establish the monitoring systems that are critical to the success of any total mortality accounting system. In Southeastern fisheries, this may best be achieved by a combination of mandatory logbooks, traditional observers, and emerging scientific technologies, most notably EM or Electronic Monitoring systems. ENGOs are actively working through impediments to achieving independent monitoring systems that include, but are not limited to a lack of political will of fishery managers; lack of funding from government and outside sources; logistical issues such as vessel size, number of participants, and duration of trips; and establishing a clear connection between the management goals defined at the regional council level and the data collection systems maintained by the federal agency.

Keywords: fisheries, overfishing, by-catch, total mortality, Southeast US

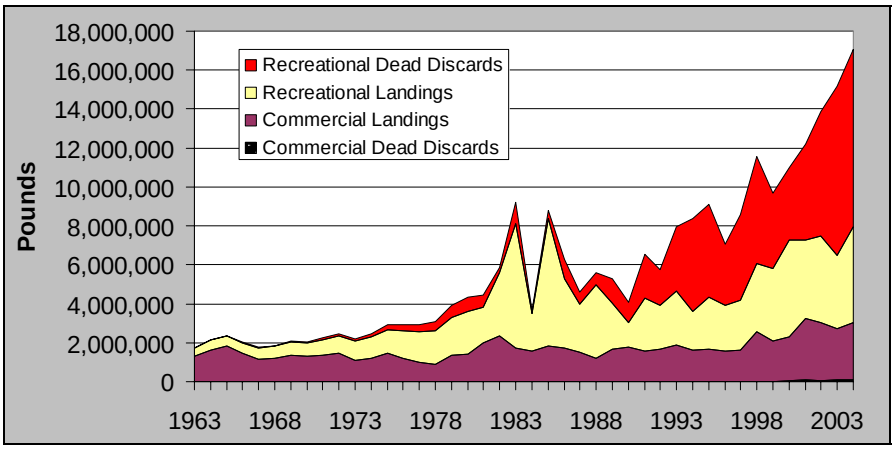


Figure P5.1: *Gul gag grouper removals by sector. Note: The gag grouper stock assessment is currently undergoing review and these numbers are likely to change.*

U.S. fisheries observer data – available and usable to public?

Elizabeth Griffin*, J. Good, B. Lowell, C. Sakai and M. Hirshfield

Oceana, Washington – USA

Fisheries observer programs provide valuable data for the management of marine resources if, and only if, the data is properly analysed and used. Governments should use the data for a variety of applications such as creating by-catch estimates, determining hot spots of by-catch, monitoring by-catch mitigation efforts, and conducting stock assessments. However, governments often do not have the resources to analyse all of the data obtained through fisheries observer programs. Because governments have limited resources and an obligation of some level of transparency, they should make observer data available to the public in a standard and useable format that gives stakeholders the ability to conduct their own data analyses. Oceana has used data from U.S. fisheries observer programs for a variety of projects ranging from by-catch estimates to identification of time area closures for protected species. However, in the U.S. there is little consistency among observer programs in the presentation and accessibility of the data, which complicates data use by stakeholders.

Six criteria were used to evaluate data from U.S. observer programs: availability of online data, availability of online maps, inclusion of protected species by-catch data, inclusion of non-protected species by-catch data, reporting of level of observer coverage, and the user-friendliness of the data presentation system. Of the 13 U.S. observer programs reviewed, four do not have any data available online. The problems with the data presentation of the other 9 programs fall into three categories: the first is a lack of data, whether it is the whole dataset or certain subsets of the dataset, such as protected species interactions. The second is the nature of the presentation. Presentations range from a one-page summary to the inclusion of whole dataset in a difficult to use format. The third overarching category is the inconsistency in what observer data is presented, such as aggregating by year in some programs and month in others. This can make assessments or comparisons of data across regions extremely difficult. Table P5.1 below summarises what is currently available online for each of the U.S. observer programs.

In conclusion, there is no standardised format for presenting observer data to the U.S. public. Efforts need to be made to pull the best aspects from each regional program and design a system for displaying observer data that can be used for all observer programs in the U.S. The system, once developed and tested, can serve as a model for observer programs world-wide. Clear and standard presentation of observer data to the public will promote learning and engender better management by increasing stakeholder understanding across political and geographic boundaries, and by fostering support for management decisions.

Table P5.1: *Summary of U.S. Observer Program Data Available Online.*

Program	Data Online?	Maps Online?	Protected species included?	Bycatch included?	Observer coverage included?	User friendly?
North Pacific Groundfish Observer Program	✓	✓	x	✓	✓	✓
Alaska Marine Mammal Observer Program	✓	✓	✓	x	✓	x
West Coast Groundfish Observer Program	✓	✓	x	✓	✓	x
Pacific Islands Regional Observer Program	✓	x	✓	x	✓	✓
California/Oregon Drift Gillnet Fishery	✓	x	✓	✓	✓	✓
At-Sea Hake Mid-Water Trawl Fishery	x					
California Pelagic Longline Fishery	x					
Northeast Fisheries Observer Program	✓	✓	✓	x	✓	✓
SE Fisheries Pelagic Observer Program	✓	x	✓	✓	✓	x
South Atlantic/Gulf Shrimp Fisheries	x					
SE and Gulf of Mexico Shrimp Otter Trawl Fisheries	x					
SE Shark Bottom Longline Observer Program (2005-2006)	✓	x	✓	✓	✓	✓
SE Shark Gillnet Observer Program	✓	x	✓	✓	✓	✓

Canadian fisheries observer data – available for analysis?

Scott Wallace

David Suzuki Foundation – Canada

There is little question that observer programs are windows into fisheries. Every citizen of a maritime nation has the right to know how fisheries are carried out on the water. As increased numbers of fisheries move to individual quota regimes, the role of observer programs becomes not only critical for ensuring compliance and carrying out the fisheries management plan but also serve as a window for the public to understand how the resource is being utilised. For the public to be informed, the data gathered from observed fisheries must be made available.

The Canadian government has formally endorsed public participation in fisheries management, through the establishment of multi-stakeholder advisory committees. However, for conservation objectives to be raised and solutions proposed at these tables, full access to fisheries data, including observer data, is required by all parties.

The Canadian environmental non-government organisation (ENGO) experience to date suggests that accessibility to these data is inconsistent across the country and even within regional offices. Each data unit appears to have its own non-written approach as to how this data can be shared, at what resolution, and to whom?

In some parts of Canada, it is possible for stakeholders to receive observer datasets that give you all of the data including the name of the vessel. In other regions or even different management units the data can be very restrictive, not just to ENGOs, but also to government scientists and industry. There is clearly no federal or regional policy. Having compromised access to data, such as datasets with low spatial resolution, prevents the ability for meaningful solutions to be developed from all stakeholders interested in the management of a fishery.

In Canada's Pacific region, observer data is released only if it fits the 'three boat rule'. That is, you can only receive data at a resolution where three or more boats are fishing within the requested spatial or temporal window. For example, if a stakeholder wanted bottom trawl observer data for a particular 5x5 km area of the coast for April 2007, they could only get these

data if three or more different vessels were fishing in that region over the requested time period. As a result of this rule, data is only available in a highly aggregated form.

Conservation based solutions cannot be achieved through highly aggregated data. I will give you a couple of examples to illustrate my point.

Example 1

First is an example from BC's groundfish bottom trawl industry. In 2005 it was found that the fleet was capturing about 8,500 kg of sponges coast-wide, about 6,000 kg (70%) was being captured from an area adjacent to recognised 'sponge reef closures'. A closer look at the data found that 80% of the sponge by-catch adjacent to the closure was being captured by a single vessel. Identifying the single vessel responsible resulted in a timely and effective conservation solution. However, for this solution to have been achieved required fisheries managers to break or at least severely bend its own 'three boat rule'.

Example 2

Two weeks ago, the basking shark was listed as 'endangered' by Canada's scientific committee that assesses species endangerment. Under contract with the federal government I wrote the status report on the basking shark used as the basis for the listing. In writing the report, I made data requests for observer data containing basking sharks for both the Atlantic and Pacific Ocean. For the Atlantic, I received the entire observer dataset with every recorded piece of information. For the Pacific coast the only legally accessed data I received indicated that 3,500 kg of basking shark had been caught in BC over a ten year period. Fortunately, I received some additional 'leaked' data which interestingly showed that there were four sharks caught by trawl in BC, three of which were practically on top of one another, but in separate years – possibly indicating an area of important habitat. This example shows both the inconsistency but as well the potential loss of important information that is not being made fully available even for federal contractors assessing species at risk.

The message from these examples is that realistic and effective conservation solutions require the highest resolution of observer data available.

So why is data not being made available? In Canada, the most cited reason for not releasing high-resolution observer data, or any other fisheries data, is based on apparent legal restrictions through the *Privacy Act*. Because of this Act, fishers' identities and precise fishing locations have historically been withheld to protect the economic interest of the fisher. However, since DFO does not actually have a data policy, it is uncertain as to whether this Act is a legitimate legal mechanism to prevent public access to fisheries data.

The *Privacy Act* has a provision that allows so called 'private information' to be disclosed when 'the public interest in disclosure clearly outweighs any invasion of privacy that could result from the disclosure.' I believe a legal case can be made that the public benefit to access to fisheries data outweighs the invasion of privacy to an individual fisher.

For much of Canada's west coast fishery, the *Privacy Act* does not have the historical relevancy it once did. All of the major groundfish fisheries are managed through ITQs, where there is less obvious benefit for individual privacy, in several fisheries, fishers are actually more likely to actually share their location and catch composition with other fishers to avoid coming up against by-catch limits etc.

It is clear that access to observer data in Canadian fisheries needs to be more fully addressed. Unfortunately, the most likely way of getting this issue resolved will be through some form of legal challenge where the intent of the *Privacy Act* is weighed against the current day reality and public interest in the management of the fishery.

Ultimately, fisheries observer data needs to be accessible to all stakeholders for multi-stakeholder management process to be effective. However, access should probably be regulated through training courses and data-sharing agreements to ensure that the data used is the most current and is interpreted properly.

Spanish Mediterranean sea turtle collaboration between Alnitak (Spain) and NOAA Fisheries

Adam Bailey

NOAA Fisheries. Pacific Islands Region Observer Program, Honolulu, Hawaii – USA

Due to continuing high interaction rates between Spanish longline fishermen and Loggerhead sea turtles (*Caretta caretta*), the Pacific Islands Region Observer Program was asked to provide technical assistance in cooperation with Ricardo Sagarminaga, co-founder of Alnitak, a Spanish non-profit ENGO. The purpose was to follow up Sagarminaga's earlier mitigation experiments in the EU LIFE Nature Project with Spanish swordfish (*Xyphias gladius*) longline fishermen by using sea turtle dehooking equipment and safe handling techniques.

The Hawaii fishery has reduced its sea turtle take and mortality by employing various mitigations and handling measures. These mitigation measures have been required by federal regulations since April 2, 2004. This includes the possession and use of specific gear and handling requirements on the vessels. In addition, each of our observers is trained in the implementation of these regulations.

The year 2000 interaction estimates with Loggerheads by the Spanish Mediterranean swordfish longline fleet range from 2,800 to 29,000. This surpasses the 2005 Hawaii longline fisheries interaction rate at a minimum of 76 times. A 2006 interaction rate of 0.028 turtles per 1,000 hooks in the Hawaii longline fishery targeting swordfish is the highest in the past several years. The rate experienced by the Spanish overwhelmingly surpasses the highest rate that the observed Hawaii longline fleet has ever recorded in its 13 year history. Due to this high interaction rate, our Program was given an opportunity to gain more concentrated experience with sea turtle interactions.

From late August to mid-September 2006, I was with two Spanish observers deployed off the southeastern Spanish Mediterranean coast to collaborate with the fishermen on using dehooking equipment on incidentally caught sea turtles, and collect data. Six interactions with loggerheads resulted from eight gear sets, at an interaction rate of approximately 0.75 sea turtles per 1,000 hooks.

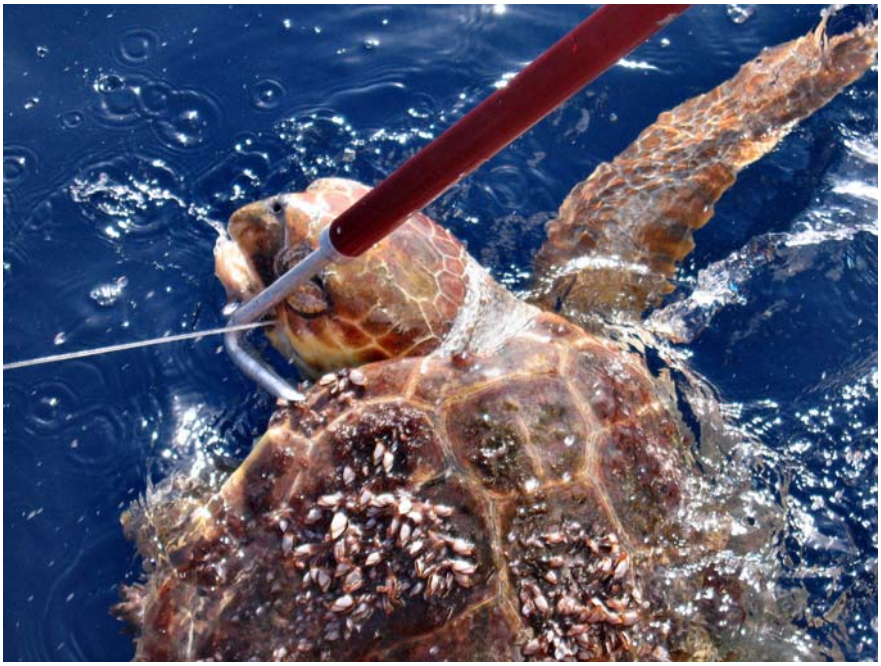


Figure P5.2: *Photo taken by Lucia Rueda while Adam Bailey employed the ARC line cutter on a Loggerhead sea turtle (Caretta caretta).*

Data on the turtle interactions mirrored results from a 2005 experiment in that no success in using the long-handled dehooker was obtained when the turtles were hooked in the beak or mouth, and were unable to be brought aboard. The turtles would not open their mouth for the dehooker to slide down to the bottom portion of the hook, as is required to use the equipment. Additionally, the vessels layouts did not include any opening at the railing that might have made it possible to simply lift the turtles onboard by their carapace. Four turtles were released by using a long-handled line cutter and cutting the line as close to the hook as possible. No dip nets were present on any of the vessels.

This project provided additional data to Alnitak on the use of dehooking equipment and the lack of appropriate sea turtle handling methods. The Observer Program benefited by obtaining video footage and enhanced knowledge of sea turtle dehooking methods. Further cooperation between Alnitak and NOAA Fisheries is planned for observation and outreach using fishery observers and teaching suitable handling techniques.

Toward a sea turtle by-catch observer program in Vietnam: The role of NGOs and cooperative mechanisms

Keith Symington

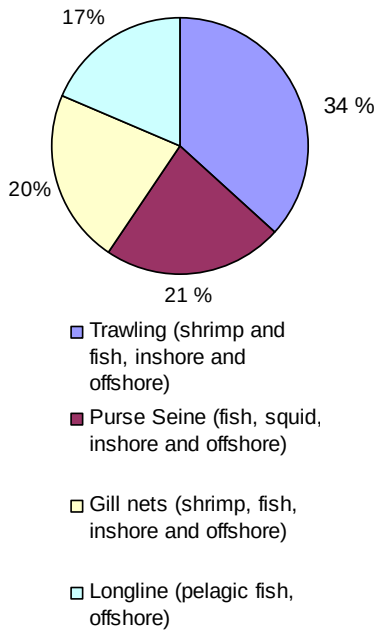
WWF Greater Mekong – Vietnam Country Office

Overview

- Quick overview of fisheries in Vietnam, management issues, in-country activities of WWF.
- Summary of by-catch project and proposed observer program.
- Perspectives on NGO-Government-donor cooperation; cooperative mechanisms.

Fisheries in Vietnam

- Approximately 85,000 mechanised boats.
- 12,000 long line vessels (tuna fishery expanding).



WWF roles/activities

- Technical training, capacity-building and awareness raising at all levels, national to local.
- Establishing partnerships with Government and donor and/or technical institutions (MOUs).
- Pilot projects on EBM.
- Marine Stewardship Council (2 fisheries).
- Strategic analysis of ODA investments in sector, and related outreach.
- Sea turtle by-catch reduction.

Sea turtle by-catch project

- Supported by NOAA and WWF International (regional project); lead Vietnam implementing agency is RIMF.
- MOU with Government of Vietnam to harmonise and coordinate efforts.
- National *Sea Turtle Action Plan*.
- SEAFDEC and IUCN.

Key factors

- Lack of baselines: target catch and sea turtle by-catch rates, livelihood indicators.
- Critical mass for community and Department of Fisheries awareness and support?
- Systematic, step-by-step process, involving community at all stages.

- Management 'model' for SEA, multi-species fisheries with sustainable livelihood elements.

Pilot project objectives

- Gain better understanding of the relative impacts of different fisheries and gears.
- Identify geographic hotspots.
- Design modest OP for longline fishery.
- Assist MOFI to develop Management Options Paper for gillnet (including socio-eco impact assessment and monitoring program).
- Implement OP and report results.

Next steps

- Design and implement observer program training and at-sea program.
- Incorporate other observer program applications?: shark species composition, finning, other by-catch of species of concern.
- Based on results of observer programs, begin circle hook trials.
- Assess feasibility and future potential applications of observer programs in Vietnam.

Prospects/Avenues for Successful Cooperation

- WWF-RIMF-NOAA Memorandum of Understanding forms the basis, using STAP as reference point.
- Fisheries co-management framework.
- Integration of Fisheries Strategies with livelihood objectives:
  - national multi-agency steering committee;
  - local AIG pilots.

Cooperation in Vietnam

- WWF/IUCN serve as in-country government liaison, technical provider or policy conduit for NOAA assistance (e.g., sea turtle by-catch, nesting beach management, MPAs, harvest refugia, ICZM).
- Other technical research assistance, expertise, lessons sharing.
- NGOs – serve as liaison with quasi-government institutions like SEAFDEC.
- Leverage from NOAA involvement – Vietnam government and fishing stakeholders paying more attention!:
  - Prospect of trade embargoes?
  - WTO accession and market system;
  - Emerging leadership from business sector.

Sea Grant and observer programs: opportunities for future cooperation

Kim Dietrich

Washington Sea Grant, University of Washington – USA

Within the United States, Sea Grant (SG) programs have a long history of cooperative and collaborative research involving fishers, state and federal management agencies and non-governmental organisations. Observers have played a central role in the success of several projects including attempts to reduce sea turtle and finfish by-catch in Gulf of Mexico shrimp trawl fisheries (Texas SG) and seabird by-catch in Alaskan longline fisheries (Washington SG). I currently work for Washington SG on the on seabird catch reduction and we have had an excellent working relationship with the North Pacific Groundfish Observer Program on our projects. I have also worked as a fisheries observer in Alaska.

Last October, I participated in a national workshop for SG Fisheries Extension personnel. Steve Murawski, Director of Scientific Programs and Chief Science Advisor for NOAA Fisheries, spoke at our event and provided the following quote from Bill Hogarth, Director of NOAA Fisheries, *"I wish NOAA Fisheries had a group of extension agents like Sea Grant"*. As I continued to listen, I couldn't help but think, *"Dr Hogarth has hundreds of potential fisheries extension agents at his disposal (i.e., fisheries observers) although for the most part, they are not tasked with extension or outreach duties"*.

I followed up this thought with Dr Murawski and several SG personnel and decided that the IFOC would be a great place to share a few ideas regarding how SG and observer programs (OP) could increase their cooperation and collaboration to potentially improve data collection and fisheries management in the future.

What is SG?

Sea Grant is a national organisation in the U.S. headquartered in NOAA's Oceanic and Atmospheric Research Division and is comprised of 30 university-based colleges located in all coastal and Great Lake states and Puerto Rico. SG integrates scientific research, outreach and education to accomplish its mission which is very similar to the mission of NOAA Fisheries. The essence of both missions is to conserve ocean and coastal resources.

Questions

I contacted 14 SG Extension staff who are currently working with fishers on a variety of projects and asked them a series of questions which are summarised below (*n* = 8 responses):

How does SG fisheries extension staff currently utilise observers or observer data?

SG personnel have utilised observer data in raw or summarised form to identify research questions, classify potential problems in fisheries or inform research underway. They've also used OP forms as basis for own data collection projects or observer programs.

What services could SG provide observer programs?

Responses ranged from supplemental data collection to educational augmentation to outreach training. In terms of supplemental data collection, SG administers or has administered observer programs in the Gulf of Mexico, Virginia and Washington. If data fields were designed to be compatible among the programs, there could be more efficient sharing of data collected by SG with federal or state observer programs. In terms of educational augmentation, SG could use the Marine Resource Education Project funded by the Northeast Consortium (http://www.northeast consortium.org) as a model to create a course designed to specifically address observer-related issues bringing fishers and observers together to enhance mutual understanding and build trust. In some regions, SG also has the capacity to offer training courses on conflict resolution, vessel safety and remote first aid. Needs are variable by region but some programs could benefit from updates performed by SG staff given limitations on current observer program staff time. An added benefit is that observers would be interacting with fishers who regularly attend SG trainings. SG could enhance outreach by providing training for outreach functions recognising the word outreach means different things to different people so objectives would need to be clear. My experience with outreach has been to use a science-based collaborative approach to problem solving with fishers which is consistent with NOAAs recently released Outreach Strategic Plan.

What services could observer programs provide to SG?

Responses encompassed research support and outreach opportunities. For research support, OPs could provide supplemental staff or recommend experienced observer to SG projects. If a project has the potential to change a regulation that observers will eventually be required to monitor for compliance, OP staff can provide valuable insight regarding how practical a given technique will be. OPs can also provide supplemental information (i.e., special projects). SG funds hundreds of researchers each year. Many of the SG projects could benefit by partnering with OPs for special project data collection. SG could assist with building these bridges.

In terms of Outreach opportunities, observers and OPs could educate fishers regarding gear modification research or upcoming management issues. Some of these functions are already being performed by OP staff and observers (e.g., fisher workshops for careful release of sea turtles caught by longlines). One SG staff also noted that observers shouldn't just collect data but they should also be responsible for disseminating accurate information to help fishers become better stewards. Again, this is a goal of NOAAs Strategic Outreach Plan.

There are a number of potential issues or limitations to increasing cooperation and collaboration between OPs and SG. As the other speakers on this panel have noted, a potential roadblock for cooperation are data access and confidentiality issues. Not all individual observers are suited to outreach activities but I think this skill set could be fostered in a subset of the observers. Currently, there is no mechanism to formally implement this sort of collaboration. Recognition of the balance between existing tasks and the feasibility of adding new tasks. Finally, there is currently a clash of cultures. The observer image among fishers and scientists is highly variable between

the regions in the U.S. The compliance duties of observers are in conflict with the traditional SG trust building approach when working with fishers.

Despite these limitations, the benefits of enhanced cooperation include:

- Building capacity for future fisheries managers and scientists. Many observers move into fisheries management or scientific positions. If we foster a more comprehensive understanding of their role now, future management could be enhanced.
- All components of fisheries management benefit from building trust among the stakeholders.
- And finally, management data can be enhanced by integrating observer and fisher knowledge and through supplemental collection projects.

Questions & Panel Discussion – Session P5 –

Vicki Cornish (The Ocean Conservancy)

Comment / Question:

I liked hearing how ENGO's play an important role in observer programs and, as a recent convert to the ENGO community, I'm looking for more and more ways to open up those partnerships. I don't have any specific questions but a couple of comments that you might wish to elaborate on. Elizabeth talked about the need for data standards so there could be better analysis and sharing among programs – perhaps a role that the ENGOs could play is bringing together the observer programs, data users and fishers to help develop those standards. ENGOs can convene the kinds of fora to help do that and support observer programs in ways that strengthen the policies and laws that call for observer programs. Sharon has worked a lot in this area in the realisation of the *Marine Mammals Protection Act* and ensuring observer coverage is part of the mandate for better management of marine mammals. I think ENGOs also can play a role in developing market-based incentives that help promote sustainable fisheries and we can bring ideas to the table that involve the use of observer programs to help promote that. Also, data access is a big issue and I feel we may have taken a step backwards with the recent *Magneson-Stevens Act* with respect to data confidentiality and limiting access to data and I wonder how that is going to play a role when we look to ENGOs to help analyse the reams of data that come out of observer programs.

Howard McElderry (Archipelago Marine Research Ltd.)

Comment / Question:

Howard McElderry – One of the supporters of this conference is the Betty & Gordon-Moore Foundation. Unfortunately, their representative Meaghan Calcari was unable to come to the conference at the last minute. One of the projects they're involved with on the east coast is called 'FishTank' which is basically a forum to get ideas hooked-up and developed in a way that can be presented into the United States and the Council process. In Canada, there is a large interest by the fisheries agency to create co-management and pass the responsibility onto the fishing industry and getting industry involved in taking control. However, the passing over of that responsibility and building leadership within industry is difficult and slow, particularly when it is a contentious industry. I wanted to raise this as another important role of ENGOs.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment / Question:

Communication is behind a lot of the things that we are doing or trying to do, but finding the right forum for that can be difficult. I think universities are a good place and ENGOs could be another. We should be bringing together some of the fisher cultures from the different regions with the stakeholders. For instance, they could spend a week at the University of British Columbia, University of Victoria, etc. and look at some of the fisheries models and things that are being done to manage fisheries and talk about what is being planned, etc. I would also be happy for the ENGOs to meet with observers and it would add to the ENGO's communication with the fishing industry.

Response:

Libby Fetherston – I agree with bringing together different fishers that are successful in

one place to talk about how they can adapt it to somewhere else – it starts with people who are willing to go and talk to the fishers and the fishing communities and discussing the limitations and opportunities. We're making great strides in the Gulf, which has not traditionally been a good place for fisher cooperation, but the tide is turning, not only with the ENGO communities but with the fishers themselves. Only 10 years ago these partnerships were unthought of, so I think the evolution is gaining speed and our successes will carry the flag for us. Other places will see what we've done when we succeed and it will go a long way to making a great change. It is fantastic to see the acceleration of all these things coming together.

Keith Davis (Fisheries Observer – USA)

Comment / Question:

Some of the experienced observers were speaking last night about the possibility of providing our own equipment and training and being independent contractors. Do you think ENGOs (e.g., Sea Grant or Oceana) could facilitate that for programs in the future?

Response:

Libby Fetherston – There is a complicated series of methodologies that go into this type of data collection and our good friends in Galveston draw that together or us. If there are people who are willing to do this kind of thing, then we need to seize the opportunity and perhaps bring the idea forward to the agency and ask them how we can make it work. But, as you well know, there is a much larger data collection scheme that you would need to fit into and that takes a lot of planning and forethought.

Kim Dietrich – I think what Keith is asking for is another option as a service delivery model. Direct contracting of observers by NMFS used to exist. I think it is a good model for really experienced observers. I have had some direct contract work with NOAA to do research in the Antarctic which has worked out fine. What I think Keith is getting at is for the ENGOs to put some political pressure on the agency to make that service delivery model available again.

Jerry Cygler (East West Technical Services) to Sharon Young

Comment / Question:

I'm interested to know, from your experience in a non-government organisation, how non-fishery observer-based programs compare to fisheries-based observer programs and what sort of data exists from these other programs (e.g., in terms of incidental takes of species).

Response:

Sharon Young – My focus is on marine mammals because that is what my organisation has prioritised and each year we talk about how much money is available and how we would allocate it to the various priorities. We frequently make recommendations for what kinds of data are helpful for observers to gather when they're onboard vessels. I've also participated in workshops where some of the NMFS north-east fishery people will be looking at what data are being collected, what additional data would be helpful and reliable in informing what we need to know. I have not personally been involved in setting observer priorities for non-protected species data collection so I would have to bow to someone else about how they work on that.

Teresa Turk – Most of our information comes from fisheries observer programs but the marine mammal component is in there, so it is the same program that is providing the information about marine mammals and other protected species.

Jerry Cygler – Yes, but there are other programs such as seismic vessels and the oil industry that must also comply with the *Marine Mammal Protected Protection Act* – what data do these other industries collect? I believe the Marine Mineral Management Service has authority to train its own observers so I wonder if there is a conflict in this with fisheries observer programs. The dredging industry is also involved in operations that have similar effects as trawlers and I would like to see how we, as fisheries observers, compare with these other industries.

Sharon Young – Again, it is part of the same program. I've been frustrated to see programs becoming more decentralised and therefore less standardised. We have to advocate region by region and this makes it much more difficult for

us to get action than if there was a single entity. I understand the benefits for the region in terms of bringing knowledge to bare on local issues but it makes it harder for us to be helpful in the broader sense.

Georg Hinteregger (Observer) – I don't think we're getting an answer to Jerry's question. What he is asking is what are non-government organisations doing in terms of looking at the impacts from other, non-fishery activities such as dredging?

Sharon Young – We're a non-discriminating complainer, so where we sometimes bring pressure to bare on fisheries, we do so on other areas as well. For example, for right whales there is a significant problem with entanglement in fishing gear, but we're also going after the shipping industries which are striking the right whales. We've also been advocating for recreational fisheries to be included in the take reduction process, for example, recreational gill nets can be used side-by-side with commercial gillnets, yet they're not bound by the same mandates as commercial gear with respect to gear modification and area closures etc. We've also looked at the impacts of ocean noise which was a part of a large symposium we were at two weeks ago to work with the shipping industry on ways to reduce ocean noise.

Georg Hinteregger – I think the other thing that Jerry was asking is how does the quality of the data from fisheries observers compare to the quality of data from these other industries that impact on protected species?

Sharon Young – There is a saying: "*who are you going to believe – me or your lying eyes?*" When you've got observers, you've got eyes. There is the tendency for us to err on the side of what will benefit us, whether it be the Internal Revenue Service and tax reporting, or self-reporting by fishers. We tend to know less about things that don't have an objective observer source. For example, we know a lot more about the impacts on harbour porpoise because they interact, almost exclusively, with gillnet fleets that are well observed on the east coast. In comparison, we know very little about the levels of interactions for right whales and humpback whales because they're primarily entangled in fixed fishing gear (e.g., lobster gear), which have a low catch per unit effort and the chance of an observer seeing an interaction is very little. Because we don't have as much quantitative data for right whales, we depend a lot on stranding programs to provide data for these species. There is a tendency to place more effort on fisheries, which is partly because of the publicity given to fisheries which leads people to immediately suspect fisheries of doing something bad and so it is easier to get attention focussed in that area. I think part of our mission as an ENGO is to educate people about the other sources of interaction and to make people responsible consumers with respect to these other sectors.

SESSION P6

How are fishery monitoring data analysed and used by government, industry, academics, and NGO's?

Moderators:	
Jim Nance	*National Marine Fisheries Service – USA*
Lisa Borges	*European Commission*
Speakers:	
Makhdoom Hussain	*Centre of Excellence in Marine Biology, University of Karachi – Pakistan*
Scott Buchanan	*Archipelago Marine Research Ltd. – Canada*
Elizabeth Voges	*Fisheries Observer Agency – Namibia*
Rowan Haigh	*Department of Fisheries & Oceans – Canada*
Lisa Desfosse	*NOAA Fisheries, National Observer Program – USA*
Matthew Grinnell	*School of Resource & Environment Management – Simon Fraser University – Canada*
John Carlson	*NOAA Fisheries, Southeast Fisheries Science Center, USA*
Robert Trumble	*MRAG Americas – USA*
Craig Davis	*Fisheries Research Services – Scotland*
Kimberly Murray	*NOAA Fisheries, Northeast Fisheries Science Centre – USA*
Miguel Machete	*Institute of Marine Research, University of Azores – Portugal*
Sara Wetmore	*NOAA Fisheries – USA*
Lutgarde van Eeckhaute	*Department of Fisheries & Oceans – Canada*
Matt Koopman	*Primary Industries Research Victoria – Australia*
Jim Nance	*National Marine Fisheries Service – USA*

Fisheries resources of Arabian Sea along the coast of Pakistan with special reference to yellow fin tuna (*Thunnus albaceres* (Bonnaterree, 1788)

S. Makhdoom Hussain*, Zakia Khatoon and Baradi

Centre of Excellence in Marine Biology, University of Karachi – Pakistan

The Arabian Sea coast of Pakistan is one of the most productive regions of the Indian Ocean. Although fish production during a decade is under heavy fishing and environmental pressure, millions of tons of fish and shell fish is exported to Countries like Saudi Arabia, Dubai, Oman etc. and many western countries are regular importers of fish from Pakistan. Species that are exported are Tuna, Mackerel, Groupers, Lobsters, Shrimp and prawn. The total fish production in 2000 ranged from 395,307 metric tons while that of shell fish was 42,086 metric tons. This data represents the fish collected from the waters less than 35 nautical miles from the coast beyond which the local fishing fleets because of their technical limitations are incapable to fish. The huge fish production beyond 35 nautical miles has been wasted. The coast of Pakistan further includes 200 miles of EEZ where no foreign vessels are permitted to fish.

From the last three decades the Government of Pakistan has been able to make these huge resources exploitable by allowing foreign fishing vessels from Korea, Vietnam and China by charging a license fee from each fishing vessels as per its fishing captivity. These vessels are long liners which operate beyond 35 nautical miles and are expected to exploit the Exclusive Economic borders/Zone.

The present study was initiated to observe the catches of yellow fin tuna so as to acquire information on the population dynamics of the species which may be useful tool to implement measures to save the important Indian Ocean species. The data was collected on one of the Chinese vessel from October 2005 to May 2006 while dozens of such vessels were in operation during the same period in the area.

The coastal fishery is entirely dependent on the fishing fleet which consists of Oar/Row Boats, Sail Boats, Mechanised Sail Boats, Gill-netters and Trawlers. The changes occurring in number of fleet during the years 1993 – 2003 are shown in Figure P6.1. The capacity and power of the fleet is restricted to the coastal areas and the long EEZ remains unexploited by the local fishermen.

The number of fishermen engaged in marine and inland sector during 1993 – 2003 were 281,443 416,495 as given in Figure P6.2. The majority of these fishermen engaged are exploiting fresh water resources as their livelihood and their figures range from minimum in 2002 as 281,443 most of them exploit fresh resources and belong to fresh water aquaculture industry which is well established.

Commercial fishing of crab, lobsters and shrimp is practiced all over the coastal area and these commodities are included in major export from this sector. *Portunus sp* are the common crabs that are exported live and frozen. Their catches range 1,877 – 5,680 metric tons from 1995 to maximum in 1998 (Fig. P6.3a) after that their catches are on the decline perhaps because of over exploitation. Similarly the *Palinurus* sp of lobster is common and maximum 612 metric tons was caught in 1999 and earlier they recorded as low as 199 metric tons in 1996. After attaining a peak present catches are on decline (Fig. P6.3b).

Shrimp species *Penaeus, Metapenaeus* sp. and *Parapenaeopsis stylifera* are commercially exported. Figures P6.3c, d & e give the detail of the shrimp caught. In general the catches of *Penaeus, Metapaenus* and *P. stylifera* are prominent.

The fish fauna of the region is consistent because of the tropical environment. Many families are represented with similar water masses and over similar deposits. Occurrence of isolated patches of rocky or biogenic reefs, brackish estuarine conditions associated with lagoons, river delta and the continental shelf makes the nature of more productive water masses with acme of fish community diversity.

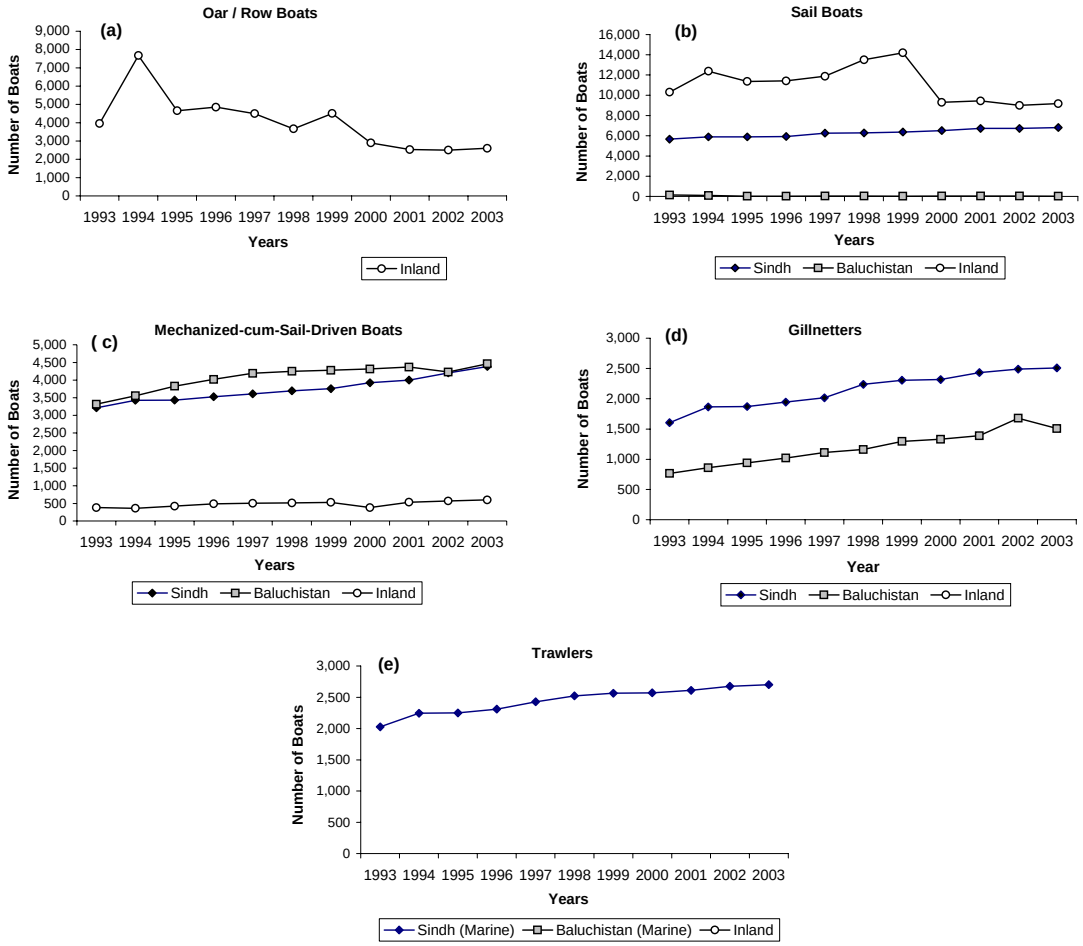


Figure P6.1: *Fishing boats in operation from 1993 – 2003 (a) oar/row boats; (b) sail boats; (c) mechanised-cum-sail-driven boats; (d) gillnets; and (e) trawlers.*

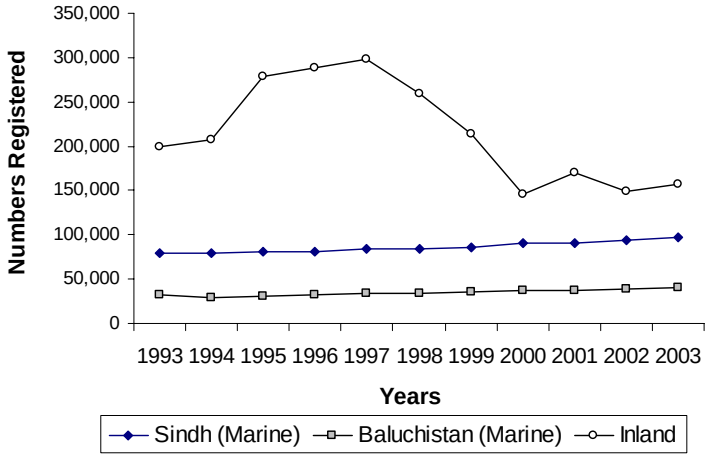


Figure P6.2: *Number of fishermen engaged in Sindh and Baluchistan (Marine) and Inland areas.*

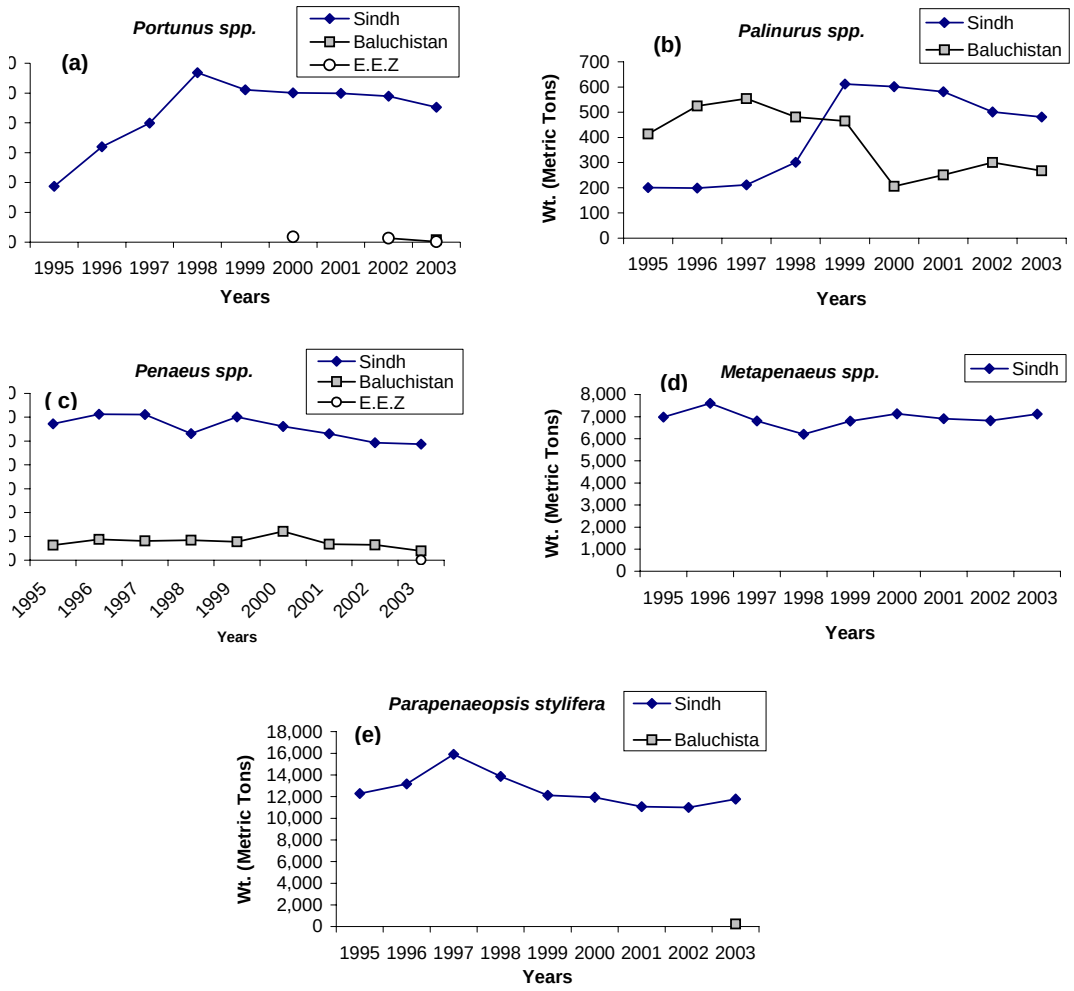


Figure P6.3: *Total catches from 1995 – 2003. (a) Crab; (b) Lobster; (c), (d) and (e) Shrimps.*

Elasmobranches are quite diverse and abundant they are number of pelagic and demersal species that often are caught and some time form abundant part of the commercial catches. Saw sharks (Pristophoridae) are rare and often caught in deeper parts of Arabian Sea. Hammer headed sharks (*Sphyrna sp*) once very common are rare in catches. Saw-fish (Pristidae) are seen in trawl catches. Several species of Rajidae occur through out the Arabian Sea, Rhinobatidae, Torpedinae, Rajinae and Dasyatinae commonly occur in estuaries and shallow open seas. There is no a specific fishery but these species are often caught in trawl net and because of low fecundity are especially sensitive to fishing.

Dominant pelagic communities are the fishes of Clupeiformes. These are not only in pelagic ecosystem but also in the benthic-demersal ecosystem. Several dominant species that occur in the region belong to genera *Ilisha, Pellona, Pellonula, Opisthonema, Opisthopterus* and *Sardinella.*

Perciformes is the largest group of fishes that dominate the demersal fish fauna of coast, estuaries, mangrove swamps and continental shelf of the tropical sea. Along the coast of Pakistan three groups of the Perciformes can be separated into species associated with inshore muddy areas, of sandy bottoms like that of continental shelf and those that inhabit rocky areas.

Along the coast of Pakistan a very specific established commercial tuna fishery exists – the species belong to genus *Thunnus* of the family Scombridae. Tuna are in great demand in the world markets. Tuna fishery is exploited both from coastal waters and from offshore waters. In the coastal waters local boats with long lines and in deeper offshore fishing is mainly permitted to

Chinese and Vietnamese factory ships. Locally caught species are *Thunnus tonggoi*, *Tuna nei* and *Scomberomorues spp*. Associated with the tuna species the local fishermen catch a small number of sail fish *Istiophorous platypterus* and Black marlin *Makaira indica.*

The Chinese and Vietnamese factory fishing vessels are issued permits to fish tuna while marlin, sail fish and sharks are caught in addition. These vessels operate with long lines off shore beyond 35 nautical miles from the coast with depth exceeding 500 meters the gear depth is normally 100 meters. Although these fishing vessels are operating from a decade but data obtained is limited and kept confined for official use.

Fisheries observer program metadata. Ensuring the meaningful interpretation of fisheries observer data

Scott Buchanan

Archipelago Marine Research Ltd. – Canada

Abstract

The data products generated from fisheries observer programs have many influences on their utility. The accuracy of the data collected by individual fisheries observers is a product of their background, interests, training, experience and resource materials. The interaction between fisheries regulations, fishing technology, members of the fishing industry and observers will have a great influence on the quality of data produced by a monitoring program. In addition, the mandate and design of a monitoring program will have a direct effect on the usefulness of the data it produces. The various groups who have access to fisheries observer data must be aware of these influencing factors in order to use these data in an effective manner. User groups must also be involved in establishing operational protocols in order to maximise the potential value observer data. Observer programs have the responsibility of documenting data collection procedures and potential influences on data quality. Observer programs and their user groups have the shared responsibility of mitigating these influences through changes in program design, data auditing procedures and observer support materials. Case examples from British Columbia's trawl observer program will be provided to illustrate influences on the efficacy of observer data and what result program changes had on these influences.

The use of observer collected data from the Namibian fishing fleet by different stakeholders and possible biases

Elizabeth (Lizette) Voges* and Elwin Kruger

Fisheries ObserverAgency (FOA) – Namibia

Introduction

- Namibian waters influenced by Benguella upwelling system of the Southeast Atlantic
- Total allowable Catches (TAC) +-520,000 tonnes

Fleet activity

- 513 fishing vessels.
- Representing13 different fisheries.
- 3,982 trips during 2006.

The Role of the Fisheries Observer Agency (FOA)

- Started in 1991 with 200 Observers employed to work in the newly established Namibian Exclusive Economic Zone (EEZ) – governmental.
- In terms of the *Marine Resources Act* of 2000 the Fisheries Observer Agency was established as a Non-Governmental Agency in 2002, directed by a Board of Directors, to run the observer program.
- Carrying observers on fishing vessels is compulsory. Either an observer or letter of authorisation to sail without observer.
- Currently 197 Fisheries Observers are employed and tasked with the functions of observing fishing activities to ensure compliance with the *Sea Fisheries Act* and Regulations and other relevant acts and to collect scientific information on catches and fishing activities for the fisheries managers of MFMR.

Observer coverage

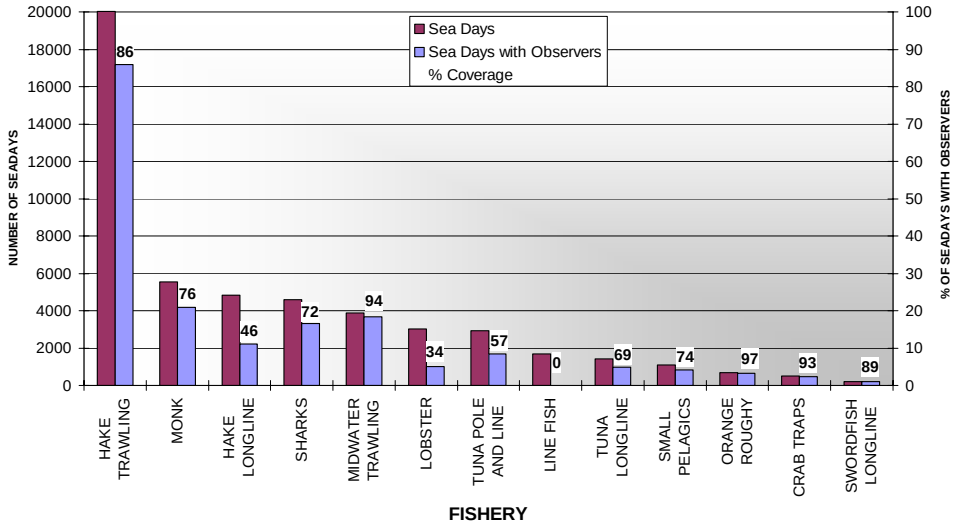


Figure P6.5: *Number of sea days with and without observers in Namibian waters per fishery in 2006. The percentage observer coverage is also indicated.*

Collection of information

Compliance

Whenever an observer is onboard any fishing vessels he/she is responsible for surveillance of the fishing activities and ensures it conforms to the relevant acts and regulations. This includes proper licensing of the vessel, correct recording of catches, no dumping of fish, no pollution, the correct gear and setup thereof and adhering to restricted areas and seasons. In cases of non coherence to any of the fishing regulations, the observer reports back after the trip. The report is handed over to the MFMR for following up and possible prosecution of the case.

During 2006 a total of 100 violations were reported by observers of which 12 were withdrawn, 60 finalised and 28 pending.

Scientific information

On fishing vessels where it is possible to take samples of the catch for investigation, that is also the task of the observer. The type of scientific information collected differs between fisheries and research projects. Mainly species identification, length measurements and sex identification are done.

For all the species sampled, the information is used as input into stock assessment models and for behavioural studies. The length information as used as input into age structured production models for four of the main species and into De Lury models for two other species. The by-catch of some species are used in research on distribution of other species.

There are also special research programs going on for which observers are trained specifically. One is a seabird project and another shark project.

Biases

Violations

- One observer on vessels with 24 hours operations.
- Observers not properly informed of al regulations – lack of communication.
- Intimidation by crew.
- Bribery.
- Lack of knowledge to read equipment onboard – navigation and various sensors.
- Lack of equipment – cameras, binoculars, GPS etc.
- Lack of collecting and presenting proper evidence.
- Fines are too low.

Scientific information

- Sampling conditions not favourable on some vessels.

- Non-random sampling can result in equal sex ratios reported.
- Not proper reporting of by-catch.
- Not fully recording of environmental data.
- Station and catch information not recorded.
- Species not identified.
- Fish not sexed.
- Vessel position during fishing not recorded.
- Hauling time not recorded.
- Gear and bottom depth not recorded.
- Catch over estimated.
- Time delay in feedback from scientists on quality of observer data and areas covered.
- Lack of proper sampling equipment.

What do we do about biases?

Biases due to observer negligence or ignorance

- The biases due to observer negligence are long in listing but not so bad in quantity. Only about 7% of all data sets collected by observers for the hake fleet is rejected due to incomplete or incorrect data.
- Encourage feedback from industry and scientists and law enforcing inspectors on observer performance.
- Follow up on problems reported with individual observers – monitor that it is not repeated.
- Refresher training courses where needed.
- Improve briefing and debriefing.
- Capture number of stations sampled and fishing days in database – greater observer performance reports and disciplinary consequences for non-performers.

Other Challenges

- Seek outside funding to equip observers better – measuring boards that allows one observer to take measurements and cameras to take evidence.
- Improve information flow from Ministry on amendments in fishing regulations.
- Try to have fines for violations increased.
- Vessels that are not suitable for sampling.

Visualising Observer Data

Rowan Haigh* and Jon T. Schnute

Department of Fisheries & Oceans– Canada

The groundfish trawl observer program, which covers 100% of the offshore commercial trawl fleet, has been active along the British Columbia coast since 1996. To date, Archipelago Marine Research (AMR) in Victoria BC, has supplied the expertise and manpower for the onboard observer side of this program. From its inception to the end of calendar year 2006 (11 years), AMR observers have recorded 198,100 fishing events with 2,046,539 estimates of individual species catch. Each record includes the catch (kept and discarded), effort, and spatial coordinates (latitude, longitude, depth). After initial collection and compilation by AMR, the data are transferred to the relational database *PacHarvTrawl* maintained by Fisheries & Oceans Canada at the Pacific Biological Station (PBS) in Nanaimo, BC.

AMR observers also record biological sample data (such as fish length and sex) and collect fish structures (such as otoliths). Information from these sources helps characterise species stock status and provides input to assessment models. Biological sample data from the fishery, research surveys, and other sources appear in a second relational database *GFBio*, also maintained at PBS.

As these databases grow, it becomes an increasing challenge to make sense of their contents. Visual representations and other methods of summarising information can play a valuable role. Partly to facilitate our understanding of complex groundfish data, we have developed two software packages for the environment of the *R* statistical language (http://cran.r-project.org/). The web site offers R without charge to users running a variety of operating systems, including Windows, MacOS X, and popular versions of Linux. Our packages, *PBSmapping* and *PBSmodelling* (both developed at PBS), appear in an extensive collection of user-contributed libraries that are also available without charge. Anyone attending this conference or reading this report potentially has free access to all the software discussed here.

PBSmapping (Schnute *et al*., 2004) makes it possible to represent fishery information on maps, with two-dimensional plotting features similar to those available in a Geographic Information System (GIS). Embedded C code speeds algorithms from computational geometry, such as finding polygons that contain specified point events or performing Boolean operations on polygons. *PBSmodelling* (Schnute *et al*., 2006) facilitates the design, testing, and operation of computer models. Taken together, these two packages provide powerful tools for interactively displaying spatial patterns in observer data.

Figure P6.5 illustrates a customised GUI for investigating longspine thornyhead *Sebastolobus altivelis* catch per unit effort (CPUE) along the BC coast in 1996. A user can choose any combination of spatial and temporal limits: a longitude interval (**X**), latitude interval (**Y**), depth range (**Dep**), and date range (**YMD**). The GUI also allows a user to view management areas, survey strata, and/or isobaths. Summaries depend on a specified spatial grid, with cells that define coordinates within which data are summarised. Figure 6.5 represents mean CPUE data, but a user might alternatively choose to summarise total catch or effort within each cell. The GUI makes a few other choices available, such as:

- use coordinates from the start or end position of tows (or a vectorised blend of both),
- choose interval ranges for the summarised data, or
- specify a minimum number of vessels to allow in a summary grid.

Furthermore, *PBSmodelling* makes it easy to modify the GUI to include other features. The choices in Fig. P6.5 (left) lead to the CPUE density map in Fig. P6.5 (right). Generating figures for successive years and splicing the images together yields a small movie on how the fishery has evolved over the 11 years.

Aside from helping make spatial summaries easier, *PBSmodelling* also facilitates the modelling of biological data. For instance, observer programs typically provide numerous length measurements that can be modelled as a function of age (if otoliths were also taken). Analysts often apply the von Bertalanffy model to lengths-at-age; however, more flexible growth models, like those proposed by Schnute (1981) and demonstrated in *PBSmodelling*, allow extra parameterisation for potentially better fits.

The BC observer program also generates a lot of sporadic data on non-target fish species. For example, otolith ages may be available for only a few years, often spaced far apart. In these data-limited situations, catch-curve analysis remains the only tool for determining mortality rates. Single-year age profiles for rockfish often exhibit complicated patterns, primarily due to long life histories and episodic recruitment events. To address this issue, Schnute and Haigh (2007) presented a novel catch-curve analysis where proportions at age a are fit using a model with three key components: survival S_a, selectivity β_a, and recruitment anomalies R_a.

Generally, as models become more complex, they require multiple input tweaks to fully realise the spectrum of outcomes. In these situations, GUIs become indispensable. Figure P6.6 presents the Schnute-Haigh catch-curve analysis, using 1986 data from quillback rockfish *Sebastes maliger* for illustration. Estimating the target parameter Z (total mortality) using the full model requires estimating various 'nuisance' parameters. The GUI (Fig. P6.6, left) allows the user to turn on or off combinations of parameters that control the three model components:

- survival S_a parameter: Z;
- selectivity β_a parameters: β_k, α, where k = youngest age of interest;
- recruitment R_a parameters: $\rho_1,\ldots,\rho_m$, τ, where m = number of recruitment anomalies;

Once the non-linear minimiser estimates the modal parameters (Fig. P6.6, top right), the user can check these against the Bayes posterior distributions (Fig. P6.6, bottom right). Often a modal estimate will lie at the edge of a posterior parameter distribution.

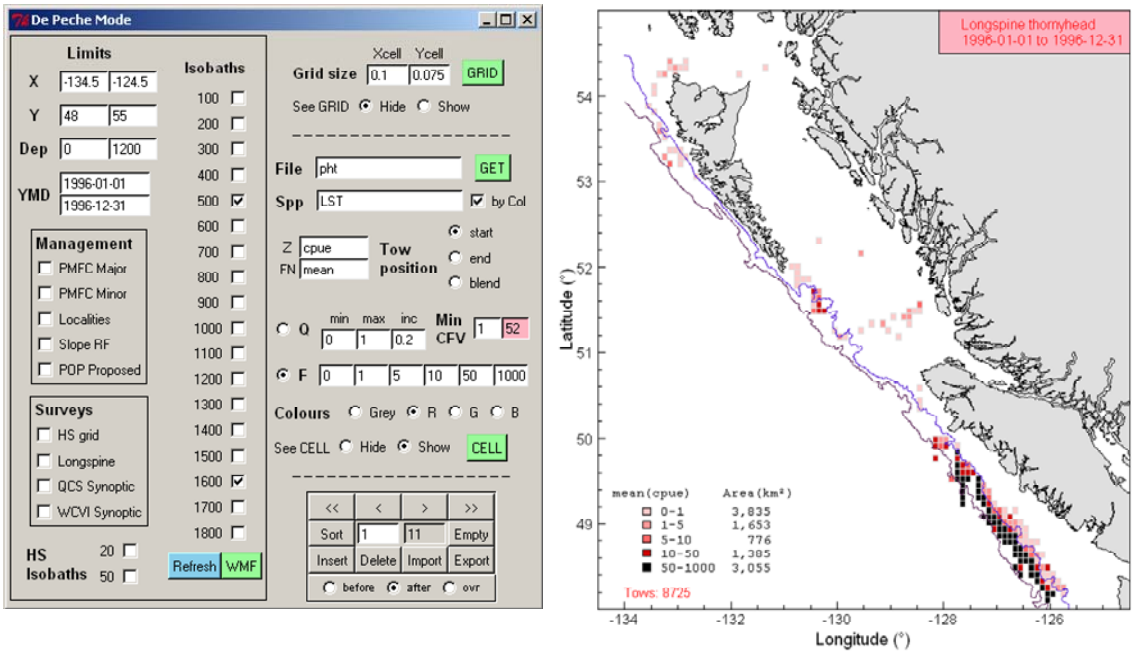


Figure P6.5: *PBSmodelling GUI (left) controls PBSmapping plot (right). Longspine thornyhead Sebastolobus altivelis CPUE density for 1996 summarised in grid cells with estimates of bottom area (km^2) for each density interval. Isobaths trace 500 m and 1,600 m.*

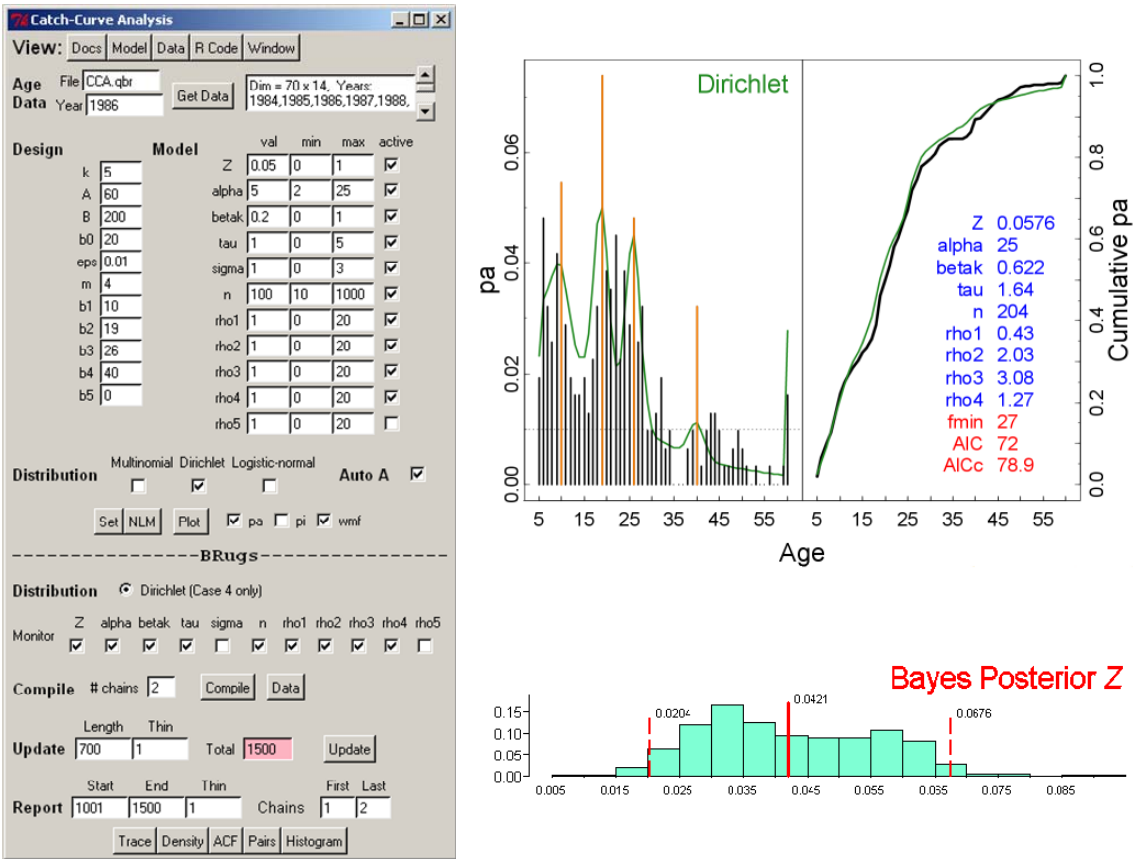


Figure P.6.6: *PBSmodelling GUI (left) controls the Schnute-Haigh catch-curve model (right). The user can get modal parameter estimates through non-linear minimisation (top right) and check these estimates using Bayesian sampling (bottom right).*

Estimating Discards in United States Commercial Fisheries

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The *Magnuson-Stevens Fishery Conservation and Management Act*, the *Endangered Species Act*, the *Marine Mammal Protection Act*, and international agreements identify the stewardship role of the National Marine Fisheries Service (NOAA Fisheries) in leading the collaborative effort to monitor and reduce the by-catch of living marine resources within the United States Exclusive Economic Zone. NMFS has initiated development of a National By-catch Report (NBR) to provide a comprehensive summary of by-catch estimates in U.S. commercial fisheries. The intent of the report is to quantify by-catch, to the extent possible, for all living marine resources, including fish, marine mammals, sea turtles, and sea birds. For the purposes of this report, NMFS defines by-catch as the discarded catch of any living marine resource, plus unobserved mortality due to a direct encounter with fishing gear. The report will quantify at-sea discards of fish and by-catch of marine mammals, sea turtles, and seabirds. The report will not provide estimates of unobserved mortality since these estimates are not available for many species. The NBR will serve as a strategic document to guide future by-catch data collection, monitoring, and research priorities, and will provide valuable input for setting NMFS data collection and management goals.

The NBR is a collaborative, nation-wide effort that involves NMFS fisheries biologists and protected resource experts from all regions of the U.S. The first edition of the report, targeted for publication in 2008, will discuss the quantity of by-catch for which data and estimation procedures are presently available to support the development of accurate by-catch estimates. Future editions of the report will include updates and additional fisheries as data become available. By-catch estimates published in the NBR will be based on information collected by fisheries observers and reports submitted by fishers and fish processing companies (Table P6.1). Observer data are utilised for a variety of assessment and monitoring purposes and, when available, is considered the most accurate source of information for monitoring fisheries by-catch. U.S. observer programs currently provide observer coverage for 42 U.S. commercial fisheries. For fisheries with little or no observer coverage, industry reports are either the primary or only source of data for by-catch and discard estimation.

The NBR will include a formal evaluation of all U.S. commercial fisheries for by-catch data quality and estimation methodologies through a tier classification system. Specific criteria have been developed to evaluate the adequacy of by-catch data provided by observer programs and industry reported data, the use of supplemental data for expansion of observer data and other analyses, the level of database linkages between observer and supplemental data, and factors regarding the analytical approach such as peer review, statistical bias, and measures of uncertainty. The classification system has five tiers, ranging from fisheries with no by-catch data (Tier 0) to fisheries with extensive observer data that produce high quality by-catch estimates (Tier 4).

The NBR will include fishery by-catch improvement plans for all fisheries with high levels of by-catch or by-catch of key management species. These by-catch improvement plans will include information on the feasibility of implementing new by-catch data collection programs, estimated costs of implementation, and management issues. The information included in the by-catch improvement plans will be useful to NMFS and other agencies for setting of observer program priorities and coverage requirements, improvements to the Standard By-catch Reporting Methodologies included in all Fishery Management Council fishery management plans, development of by-catch management strategies, setting priorities for by-catch reduction technology activities, and other Agency planning and budgeting activities.

Table P6.1 *Data sources available for U.S. commercial fisheries by NMFS region. An 'x' indicates this type of data is available for at least 1 of the fisheries in the region.*

Data Source	NMFS Region					
	AK	NE	NW	PI	SE	SW
Observer Program	x	x	x	x	x	x
Logbook/Vessel Trip Report (VTR)	x	x	x	x	x	x
Production Reports	x					
Fish Tickets (landings receipts)	x		x			x
Vessel Monitoring System		x	x			
State Dealer Data				x	x	
Port Sampling			x		x	
Dock Surveys			x			x

Logbook/Vessel Trip Report: a type of detailed, often mandatory, self-reporting that includes information on types of gear used, date, time and position of fishing activity, weather, catch, and by-catch. May be an electronic form (VTR).
Production Reports: self-reporting by seafood processors that includes amount of product obtained from catch.
Fish Tickets: official forms completed by fishermen and or dealers (i.e., sea food buyers/processors) documenting landed weight by species.
Vessel Monitoring System (VMS): A VMS automatically collects, records and analyses information related to the location and activity of vessels.
Dealer Reports: a type of self-reporting where seafood dealers are required to report the amounts of fish bought and sold, by vessel and by species.
Port Sampling/Dock Surveys: federal or state government-employed or contracted biologists are trained to collect fishery information and biological samples from fishermen and/or dealers, at or near the time of landing.

Evaluating the performance of the at-sea observer program in BC: a preliminary investigation

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It is essential that at-sea observer monitoring programs and procedures be evaluated periodically to ensure their accuracy and reliability, especially with respect to contentious issues that could undermine the credibility of the data collected. The impetus of this project is not to discredit the at-sea observer program (ASOP), Fisheries & Oceans Canada or any individual(s) involved in the BC trawl fishery. Rather, the objective is to test the reliability of historical catch monitoring so that improvements can be made or correction factors can be developed if necessary.

The at-sea observer program for monitoring trawl fishing activity in BC has provided 100 % onboard observer coverage since 1996. At-sea observers monitor all aspects of fishing activity, including weights by species of retained and released fish (Fig. P6.7). Released fish are divided into two categories based on an assessment by the observer; released fish are either marketable or unmarketable. The proportion that is marketable is of interest to the skipper because a percentage of marketable releases are classified as 'dead', as determined by the duration of the tow. The weight of 'marketable dead released' catch is deducted from the vessel's quota and can therefore affect the profitability of the vessel.

At-sea observer catch monitoring data are critical to achieving both economic and conservation objectives in BC trawl fisheries. An important assumption underlying the use of at-sea observer data is that reports of at-sea releases represent an accurate account of fishing activity. However, unlike scientists aboard standard scientific monitoring surveys, observers are often faced with making day-to-day decisions that affect the profitability of individual vessels and crew. Thus, elements of human nature might affect the quality of data obtained.

In this paper we test the null hypothesis that observer reports of marketable releases in the BC trawl fishery are independent of economic variables (remaining quota and season), physical variables (tow duration and depth) and observer experience. Our null hypothesis implies that at-

sea release data are collected in such a way as to not have systematic dependencies on obvious factors such as skippers, vessels, observers or the amount of quota available to the vessel. If we cannot reject the null hypothesis of independence, it will improve the confidence we can place in ASOP data as well as the stock assessments and the individual vessel quota management system that depend on it.

Sablefish are a commercially important and high value catch in the BC trawl fishery. Most trawl vessels have sablefish quota and retain sablefish, but may selectively release sablefish if they believe they will exceed their quota. The proportion of marketable sablefish releases is considered as the response variable for this preliminary investigation. Fishing situations are formulated as scenarios that are formally tested using generalised linear modelling that accounts for natural patterns of random and non-random variation in the data on a tow-by-tow basis.

Although our results suggest that marketable releases may depend on some of the above factors: (i) most effects are negligible and can essentially be ignored on the larger fishery scale and (ii) some variables, in particular economic ones, have directions of effect that are opposite to what would be expected if pressures to under-report releases are present. For example, regression coefficients suggest that observers report more releases of marketable sablefish when the vessel's remaining sablefish quota is lower.

Depth also has an inverse relationship to the proportion of the marketable sablefish that is released dead, indicating that deeper tows may have fewer marketable releases, possibly due to the fact that larger, marketable sablefish are more common in deeper waters. The results also indicate that season may have an effect on the proportion of reported marketable releases. This may be due to interactions between quota and season or simply seasonal variations in fish distribution. Finally, our analysis suggests that tow duration and observer experience do not have an effect on the proportion of marketable released sablefish.

The presence of small coefficients may indicate that the factors are negligible in predicting the proportion marketable released. Furthermore, the low coefficient of determination ($R^2 < 4$ %) indicates that the model itself is unable to account for a substantial proportion of variation in the data. Future research will account for the nested structure of the tow-by-tow data as well as interactions among variables and between observers and skippers.

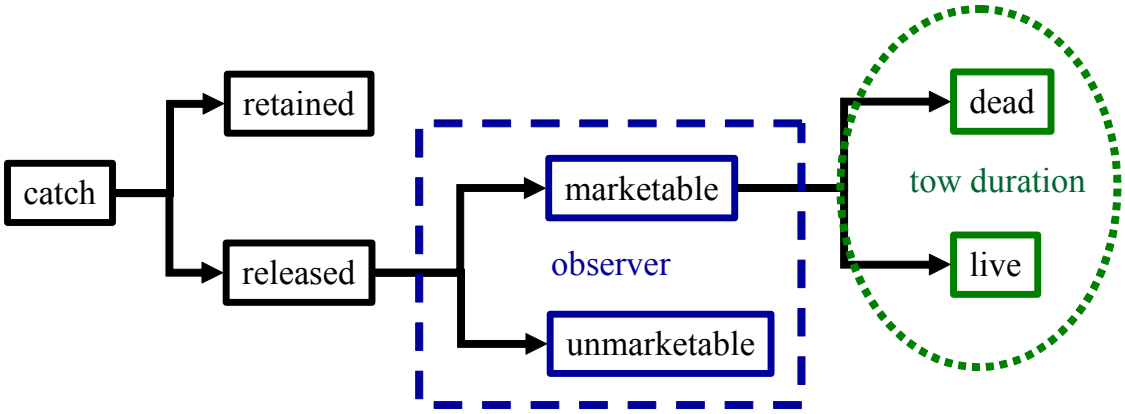

Figure P6.7: *Conceptual diagram of retained and released catch in the BC trawl.*

Bias associated with mandatory vs voluntary observer programs

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Stock assessments and expanded take estimates of protected resources rely on observer data as a source of accurate information. However, a range of factors may influence the data that could lead to biased conclusions. Bias may result from poor observer coverage of the entire sampling universe due to an observer program that is based on voluntary acceptance of observers. Bias is further enhanced if the design of the program is changed from voluntary to mandatory and time series of abundance are derived from these data. The shark bottom longline fishery is active in the U.S. Atlantic Ocean and Gulf of Mexico from North Carolina through Texas. Vessels in the fishery are typically fibreglass and average 50 feet in length. Longline characteristics vary regionally with gear normally consisting of about 8 – 24 km of longline and 500 – 1,500 hooks. Gear is set at sunset and allowed to soak overnight before hauling back in the morning. There are currently about 100 active vessels in this fishery out of about 250 vessels that possess directed shark fishing permits. These vessels make 4,000 to 9,000 sets per year. The shark bottom longline fishery targets large coastal sharks but small coastal sharks, pelagic sharks, and dogfish species are also caught. Depending on the time of year and length of the large coastal shark season, these vessels may also target reef fishes such as grouper, snapper, and tilefish. The University of Florida began placing scientific observers on shark bottom longline fishing vessels targeting sharks in 1994. This NMFS-sponsored observer program covered vessels targeting sharks primarily in the Gulf of Mexico and South Atlantic region but as a result of the program's voluntary nature, vessel owners/captains could refuse coverage. As of January 2002, observer coverage requirements for this fishery changed from voluntary participation to mandatory compliance under the current federal management plan for highly migratory species. Vessels with a current directed shark permit and that have reported shark landings in the past are selected at random. We investigated the effects of changes in the observer program design using generalised linear model analysis. Because observations of the fishery have been conducted using two different non-overlapping sampling strategies (i.e., voluntary and mandatory), catch rates were modelled independently for two time series representing periods of 1994 – 2001 (voluntary) and 2002 – 2005 (mandatory) and for the complete time period. Catch rates were standardised in a two-part generalised linear model analysis. One part modelled the proportion of sets that caught sharks (when at least one shark was caught) was modelled assuming a binomial distribution with a logit link function while the other modelled only positive catches assuming a lognormal distribution. We considered the factors year, area, time-of-day, season, depth, hook type and bait type. The final model determination was evaluated using the Akaike Information Criteria (AIC). Trends in abundance were modelled for two species of sharks, sandbar shark, which is targeted and Atlantic sharpnose shark, which is generally considered by-catch. Depending on species and time series, factors found to influence catch rates included year, area, bait type and hook type. Overall, little difference was observed in the trend of abundance for sandbar shark between sampling designs. However, trends in abundance for Atlantic sharpnose shark did vary between the voluntary and mandatory programs and the overall series when the trend was not analysed separately. Although the series were not different for sandbar shark, we could not rule out a potential vessel effect and how this could have influenced the lack of change in overall abundance trends. Future analysis should explore these effects as well as the effect changes in sampling design may have on expanded takes estimates for protected resources (e.g., sea turtles).

A Bayesian Estimator for Discard Weight in Commercial Marine Fisheries

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Estimators of discard weight are commonly based on survey sampling methodology, such as traditional ratio estimators. Little attention has been given to the development of alternative statistical approaches for estimating discard weights from observer data or careful assessment of the likely performance of estimators outside of the theoretical context of finite population estimation. MRAG conducted an analysis of the 'adequacy of commercial sea sampling data for by-catch' for the Northeast Fishery Science Center. One can only consider adequacy within the context of particular objectives and under agreement of specific criteria to define what is meant by adequate. We approached the question through the investigation of the statistical properties and behaviour of several plausible estimation strategies, within the context of an agreed upon definitions of what is meant by by-catch, and levels of spatial and temporal resolution at which such estimates are desired.

An alternative estimator is proposed, based on connecting observed and unobserved trips through information on whether a trip results in kept catch of a species of concern. Bayesian modelling of conditional probabilities of discard given kept catch or the absence of kept catch, and the conditional distribution of discard weights given discard allows the model to produce estimates of discard weights in an efficient manner. In terms of measures of overall error in the set of basic simulation studies conducted, the proposed estimator was never outperformed by any of the sampling based estimators, regardless of whether it was given excellent prior information, less than excellent prior information, or actually bad prior information. In the set of simulations conducted to assess interval estimation, in all of which high quality prior information was used, intervals associated with the proposed estimator were uniformly better in both coverage and average width than all of the sampling based estimators. These simulation studies certainly do not include all the types of situations in which one might consider comparing estimators, nor could any set of simulations of a reasonable size for one project. But, all indications point to the proposed estimator as a basic structure which can improve the estimation of discard weights over current practice.

Although the proposed estimator was never outperformed by sampling estimators, even with poor prior information, its quality was clearly dependent on the quality of prior information it was given. In some cases in which incorrect prior information was used the proposed estimator was not decidedly superior to sampling estimators, even if it was not worse. Importantly, however, several simulation studies indicate that the proposed estimator is able to 'self-correct' for poor prior information if given a moderate amount of data on which to base such adjustment. In terms of the sensitivity of the proposed estimator to prior information, it would appear that the estimator is least sensitive to specification of prior parameters for distributions of the conditional probabilities of discard given kept catch and given no kept catch, somewhat more sensitive to specification of prior parameters for discard weight categories, and most sensitive to the definition of discard weight categories.

While indications about the usefulness of the proposed estimator contained in this report are positive, there are a number of directions that need further investigation, both in terms of additional assessment and in terms of potential modifications or additional development. Some of these are listed here.

- It would be useful to learn something about the adaptive flexibility of the proposed estimator in situations involving temporal changes in discard values. This supposes that the estimator is used in a sequential fashion, which is facilitated by the conjugate forms used for prior distributions. While it has been demonstrated that the estimator responds well to moderate amounts of data in correction of prior parameter values, more needs to be learned about how fast the estimator can 'correct' itself in the face of both gradual and sharp changes in discard values.
- Similar to the additional investigation indicated in item 1 above, it would be useful to investigate a sequential use of the estimator over the course of one or more

'seasons,' an investigation which again is amenable to simulation of hypothetical populations.

- It would also be useful to gain a better understanding of the effects of specifying stronger versus weaker prior information in terms of the number of 'prior observations' that information is taken to be worth.
- The potential 'Achilles heel' of the proposed estimator seems to be the selection of discard weight categories. While a reasonable level of robustness and ability to adjust to less than excellent prior information appears to exist, this indication comes from a few simulation studies with reciprocal misspecification of discard weight priors for two species (cod and hake) that have roughly similar overall ranges of discard if not the same category boundaries within this range. The single greatest potential advancement over the current form of the proposed estimator would be to find a way to model discard weight distributions that does not require the use of discreet discard weights in the first place.
- Within the basic form of the proposed estimator, a number of possibilities exist for improving the modelling of the component quantities. Two of the more intriguing of these are incorporation of external information in the form of covariates, and modelling of dependence among several species rather than applying the estimator separately to each species. Covariates that influence the probabilities of discard could be incorporated through a logistic formulation of those probabilities.

Expanding the uses of data collected from Observer programmes: Cetacean Observations

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Fisheries Research Services – Scotland

The majority of countries within the European Union (EU) which fall under the auspices of the Common Fisheries Policy (CFP) have established fisheries observer programmes, some of which have built up considerable time series of data. Fisheries Research Services (FRS), an agency of the Scottish Executive is one of these, with its main observer programme running in its current format for some 32 years.

Generally speaking, the objectives of EU observer programmes were based around providing fisheries scientists and managers with spatial and temporal information on catch, effort and levels of discarding within the fisheries of interest.

It is generally acknowledged that there is a need for more information about what is actually going on within our marine environment as a whole.

In December 2002 a revised EU Common Fisheries Policy was agreed. This directed member states to actively progress to an ecosystem based approach towards fisheries management in association with the precautionary approach principle.

Some Observer programmes, including that of FRS, have already evolved from collecting specific biological information on target species to broader information on fisheries by-catch, by-product species, environmental, shark, bird and marine mammal interaction etcetera. As such, the role of observers has expanded from basic fishery data gathering to the collection of a complex variety of information relating to the ecosystem and the various interactions that occur between the fishery and the environment. These data provide added value to programmes.

The majority of Observer programmes are established and supported by reasonably large amounts of funding.

It is the responsibility of observer programme managers, coordinators and indeed the larger scientific community that have access to this quality data source, to make full use of all the data collected from the respective programmes.

There are many observer programmes where you can find vast quantities of data, covering multiple topics, that is just simply being stored or filed and where the multidisciplinary use of observer data is not being fully realised. Often these data can provide PhD or MSc students with novel and exciting projects on which to work. It was during discussions with Aberdeen University (Scotland, U.K.) on possible PhD student partnership work, that we at FRS recognised that we were in fact not fully

utilising all the data types being gathered from our pelagic fleet observer programme; in particular the growing number of cetacean observation information that had amassed and were simply being stored. As such, in collaboration with a PhD student, we began a study on this cetacean data collected.

Killer whale (*Orcinus orca*) encounters from commercial pelagic trawlers as well as other types of vessel have been documented in several regions of the north eastern Atlantic; however, very little published information is available regarding such encounters in Mackerel (*Scomber scombrus*) and Herring (*Clupea harengus*) fisheries in the waters covered by FRS's pelagic observer programme.

The Scottish pelagic fleet currently numbers 30 vessels comprised of mainly single and pair trawlers, although some vessels retain the capability of purse seine fishing. The average length is 60 – 70 metres with engine power in excess of 11,000 horse power.

Mackerel and Herring are the two main species targeted by the Scottish pelagic fleet, primarily during the months of October to March and June to September, respectively. It is during the Mackerel fishery in particular, where FRS's observers have documented frequent (> 80% voyages) Orca interaction. Orca distribution in NE Atlantic varies seasonally, correlated with change in the distribution and abundance of prey species, in particular the lipid-rich species such as Mackerel and Herring.

Interaction between Orca and fisheries are known from many parts of the world. Often the public's perception of these interactions is that they lead to detrimental situations for the Orca. FRS's data has demonstrated that this is not the case for this fishery, to date. No evidence of any negative effect on these whales and the fact that the Orca follow individual vessels for long periods suggests that during the mackerel season, Orca may obtain a significant proportion of their daily energy requirements from this source.

These Orca have developed a specialised foraging strategy. This type of strategy has only previously been recorded within coastal populations. The behaviour described from the observer data is largely of foraging, i.e., tail slapping, releasing blasts of bubbles etcetera. All behaviours associated with pursuing, handling and catching prey. Resource specialisation has led to genetic divergence and isolation and phenotypic divergence in Orca in other areas. Several genotypes have been identified in NE Atlantic waters and there is preliminary evidence of phenotypic variation.

Sightings during February 2006 were typical for a month during the mackerel fishery, with 513 Orca observed during 97 hours of fishing effort which secured 8,527 tonnes of mackerel.

Orca were always observed in groups, with group size ranging from 3 to 40 individuals (mean 17.4; st dev 12.5), excluding one event where 200 – 300 animals were observed around 10 vessels, with each trawler having 10 – 40 animals in attendance. Most groups included calves, juveniles and adults of both sexes.

In contrast, no Orca encounters were recorded during the 2006 Herring fishery, where most marine mammal sightings were of seals. It is also clear that there is a strong geographical overlap between the Herring and Mackerel fisheries. Dedicated cetacean surveys undertaken by other institutes have recorded Orca present in this area over the summer months.

The fact that the whales do not interact with the herring fishery and appear not to follow the mackerel migration westward in spring, indicates that this interaction is seasonal in nature. Although Orca do not have a fixed breeding season, in the north Atlantic mating occurs mainly in October and November. Given a gestation period of 17 months, this means that most births will occur in March and April. It is during April to October that Orca are most commonly observed close to shore. This may explain their lack of presence in the herring fishery.

In summary, we have documented a significant but as yet benign Orca interaction in the mackerel fishery. There is no evidence of such interaction in the herring fishery. Perhaps most importantly, we have highlighted a population that requires much more study.

Observer programmes provide us with a wonderful range and notable quality of data. It is our duty to ensure that we maximise its potential and fully utilise this invaluable resource.

Use of observer data in estimating and mitigating loggerhead sea turtle by-catch in U.S. Mid-Atlantic bottom otter trawl gear

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During 1994 – 2004, Northeast Fisheries Science Center fisheries observers documented interactions between loggerhead sea turtles (*Caretta caretta*) and bottom otter trawl commercial fishing gear operating in the U.S. Mid-Atlantic region. These interactions were analysed to delineate possible environmental factors and fishing practices influencing the by-catch of loggerheads, and to estimate the by-catch mortality of loggerheads in Mid-Atlantic bottom otter trawl gear (Murray, 2006). Results from this analysis are now being considered by various user groups in attempting to reduce and mitigate the by-catch of sea turtles in trawl gear.

Out of 18,665 observed hauls using bottom otter trawl gear from 1994 – 2004 (roughly 1% observer coverage), observers documented 66 loggerhead turtle interactions (Fig. P6.8). Forty-five (68%) interactions occurred between November and February, and 21 (32%) occurred between June and October. Most of the interactions (88%) were south of 39°N latitude. Only two (3%) of the interactions occurred in waters deeper than 31 m. Loggerhead turtles were captured on vessels targeting summer flounder (50%), croaker (27%), weakfish (11%), long-finned squid (8%), groundfish (3%) and short-finned squid (1%).

Under Amendment 2 to the Summer Flounder Fishery Management Plan, (implemented in 1992), all vessels using bottom trawls to fish for summer flounder in specific times and areas off Virginia and North Carolina are required to use NMFS-approved Turtle Excluder Devices (TEDs) in their nets (Final Rule, FR 57:57358, 4 December 1992). From 1994 – 1999, eight loggerhead turtles were captured on vessels equipped with TEDs, though most of these (87%) occurred when the TED was clogged with fish or debris.

Information collected by observers was used to calculate by-catch rates, which were then expanded using commercial fisheries Vessel Trip Report (VTR) data to estimate total turtle by-catch in the fishery. The by-catch rate of turtles was calculated as the number of observed turtles per days fished, where days fished is equal to the number of hours the trawl net fished/24. A poisson regression (GAM function, SPLUS 7.0) was used to model the expected number of turtles caught per day fished as a function of gear and environmental variables.

Significant factors affecting sea turtle by-catch were latitude zone, depth, sea surface temperature, and the use of a working TED. Predicted by-catch rates were stratified by the combination of these factors. The highest by-catch rate occurred between 34°N and 39°N, in waters shallower than 50m and warmer than 18°C, for vessels using either no TED or a non-working TED. In this stratum the predicted number of turtles per days fished was 0.4813. By-catch rates were much lower on hauls equipped with working TEDs. On average, the model predicted that in any given latitude zone, depth, and SST stratum, by-catch rates with a working TED were 11% of the by-catch rate without a working TED. The estimated average annual by-catch of turtles per year in Mid-Atlantic bottom otter trawl fisheries, averaged over 1996 – 2004[2], was 616 turtles (CV = 0.23, 95% CI = 367 – 890).

Results from the by-catch analysis have helped inform discussions between fishermen, fisheries scientists, and fisheries managers about by-catch mitigation strategies. For example, the Northeast Fisheries Science Center and the University of Rhode Island recently convened a workshop with the fishing industry to discuss strategies to reduce the by-catch of turtles in Mid-Atlantic trawl gear. The goal of the workshop was to solicit ideas and concepts from trawl fishing industry participants for By-catch Reduction Technologies (BRTs) or other measures that would reduce the capture of sea turtles in the trawl fisheries in the Mid-Atlantic region, while minimising impacts on the catches of target species. Discussions began by identifying fisheries operating in the stratum with the highest estimated turtle by-catch rate, that is those operating south of 39°N latitude, in waters less than 50m deep, and at water temperatures

[2] By-catch estimates were not reported for 1994 and 1995 due to the reduced quality of VTR data during these years.

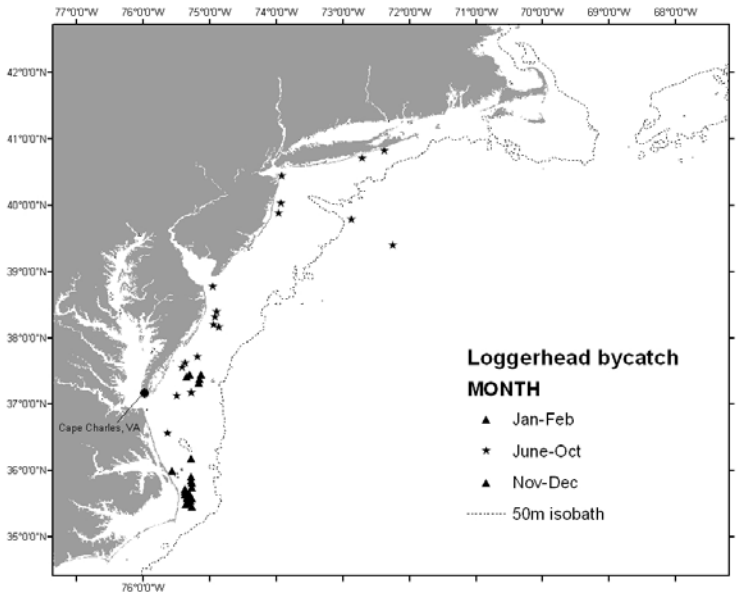

Figure P6.8: *Loggerhead Turtle By-catch in Mid-Atlantic Trawl Fisheries, 1994 – 2004.*

greater than 18°C. Some fisheries identified within this stratum were the summer flounder fishery, the sea scallop trawl fishery, and the croaker fishery. The workshop participants then identified potential research topics related to mitigation strategies for these fisheries.

Information collected by observers in Mid-Atlantic trawl fisheries also cast a background for deliberations on the boundary line for TED requirements. Currently, the requirement to use a TED for summer flounder trawlers is bounded on the north by a line extending off Cape Charles, Virginia (Fig. P6.8). Documented turtle interactions north of that line, and the likelihood of interactions in specific thermal and bathymetric regimes (Murray, 2006), instigated discussions over whether the current TED line should be shifted farther north (Advanced Notice of Proposed Rule Making, FR 72:7382, 15 February 2007). The information on turtles collected by observers in Mid-Atlantic trawl fisheries has helped frame a by-catch problem and inform strategies for conservation.

Azores Fisheries Observer Program (POPA): A case study of the multidisciplinary use of observer data

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The 'Dolphin safe' concept was created in the United States in the early 1990s to prevent trading of tuna caught by fishing methods that may harm dolphins. This concept was extended to tuna fisheries and industry around the world. The Azores Fisheries Observer Program (POPA) was created in 1998 in order to guarantee the 'dolphin safe' certification to the tuna fishery and its products. Since then, the University of the Azores through the Institute of Marine Research has managed the Program guaranteeing the certification achievement and the collection of scientific data. POPA activities are based on observers onboard fishing boats which are supported by a scientific and supervision council (including the government, industry, ship owners and the Earth Island Institute). POPA was recognised by regional decree as a tool for monitoring all types of fisheries occurring in the Azores.

Table P6.2: *Examples of scientific outputs based on POPA data.*

Data requested	Paper/Research	Author	Year	Main Results/Conclusions
Records of cetaceans association with tuna fishery	Interactions between cetaceans and the tuna fishery in the Azores. Marine Mammal Science, 18(4):893–901.	Silva, M.A., Feio, R., Prieto, R., Gonçalves, J.M. & Santos, R.S.	2002	- Dolphin by catch in less than 1% of the fishing events. - No mortality. - 'Dolphin safe' fishery.
Fishery coverage, tuna catches, school associations, environmental records, fishing events duration	Behaviour of big eye tuna in a bait boat fishery. Col. Vol. Sci. Pap. ICCAT, 57 (1), 126–128.	Pereira, J.G.	2005	Fishery characterisation and catches according to ecological and environmental factors.
Catch and fishery records, including location and depth of fishing grounds, obtained in longline demersal fishery experience	Modelling the distribution of two fish species in seamounts of the Azores. pp: 182–195 in R. Shotton (ed.). Deep Sea 2003 Conference, FAO Fisheries Proceedings 3/1, Rome.	Machete, M., Morato, T., Menezes, G.	2006	Estimates relative abundances for two important commercial fish species in Azorean Seamounts.
Records regarding sea birds sightings, association with tuna fishery and with other marine predators (eg: cetaceans)	Important bird areas: Data analysis of seabirds information from POPA and environmental data in the Azores Archipelago. IMAR/Dop, UAc. Scientific progress report, July 2006.	Amorim, P., Machete, M., Figueiredo, M., Martins, A. & Santos, R.S.	2006	Define spatial distribution and density of the main breeding seabirds in the Azores and relate them with environmental factors.
Cetaceans sightings and associations with tuna fishery	Bottlenose dolphin and Sperm whale distribution in Azorean waters: application of geographic information systems and ecological modelling in habitat characterisation – Master thesis	Seabra, M.I.	2007	Definition of preferential areas for bottlenose dolphins and sperm whales trough Geographic Information Systems
Catch and fishery records, including location and depth of fishing grounds and fish lengths	Black scabbard fish: alternative resource in the Azores – Master thesis	Machete, M.	2007	Confirms the potential of the species for exploration and discusses its abundance according to depth and geographical areas.
Cetaceans sightings and associations with tuna fishery	Habitat preferences on bottlenose dolphins in Azores – PhD Thesis	Silva, M.A.	2007	Definition of preferential areas for bottlenose dolphins regarding physical habitat characteristics.
Cetacean, seabirds and turtles sightings and tuna catches	Testing a seamount effect on aggregating visitors. Marine Ecology Progress Series (in revisions).	Morato, T., Varkey, D.A., Damaso, C., Machete, M., Santos, M., Prieto, R., Santos, R. S., & Pitcher, T.J.	2007	Demonstrates associations between some marine predators and shallow-water seamounts

Presently, POPA tuna database includes about 1,500 fishery reports corresponding to about 15,000 fishing events and approximately 2,000,000 data entries. The database includes data on the location of fishing events, number and duration of fishing events, fishing technology used, catches of live bait, catches of tuna (12,400 Tons in 1,378 covered landings), sightings and associations of cetaceans, turtles and sea birds, and environmental data (e.g., surface temperature). POPA has proved that accidental capture of cetaceans in the tuna fishery in the Azores is highly insignificant and no records of mortality of cetaceans were ever reported (Silva *et al*., 2002).

In 1999, POPA started monitoring other fisheries. Special attention was given to experimental fishing activities such as the black scabbard fish longline fishery and the deep-sea red crab and shrimp trap fisheries in order to ensure its sustainable development in the region.

In recent years POPA dataset has been frequently requested for several research projects regarding the ecology, biology and fisheries of target and associated species. The most relevant examples are listed in Table P6.2.

Besides the scientific outputs, the data collected by POPA observers are also available for NGO's, government and to the fishery industry.

The 'Friend of the Sea' (FoS) Organisation has requested such data to evaluate tuna fishery in Azores in order to decide about its certification as a sustainable and environmental friendly fishery. The certification was obtained by that fishery in 2001. The regional government of the Azores through its fisheries department demands the presence of observers when licensing for experimental fisheries is requested. POPA is then responsible for observer deployment and data collection which is then analysed by University researchers and subsequently discussed with government decision board. The tuna canning industry is now investing in eco-labelling promotion throughout consumer information products and packaging, and frequently asks POPA to support their initiative with scientific information. Certifications such as 'Dolphin safe' and 'Friend of the Sea' are of quite importance for this kind of industry. On the other hand, fishermen and boat owners regularly consult POPA to beneficiate from the data collected in previous commercial experiments. Besides that, POPA observers are asked to inform, explain and discuss biological and ecological subjects on the boats. Observers have also played a major role in promoting the link between researchers and fishermen. POPA is, presently, an effective monitoring and management tool which was proved to be of multidisciplinary importance.

In-season fisheries management: a study of northeast fisheries observers and the 2006 Atlantic sea scallop fishing season

Sara Wetmore* and E. Kupcha

NOAA Fisheries – USA

Abstract

Northeast fisheries observers have been observing the Atlantic sea scallop fishery in special access areas, at various coverage levels since 1999. The main objectives have been to report the by-catch of yellowtail flounder, a highly regulated species; and since 2002, to monitor incidental takes of endangered and threatened sea turtles. Monitoring of the fishery changed significantly during the 2006 fishing season, after industry funding of observer coverage was approved through implementation of a NMFS issued emergency interim rule in June, 2006. Observer data were analysed immediately by program staff, to ensure that the information was accurate. Yellowtail catch weights were reported daily to the NMFS Northeast Regional Office in order to closely monitor the Total Allowable Catch (TAC) of yellowtail flounder, an effort critical to the rebuilding of the stock under the NE Multi-species Fishery Management Plan. Over time, regulators have decreased the yellowtail TAC in the access areas, and for the 2006 fishing season the yellowtail TAC was set at 31,544 lbs in the access area within the Nantucket Lightship Closed Area and 447,230 lbs in the Closed Area II access area. With a lower TAC and approximately 10% observer coverage, the data became central to the Regional Office's efforts to conduct in-season fisheries management. As a result, in the 2006 fishing year, both access areas were closed based on extrapolated observer data, in combination with landings data, and data reported from scallop vessel captains.

Determination of cod discards from the Canadian groundfish fishery on eastern Georges Bank

S. Gavaris, Lutgarde (Lou) Van Eeckhaute[1]* and K. Clark

[1] *Department of Fisheries & Oceans – Canada*

Catch quotas are a principal feature of Canadian fisheries management. Achieving catches that match multiple quotas in mixed fisheries can be difficult. In 2006, the Canadian quota for cod on eastern Georges Bank was 1,326 mt while the quota for haddock was 14,520 mt. The 2006 Canadian groundfish fishery primarily targeted haddock and tried to avoid the capture of cod, however, the disparity in cod and haddock quotas created an environment where discarding of cod was a potential hazard.

Operations at sea are subject to a variable amount of observation averaging overall about 30% coverage of days fished in 2006 for the Canadian groundfish fishery on Georges Bank. Discarding of cod is not permitted in Canadian groundfish fisheries. Accordingly, discarding of

cod does not occur on observed trips. Comparison of species composition (ratio of cod to haddock) between unobserved landings and landings for trips where an observer was onboard was used to detect discarding and to determine the total catch of cod.

Under similar conditions, the ratio of cod to haddock in the catch, landings plus discards, should be the same whether fishing is observed or not. As discarding does not occur on observed fishing operations and assuming that haddock are not discarded on unobserved fishing operations, since those quotas are not considered limiting, a landings multiplier (*m*), defined as the ratio of the observed species composition to the unobserved species composition, is the factor needed to multiply the unobserved cod landings by in order to obtain their total catch of cod. Accordingly, $m = \frac{C_O}{H_O} \Big/ \frac{{}^{L}C_U}{H_U}$, where C_o is the observed catch of cod, H_o is the observed catch of haddock, ${}^{L}C_u$ is the unobserved landings of cod and H_u is the unobserved landings of haddock. For example, consider a situation where the cod to haddock ratio for observed fishing was 0.4 and the ratio for unobserved fishing was 0.2. This suggests cod may have been discarded on the unobserved fishing. The multiplier to apply to the cod landings from the unobserved fishing to obtain the actual catch (landings plus discards) would be 0.4/0.2 = 2. If the landings of cod for the unobserved fishing were 100 mt, the estimate of total catch of cod for the unobserved fishing would be 200 mt, implying discards of 100 mt.

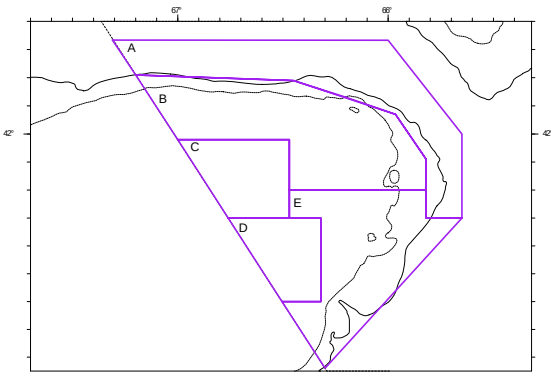

Figure P6.9: *Georges Bank was partitioned into five zones that were used for the analysis.*

Factors that are expected to affect the species composition include fishing fleet, fishing ground location and season. Quarters were used to stratify season. The definition of fishing fleets and zones aimed to identify strata within which fishing outcomes were relatively homogeneous. The Canadian quotas are sub-allocated to quota groups. Sub-allocation of shares to quota groups varies by species. Therefore, the quota mix varies substantially by quota group. The quota mix can be an important determining factor in discarding behaviour. Accordingly, fishing fleets were defined by quota groups (Table P6.3). Zones were defined for Georges Bank based on areas of fishing concentration and homogeneity of species composition (Fig. P6.9). While there appears to be considerable local scale variation in species composition, the zones could not be made too small given the observer sampling intensity. Estimates of the landings multiplier parameter *m* were derived by fishing fleet, zone and quarter in order to compute discards.

Table P6.3: *Designated fisheries participating in the Canadian groundfish fishery on Georges Bank and their initial haddock to cod quota ratios in 2006.*

Description	haddock:cod quota ratio
Longliners < 45’	4.3
Longliners 45’ and 65’	6.3
Bottom trawlers < 65’	19.2
Longliners 65’ to 100’	14.0
Bottom trawlers 65’ to 100’	14.0
> 100’ (bottom trawl only)	63.5
First nations (bottom trawl only)	20.0

Data from the DFO fisheries statistics database for 2006 were used. Trips were classified as observed or unobserved. To reduce the high variability associated with small catches, catches from all fishing events from a trip were aggregated within each zone and referred to as a subtrip.

Use of a separator panel when fishing a bottom otter trawl on Georges Bank was mandatory in 2006 unless an observer was onboard. Observed sub-trips where the separator panel was removed were excluded from the analyses as these were not representative of unobserved fishing. Also, trips where the observer deployment was for management purposes rather than routine monitoring were excluded as these might not be representative either. Sub-trips that targeted species other than haddock were excluded from

the analysis. Virtually all of the cod were caught in two zones, A and B. Accordingly, discards were only derived for Zones A and B and for the designated fleets targeting haddock, i.e., excluding pollock and yellowtail flounder targeted fishing by mobile gear and cod targeted fishing by gillnet and handline.

The data for each fleet, zone and quarter grouping were analysed separately to derive an estimator of the landings multiplier. The ratios of cod to haddock typically have a skewed distribution and their average would generally not possess desirable statistical properties, therefore the average of the ratios were not considered further. Two estimators for *m* were evaluated, the re-transformed average of the natural logarithm of the ratios and the ratio of the sum of cod to the sum of haddock (the observed to unobserved ratio of the sum of cod divided by the sum of haddock from sub-trips for each fleet, zone, quarter grouping).

Sub-trips where the catch of cod or haddock was zero could not be included in the natural logarithm method and those where the cod plus haddock catches were small, < 1 mt, exhibited erratic ratios and were also excluded. The comparison of the two methods used only those sub-trips where the catches of cod and haddock were not zero and where the combined catch of cod and haddock exceeded 1 mt. While the two methods gave similar results, the ratio of sums method proved to be more robust to the presence of sub-trips with small catches and it does not require separate consideration of zero cod and haddock catches. These characteristics considerably enhance the ease of application. On balance therefore, the ratio of sums method is recommended for routine application and was used for subsequent analyses.

The ratio of sums method was applied to obtain the landings multipliers by fleet, zone and quarter. The uncertainty in the multiplier could be evaluated using the standard error. The sampling distribution of the landings multiplier is not symmetric however, and using the standard error to determine whether the multiplier was greater than 1 does not ensure a consistent confidence level. A confidence distribution can be used to make an inference statement about the landings multiplier, e.g., the probability that the landings multiplier estimate is less than 1. An exact analytical confidence distribution for the landings multiplier is not easily derived. The bootstrap method provides an automatic way of obtaining confidence distributions of estimators in general situations. Confidence distributions of the landings multiplier, obtained using the bootstrap method, were examined to determine if it could be inferred that discarding occurred.

Discards were calculated for cases where the reference landings multiplier of 1 intersected the confidence distribution at a probability of about 0.2 or less. There was no convincing indication of discarding by longliners. With few exceptions, discarding appeared to occur by all mobile gear fleets in both zones and all quarters. In total, discards of cod from the Canadian groundfish fisheries on Georges Bank in 2006 were 239mt.

Using observer data for standardisation of catch per unit effort analyses

Matthew T. Koopman*, Terence I. Walker and Anne S. Gason

Primary Industries Research, Victoria – Australia

Catches and catch rates of by-catch species are not adequately monitored by fisher logbooks in the South East Trawl Fishery and the Great Australian Bight Trawl Fishery in southern Australia; however, an at-sea observer program has sampled these fisheries since 1992 and 2000 respectively. The aim of this study is to estimate spatial and temporal trends in relative abundance of target, by-product and by-catch teleost species using available observer data from the Integrated Scientific Monitoring Program for 1994/05.

Extensive testing of various probability density functions (pdf), with and without the delta-X model formulation, against four different data selection criteria to reduce zero catch per unit effort (CPUE) observations in the data indicate that the log-gamma combined with the binomial pdf most often converge to provide results. Models applying normal and log-normal puffs often converge, but these were rejected to avoid the assumption of homogeneous variance in the data and prediction of negative values either for mean CPUE values or for part of the range of the 95% confidence limits. CPUE was

standardised for the effects year, month, longitude or latitude, depth, and vessel.

Success of the delta-X model formulation combining the log-gamma and binomial pdfs with minimal data exclusion for analysing observer data is not only highly statistically defensible, but simplifies analysis to a single procedure. The model formulation works for species of low abundance as well as species of high abundance, except data selected from a low number of tows causes the confidence limits to widen.

Inter-annual standardised CPUE trends for teleost species exhibited four distinct patterns: rise–peak–decline, continual-decline, continual-rise, and no-trend. The continual-decline pattern is a special case of the rise–peak–decline pattern, where peaking occurred during 1992 – 1994 or before commencement of the observer program. The rise–peak–decline pattern and continual-decline pattern occurred more frequently than the continual-rise pattern and no-trend pattern for three depth classes. The three depth classes are continental-shelf species (predominantly < 200 m depth), mid-slope and upper-slope species (predominantly 200 – 599 m depth), and deep-water species (predominantly ≥600 m depth).

In a complex multi-species fishery such as bottom trawl fishery, it is difficult to distinguish between changes in fish abundance and changes in targeting, which are affected by catch rates and market forces. Of the species predominantly inhabiting depths ≥ 600 m, five had the continuous-decline pattern and one had the no-trend pattern while fishing effort declined, suggesting an overall decline in abundance. The lack of the continual-rise pattern for any deep-water species suggests that declining trends are more likely to be caused by declining stock abundance than by retargeting. For mid-slope and upper-slope species, seventeen had the rise–peak–decline pattern or decline pattern, whereas nine had the continual-rise pattern or no-trend pattern. On balance, more species exhibiting decline patterns than rise patterns suggests an overall decline in stock abundance, particularly as there has been a gradual decline in the number of tows since about 2000. Similarly, for shelf species, thirteen had the rise–peak–decline pattern or continual-decline pattern, whereas seven had the continual-rise pattern or no-trend pattern, suggesting some overall decline in stock abundance.

Distributional maps displaying spatial variation in standardised CPUE for the SETF and GABTF during the period 2000 – 2005 can be provided for interpretation as spatial variation in relative abundance of teleost species.

The complex processes developed for management of observer data and the improved statistical approach to standardisation of CPUE data developed to produce these outputs provides a basis for future update or revision of the results for any species.

The results provide a basis for classing the abundance of species as ‘abundant’, ‘common’, ‘sparse’ or ‘rare’, providing an important input to ecological risk assessment. Similarly, the results provide a basis for classing trend in standardised CPUE as ‘increasing’, ‘decreasing’, ‘variable’, ‘stable’, or ‘indeterminate’, which is also an important input to ecological risk assessment.

Use of Shrimp Trawl By-catch Data in Gulf of Mexico Red Snapper Assessments

Jim Nance

National Marine Fisheries Service – USA

During the past 13 years over 17,000 observer days have seen secured by the shrimp trawl by-catch observer program in the Gulf of Mexico and along the east coast of the United States. Analysis revealed that on average about 27 kg of organisms per hour are taken during trawling operations in the Gulf of Mexico. Examination of the composition of the organisms revealed that about 68% of the catch by weight is composed of finfish (mostly groundfish), 16% by commercial shrimp species, 13% by non-commercial shrimp crustaceans, and 3% by non-crustacean invertebrates. Although groundfish species make up the majority of the by-catch taken in shrimp trawls, three species (king mackerel, *Scomberomorus cavalla*, Spanish mackerel, *S. maculates*, and red snapper, *Lutijanus campechanus*) have received a great deal of attention because of their commercial and recreational importance, and the potential

for significant impacts on their population abundance through shrimp trawling activities. Average catch of these three species is generally below 0.5 kg per hour. The temporal and spatial species specific catch per unit effort (CPUE) data collected by the shrimp trawl observer program provides critical input variable information utilised by most of the finfish stock assessments conducted by the Southeast Fisheries Science Center (SEFSC). Without these analytical by-catch data, the assessments would not be as robust and informative, and the species directed management recommendations would not be as refined. Information was presented to show the direct application of observer data in the recent Gulf of Mexico red snapper stock assessment.

Questions & Panel Discussion – Session P6 –

Alan Sinclair (Fisheries & Oceans Canada) to Lisa Desfosse

The emphasis of your presentation was on by-catch estimation – could you clarify if this includes the catch of all species regardless of whether they're directed by-catch, or are you focussing specifically on certain rare species?

Response:

Lisa Desfosse – It includes all species – we're using the term 'by-catch' as a broad term but we're not dealing specifically with whether it was a targeted or directed catch. It has been a very comprehensive report.

Kim Dietrich (University of Washington) to Scott Buchanan

Comment / Question:

What is your opinion of ranking observer's data based on its potential for different kinds of uses? For instance, with satellite tracking, the data that comes back is ranked and can be very accurate within a certain range of distances but there are different levels of how you might use the data. Do you think there is potential for this type of ranking of observer data?

Response:

Scott Buchanan – Yes, and the primary users of the data (DFO in Nanaimo and PBS) do interact with us on that level. For instance, to investigate certain incidental species, we can look at a subset of the data for specific observers whose data we have confidence in. For example, we've seen some very odd-ball data on incidental species which are entirely attributed to an observer who is misidentifying a species and we can pick-up on that over time.

Jim Nance to Elizabeth Voges – Could you also rank the quality of data in your program in Namibia?

Elizabeth Voges – The big problem in Namibia is that the observer agency is not responsible for capturing the data. We basically hand the data over to the scientists but there are considerable delays and a lack of feedback and that is preventing us from really improving and investigating the quality of our information. When we get back I will be considering a proposal to take over the capturing of the data.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment:

A topic for discussion at a future meeting could be on the techniques to quantify observer sets and a discussion of the statistical techniques to analyse quality observer data.

Response:

Jim Nance – We had a presentation from one of your staff several years ago at one of our national meetings on that issue where we could tell observer biases were occurring in some of the data collection.

Martin Hall – Yes, and that work has continued.

Steve Kennelly (NSW Department of Primary Industries) to Lisa Desfosse

Comment / Question:

Is there a timeline for when your report will be completed?

Response:

Lisa Desfosse – We started the project about a year ago and have projected a 2-year project so the report should be available some time in

2008. It is difficult to give an exact date but the intent is to have the internal report done by the end of this calendar year and then it will go through a fairly extensive internal review process before it is released. We have very good leadership support to keep this a high priority and to keep us on a track to meet this timeline.

Steve Kennelly – The reason I asked the question is that some time in the future (perhaps in a few years), there is going to be a need or desire to expand such a program throughout the world. The concept would be to give the whole planet an idea about by-catch rates in a more sophisticated way.

Lisa Desfosse – Yes, and the FAO report (by Hennessy) was really one of the impetuses for our agency to work on our own data.

Steve Kennelly – Yes – that report was a revision of the work done in by Alverston *et al.* in 1994.

Lisa Borges – We also tried to do a report on how much is discarded by the European Union fleets. I was Chair of that meeting and it was a particularly hard job because there are so many different programs, different data and different reporting systems. We also had problems with our database and had to do all the work in EXCEL spreadsheets. We estimated the percentage of discarding for some of the fleets but didn't come up with a value for discarding *per se*. I also chaired a workshop which we organised through ICES to look for some common methodologies for discard rates. We discussed a lot of ideas at the workshop (e.g., the issue of bias and how a lot of the newer countries around the Baltic have very little experience with observer programs) and these are described in the report from the meeting. We didn't do any analyses but have presented a key for data users to follow to estimate levels of discards. The reports from both of these meetings are available on-line.

Mike Tork (National Marine Fisheries Service) to Elizabeth Voges

Comment / Question:

You mentioned that there are no at-sea discards in your fisheries – does that mean you use 100% of the catch or do you have shore-side discards?

Response:

Elizabeth Voges – Not everything that is caught is used. Sometimes there are seals in the net and they're not allowed to discard the seals but they are allowed to discard them on-shore. We also have high levies on certain species to discourage them from catching certain species.

Donatella Del Piero (University of Trieste, Italy)

Comment:

Three years ago, at the end of the Fourth International Fisheries Congress in Vancouver, somebody said that fisheries science had lost credibility. Observer programs could be improved, but fisheries science could also be improved.

Response:

Jim Nance – Yes, it is not only about the quality of data at the collection point but it is also about the analysis of the data and the improvement of these things.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment / Question:

Economics can also affect discarding in some fisheries. For instance, sharks have traditionally been discarded in longline fisheries, but since the value of sharks has increased, they are no longer being discarded. Every statistical time series will suffer from a discard becoming a catch and so I think we should treat all species the same (i.e., not separate them into target species and discard species) but we should include the economics in the estimation process.

Response:

John Carlson – I think work is already progressing in that area. For instance, I think the University of Washington and the South-East Fisheries Science Centre are using a pseudo-economic model for the analysis of their time series data which takes into account shifts in target species.

Jonathan Cusick (National Marine Fisheries Service) to Rowan Haigh

Comment / Question:

I am quite impressed with your PBS system – how long did it take you to build it? Also, I understand that the data collectors are usually deployed by different companies (including Archipelago) and DFO receives the information from the collectors. Is there a feedback mechanism from DFO back to the companies and observers to alert them to anything unusual in the data (e.g., outliers) which could be used to improve the quality of the data?

Response:

Rowan Haigh – Archipelago do a lot of the data clearing and data manipulating themselves but we also get data every three months. There is a lot of quality control done on the data, for instance, if there is anything unusual in the data the staff from our data unit will provide feedback to Archipelago. With respect to the first part of your question, the development of the software didn't take very long but it saves us a lot of time. However, we need to be mindful of the limitations of the data (e.g., truncated age distributions which occur when fishers target a particular size class; CPUE is just fisheries CPUE and should not be used for abundance). We still need fishery-independent surveys for some data.

John Carlson – In some cases, observer data is the only data we have and fishery-independent data are not available and so the data from observer programs can be critical for stock assessments.

Wes Erikson (Commercial Fisher)

Comment:

There are so many ways to fool observers. For instance, when we had piece counts as opposed to shore-side dock weight, it was very easy for us to fudge the data. One way to overcome this problem is to have piece counts on the ocean and piece counts on the shore-side.

Vicki Cornish (The Ocean Conservancy) to Craig Davis

Comment / Question:

I was very happy to see the opportunistic use of observer data to look at marine mammal interactions. Given that the original program was not set up to look at marine mammal interactions, did you have concerns about the quality or completeness of the data and, if you did, did you go back to the observer program and make any changes to the data that were being collected to improve your analyses?

Response:

Craig Davis – Yes, we got all our observers trained and certified as marine mammal observers and we also sought advice from the SeaWatch Foundation and modified the documentation we were using to include data on cetaceans.

Bryan Belay (MRAG Americas) to Craig Davis

Comment / Question:

We've seen a similar use of data in south-east Alaska for sperm whale interactions in the IFQ fishery for sable fish. After determining that whales were foraging on the fishery, have you worked with industry to do any mitigation to keep the whales away from the boats?

Response:

Craig Davis – We've worked very closely with the Scottish Pelagic industry right from the outset and they have been very supportive and keen for us to do this work. This is probably because there is a push for traceability and sea fish awareness skills in the U.K. Because they require certification, by having our guys onboard, they tick a lot of boxes for these programs. With respect to the second part of your question about mitigation, it is not actually a problem because the orca are feeding on discarded and slipped fish (i.e., fish escaping from the net during pumping operations, etc.) and our data have shown no evidence of any negative effect on the whales, in fact, there are a lot of positives for the orcas in these situations.

Bryan Belay – We have the opposite effect in our fishery – the whales are decimating the catch and so it is becoming a stock concern and we can't determine how much the whales are actually eating.

Amy Van Atten (National Marine Fisheries Service) to Lou van Eeckhaute

Comment / Question:

Your presentation gave the Canadian perspective on a similar presentation I gave yesterday for the United States and I wanted to clarify a couple of things. Firstly, did you say that a vessel does not have to use a haddock separator trawl if an observer is onboard? Secondly, if there is an observer onboard, do you use the observer discard rate for that vessel for that trip rather than the average discard ratio that was estimated for the fleet (i.e., they could potentially get a more accurate discard ratio if an observer was onboard)?

Response:

Lou van Eeckhaute – Yes, if there is an observer onboard they cannot use a separator panel but if there is no observer then they must use the cod separator panel. To answer your second question, discards were not allowed for the observed trips so the amount of cod on the observed trips would usually be higher and reflected in the landing ratios because they would have to keep their whole catch. The unobserved trips could show a lower ratio of cod to haddock and so we actually only used the data from the landings and the observed data would only be used to mark which trips were observed and which were not observed. We wanted the data to be homogenous and not a mix of observed data and data from landings.

Amy Van Atten – I saw those two issues as a benefit for observer programs and a selling point for fishers to take observers on their vessels. That is, it is an advantage to have an observer because you don't have to use the separator panel.

Lou van Eeckhaute – Actually, I think there were very few trips where people did not use the panel because they were all trying to catch their haddock quota. The cod quota was very low and the haddock quota was actually higher than it should have been (which we found out after the fact).

Ernesto Altamirano (Inter-American Tropical Tuna Commission) to Miguel Machete

Comment / Question:

I think the certification of products is part of the evolution of observer programs. Was the main aim at the start of your observer program the certification of dolphin-safe trips on these vessels? I noticed in your poster that you hooked about 40 dolphins in the first couple of years and then there was almost nothing in the next 7 – 8 years. Do you see any effect from observers which showed that the fishers previously didn't care if they were hooking dolphins or not hooking them, but now they have an observer onboard they do care and try to avoid them? Secondly, do you have any information on dolphin mortality in this fishery before observers were put onboard?

Response:

Miguel Machete – It is not really a by-catch problem. Dolphins were killed in the Azores on purpose by spearing and harpooning (i.e., outside of the fishery). Sometimes dolphins were caught in the fishery but I think that you're referring to the first two years when we had more numbers, but we also had more boats then. It also relates to the type of fish that are being caught, for instance, there are fewer dolphins hooked when there are low catches of big-eye. But, of course, there will be fewer dolphins killed if there is an observer onboard. Regarding your second question, we did not have any data on dolphin mortalities before the program started but had some estimates.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment / Question:

We're doing a couple of things to avoid by-catch and one of those is to define the habitats that are more likely to have the species that you don't want to catch. Species distributions are complex and can be related to the dynamics of the ocean but we tend to lack this information. I would be interested in hearing the panel's ideas on how we can evolve in those two directions

(biology and oceanography) to avoid or reduce by-catch.

Response:

Jim Nance – In our snapper fishery we can see where the juveniles are occurring and we can try to avoid those areas but, as we move into other areas, there may be more turtle interactions and so our actions may have consequences on other species. We need to look at all by-catch species and I think as we move towards modelling and the ecosystem-based management approach we will find some of the answers.

Kimberly Murray – We have been trying to find a consistent set of habitat predictors that characterise the yearly distribution of turtles but we haven't been able to find them. Sea surface temperature has been the closest we've come to and that is one of the reasons participants in the trawl workshop talked about a dynamic management area system based on water temperature. They are currently doing that with right whales but it is difficult to get a real time management system in place.

SESSION P7

What can be shared between fishery monitoring programs throughout the world?

Moderator:	
Mark Showell	*Department of Fisheries & Oceans – Canada*
Speakers:	
Sara Monteiro	*European Commission – Belgium*
Victoria Cornish	*The Ocean Conservancy – USA*
John LaFargue	*NOAA Fisheries, Northwest Fisheries Science Center – USA*
Dawn Golden	*National Marine Fisheries Service – USA*
Ernesto Altamirano	*Inter-American Tropical Tuna Commission – USA*
Kimberly Blankenbeker	*National Marine Fisheries Service – USA*
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Responsibilities of fisheries observer's onboard EU fishing vessels

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European Commission, Directorate-Generale for Fisheries & Maritime Affairs, Control and Enforcement, Fisheries Inspections – Belgium

European Union (EU) flagged vessels fishing in certain areas are obliged to take an observer onboard. The responsibilities of observers differ depending on certain conditions such as: the goals of the observer programme, the geographical area, the type of fisheries and the economic and environmental aspects of the area. The goal of this study is to compile a list of obligations, based on the existing legislation that a fisheries observer should adhere to while working on an EU vessel.

The information compiled was obtained by consulting current legislation related to observer programmes. In RFOs, the Northwest Atlantic Fisheries Organisation Regulatory Area (NAFO RA) legislation; the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) legislation; the observer programme for the Inter-American Tropical Tuna Convention (IATTC); and bilateral fisheries agreements between the EU and third countries establish the general framework for the access of Community fleets to the waters of these countries. A protocol attached to each lays down the specific conditions (technical, financial, type of resources, etc.) for implementation of the agreement. For the observer programmes for vessels fishing in areas with bilateral agreements in ACP countries, the legislation consulted was from the following countries: Angola, Cape Verde, Comoros, Ivory Coast, Gabon, Guinea, Guinea-Bissau, Kiribati, Madagascar, Mauritania, Mauritius, São Tomé e Príncipe, Senegal and the Seychelles.

Legislation for vessels fishing for deep sea species in the ICES and CECAF areas was also consulted. All information related to the observers' functions, tasks, duties and obligations were gathered and analysed. Twenty different tasks are identified in the consulted legislation.

Although all areas have particular aspects and specific needs in the context of observer's programmes, there are several aspects that are common to all. Not all the EU vessel observer's programmes require that the same information is obtained by the observer while onboard, and in most cases the information is generalised and not specific for the type of fisheries present in

the area. Observer programmes are not standardised within the same area.

For all EU fishing vessels the ideal would be to have a minimum standardised programme that would allow a guarantee of standard collected data for control and assessment of the different areas.

From the data analyses it was possible to form two groups of tasks based on the responsibilities laid down by the legislation analysed. As mentioned previously, responsibilities of fisheries observers differ according to the goals of the programme, either scientific or control purposes. From all the above described twenty tasks, twelve, i.e., 60%, are applicable to scientific and control observer programmes, while eight (40%) apply only to control programmes.

The tasks applicable to both programmes, scientific and control, are: observe and record fishing activities, perform biological sampling, check fishing gear, record incidental mortality/capture, check percentage of by-catch, check discards, check undersize fish, draw activity report, sighting of other vessels, report on vessel disposal and unspecified tasks.

The tasks applicable to areas where the observer works as a complement tool for quota uptake control are: the verification of the vessel position, verify entries in the logbook, check conversion factors applicable onboard, do radio reports, report infringements, monitor the vessel monitoring system, and confidentiality of documents.

A standard list of obligations/responsibilities for fisheries observer could be drawn considering the above paragraph. This standard programme should afterwards be enlarged and adapted area by area according to the local fishing habits and characteristics.

Disclaimer: the interpretation, analyses and views are those of the authors and do not purport to represent the position of the European Commission.

Best practices for the collection of longline data to facilitate research and analysis to reduce by-catch of protected species

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Workshops focusing specifically on the reduction of sea turtle, marine mammal, and seabird incidental catch (i.e., by-catch) in longline fisheries have recommended the need for standardised data collection procedures employed by fisheries observers onboard commercial longline fishing vessels. However, these reports lack sufficient detail regarding what these standardised data collections should be.

To facilitate research and analysis of factors influencing by-catch of marine mammals, sea turtles, and seabirds in longline fisheries, a workshop was organised to develop 'best practices' in observer data collections. The workshop was held in conjunction with the International Fisheries Observer Conference, November 8 – 11, 2004, in Sydney, Australia.

The objectives of the workshop were to:

- Share information on current data collection practices and methodologies (i.e., why are certain variables collected, which variables are collected, and how are they collected by observer programs worldwide).
- Solicit information from data users on variables that are critical, preferred, optimal, or not important to facilitate research and analysis to reduce by-catch of protected species.
- Identify data not being gathered systematically that might facilitate research and analysis to reduce by-catch of protected species.
- Coordinate with observer program staff to understand data collection limitations.
- Recommend best practices for observer data collection in longline fisheries that would facilitate research and analysis to reduce by-catch of protected species, in the form of a

prioritised list of variables and consistent procedures.
- Establish a network to continue to develop, refine, and implement best practices.

Prior to the workshop, two web-based surveys were developed and distributed to observer program managers and data users worldwide. The objectives of the survey were to ensure broad input from researchers and observer program staff who may not be able to attend the workshop, and to provide a base of information from which to focus discussions during the workshop. At the workshop, participants discussed the results of the surveys and need to develop best practices for observer data collections.

Critical and **preferred** variables were identified, based on the responses provided by data users in the pre-workshop survey and discussions by workshop participants. The list of variables represents 'best practices' that should be included in the collection of longline data by fisheries observers (Table P7.1). The workshop participants generally agreed with the list of variables identified as **critical** or **preferred** by data users in the pre-workshop survey, but in some cases other variables were added to the list based on further discussions at the workshop.

Optimal data specific to by-catch species was identified by data users in the pre-workshop survey and workshop participants. They recommended the following variables and material be collected when possible:
- Collection of whole carcasses (seabirds) or parts/biopsies (sea turtles and marine mammals)
- Photographs and species identification forms
- Age (as derived from collection of teeth or other samples)
- Sex (observed, or blood sample/biopsy dart if cannot be observed).
- Size of animal (type of measurements vary by species, and may be limited to an estimate of total length if animal is not boarded).
- Time and location of capture of by-catch species within the set (although there may be constraints on the precision of these variables).
- Systematic sightings of protected species around gear during gear deployment/retrieval.
- Tags (presence/absence, attached prior to release)
- Evidence of depredation on catch (by marine mammals or other species), including species of fish damaged, description of type of damage, photographs of damaged fish, and number of fish damaged.

When incorporating these best practices into observer data collections, workshop participants recommended that each program should:
- Establish a process for periodically reviewing and prioritising data needs, in coordination with data users. Priorities may be set according to fishery-specific data needs, but should incorporate broader priorities where possible.
- Clearly communicate data collection priorities to all stakeholders.
- Establish and disseminate metadata for observer databases that describe each variable collected, how it is collected and when data collection methodologies change, why it is collected (long-term operational vs. short-term research project), and the level of precision of measurements.
- Identify which variables are or can be derived from other variables; consider eliminating collection of variables that can be derived from other variables.
- Ensure the use of standard and objective definitions and data collection methodologies.
- Clarify when data are 'reported' (by the vessel) as opposed to 'measured independently' (by the observer). Strive to meet data collection needs while keeping observer health and safety a priority.
- Keep informed regarding current by-catch reduction research and emerging data needs to support research.

In conclusion, workshop participants recognised that decisions regarding the incorporation of these best practices would necessarily be made at the program level, but that these decisions should be informed by consideration of data needs to facilitate by-catch assessments and research on protected species by-catch on a global scale.

Table P7.1: *Best Practices – recommended minimum variables to be collected in all longline fisheries.*

Gear Type Fished	Category	Variables
All	Temporal	Date gear was deployed Start time of gear deployment End time of gear deployment Date gear was retrieved Start time of gear retrieval End time of gear retrieval
Pelagic	Spatial	Latitude at beginning of gear deployment Longitude at beginning of gear deployment Latitude at end of gear deployment Longitude at end of gear deployment Latitude at beginning of gear retrieval Longitude at beginning of gear retrieval Latitude at end of gear retrieval Longitude at end of gear retrieval
Demersal[a]		Latitude at beginning of either gear deployment or retrieval Longitude at beginning of either gear deployment or retrieval Latitude at end of either gear deployment or retrieval Longitude at end of either gear deployment or retrieval
Pelagic	Physical and Environmental	Sea surface temperature Depth fished at beginning of gear deployment[b] Depth fished at end of gear deployment[b] Depth of bottom at beginning of gear deployment Depth of bottom at end of gear deployment
Demersal		Sea surface temperature Depth fished at beginning of gear deployment[b,c] Depth fished at end of gear deployment[b,c] Depth of bottom at beginning of gear deployment Depth of bottom at end of gear deployment
All	Vessel and Fishing	Unique vessel identifier Unique observer identifier Vessel length Total number of hooks deployed Direction of haulback Target species[d] Bait species Bait condition (live/fresh/frozen/thawed, whole/cut) Autobaiter used? (if used, also record bait efficiency) Weight of added weight (if used) Direction of gear retrieval
All	Gear[e]	Groundline/mainline length[f] Branchline/gangion length Distance between branchlines Hook size[g] Hook type
All	Catch	Total catch, actual or estimated (number and/or weight) Catch by species (number and/or weight) Observed effort (total number of hooks observed during retrieval)
All	Mitigation Measure/ Deterrent Device	Presence of any type of deterrent used or required to be used, and how it was used
All	By-catch	Species identification Number of each species captured Type of interaction (hooking/entanglement) Disposition (dead/alive) Description of condition/viability of the animal upon release (if released alive)

[a] *Demersal gear fished on the bottom is stationary, thus collecting data on either where gear is deployed or retrieved is sufficient.*
[b] *In some observer programs, fishing depth is derived from the sum of the floatline/dropline length and the branchline/gangion length.*
[c] *For demersal gear, depth fished should also be collected it if is different than bottom depth.*
[d] *Target species may be derived in some programs from the catch composition.*
[e] *Although ≥50% data users responding to the pre-workshop survey identified these 5 gear variables as critical or preferred, workshop attendees were reluctant to identify specific gear variables for inclusion as best practices, instead noting these will vary by fishery depending on by-catch species and regulatory measures in place. Emphasis was instead placed on standardised definitions of terms and data collection methods.*
[f] *Groundline/mainline length is rarely an exact measurement, due to the length of the line. Instead it is derived (either by multiplying distance between floats by number of floats), estimated by the observer, or reported by the vessel.*
[g] *Hook size is often reported by the vessel or provided by the manufacturer rather than measured by the observer.*

Co-training between the AFSC and the NWFSC: A Successful Partnership

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In March 2001, the National Observer Program organised a network of U.S. observer programs to compare observer training course materials and develop minimum standards for observer safety training. This process started an emphasis on cooperation between observer programs to insure the observers receive the highest quality safety training possible. As part of the process, the Alaska Marine Safety Education Association (AMSEA) marine safety curriculum was adopted as the guide for training at sea survival. This effort resulted in a broad sharing of current lesson plans along with a focus on the use of effective training techniques such as co-training and hands-on practice.

Training techniques such as co-training and the use of hands-on lessons are encouraged in the AMSEA marine safety curriculum. Co-training is a widely accepted across many disciplines as an effective training method that has benefits for everyone involved. Co-training provides the students with a dynamic learning experience as different trainers bring various skills and techniques to the classroom. This diverse learning environment better addresses the various learning styles of individual students and allows for a more hands-on approach. Hands-on lessons are especially effective for safety training because participants develop muscle memory which allows a person to respond appropriately, especially in situations requiring a physical response.

Safety related topics lend themselves well to both hands-on exercises and a co-training approach. Donning an immersion suit, boarding a life raft, testing EPIRBs, and hooking up a hydrostatic release are all examples of skills practiced in hands-on lessons. These intensive lessons are taught most effectively as small group activities. Splitting the class into small groups requires multiple qualified instructors, especially when dealing with the larger training classes that many programs are currently conducting. Co-training also allows trainers to develop and try new ideas with the help of other knowledgeable individuals. Finally, co-training brings together motivated individuals that often results in the development of new creative teaching ideas.

Two regions, the Northwest and Alaska regions, have adopted a method of cooperation throughout their respective trainings. The Northwest Fisheries Science Center (NWFSC) supports two observer programs: the West Coast Groundfish Observer Program (WCGOP) and the At-Sea Hake Observer Program (ASHOP), while the Alaska Fisheries Science Center (AFSC) supports the North Pacific Groundfish Observer Program (NPGOP). The WCGOP and ASHOP provide lessons in safety to ~80 observers every year while the AFSC provides aspects of safety training to ~400 observers each year. Although the two regions are distinctly different management programs, there are many similarities with regard to the life at sea the fisheries observers can expect. Both regions cover similar gear types, fisheries and some of the same vessels participate in fisheries in both regions. Additionally, the geographic location of the two regions and their offices are in close proximity to one another. These similarities make cooperation between the two regions very easy.

The NPGOP is a well established program and has deployed observers on U.S. groundfish vessels since 1988. The WCGOP, founded in 2001, benefited from the experience of the NPGOP in developing their training curriculum. In the early stages of the program, the WCGOP relied heavily on existing materials provided by the NPGOP and several other programs. Over time, the trainers with the WCGOP have continued to advance the materials to better suit their needs. In return, through the collaboration between the programs, the NPGOP has increased the effectiveness of their tried and tested lessons. Trainers from both programs noted a lack of knowledge retention in experienced observers and moved towards a primarily hands on curriculum. For example, one of the biggest challenges facing the NPGOP is limited time during the trainings. The WCGOP also ran into this problem and developed a successful strategy to combine topics with the goal of streamlining the material being presented and increasing hands on lessons.

The WCGOP instituted a lesson called a 'gear go-around' that took a historically dry lecture, reviewing the various safety equipment that an observer would be expected to use, into a hands-on fun activity. This approach was adopted by trainers at the NPGOP to include the 'gear go-around' with the water exercise. This allowed the NPGOP time to conduct a safe and effective water exercise with half the class while the other half received hands-on instruction on the use of the various safety equipment. This method saves time in an already hectic training schedule and relates topics in an effective way. It also changed a primarily lecture and video based module into a hands-on module with a low student to instructor ratio.

Additionally, the WCGOP had the opportunity to review the benefits of an open water drill opposed to a standard pool practice. The NPGOP has used a protected lake access for conducting an in the water practice of survival techniques. It was evident through the comments from participants that the cold water was a much more realistic and valuable experience for the observers. As a result the WCGOP reviewed their training facilities and began conducting water drills in a similar open water environment in Yaquina Bay.

The benefits to the observers as a result of coordinated training are many. To begin with, when multiple programs emphasise the importance of safety at sea, an enhanced 'safety culture' is created and continually reinforced. Additionally, a training that uses many people with diverse backgrounds is more likely to address the various learning styles of individual observers. As topics become more consistent among programs, observers that participate have additional opportunities to practice with equipment through the hands-on lessons and ultimately will be better equipped to apply the lessons should an emergency occur.

Finally, co-training has personal benefits to the training staff. Materials can be tested and reviewed by multiple people, ensuring that quality lessons are being used. Additionally, motivated people working with other like minded people, encourages a level of performance that may not be achieved alone. Such teamwork allows for brainstorming innovative ideas and builds a strong support network.

Overall the sharing of materials and staff between the AFSC and NWFSC has resulted in improvements in training quality for both groups. The programs benefit through quality lessons and trainings. Trainers benefit by sharing ideas and materials. Observers receive the highest benefits as the materials and lessons are constantly refined making the safety trainings more effective, better preparing them for emergencies at sea.

This co-training between our two programs has sparked a surge in co-training between U.S. programs. We should continue to encourage this and move towards an international network to share trainers, ideas and materials.

International sharing of materials and staff in the Pacific community

Dawn Golden

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Abstract

The Pacific Islands Regional Observer Program (PIROP) provides technical support to the Secretariat of the Pacific Community/Forum Fisheries Agency (SPC/FFA) by providing program staff to help with observer training in fish species identification, protected species identification and handling, and debriefing protocols. This support has been provided to observer programs in the Republic of the Marshall Islands, Papua New Guinea, Federated States of Micronesia, Independent Samoa, and the Republic of Palau. SPC/FFA trainers have participated in PIROP trainings in Hawaii as well. While the PIROP has a well established track record in debriefing and training observers, the PIROP has benefited from this relationship in that staff have had the opportunity to augment their abilities as trainers and debriefers. This relationship has led to the development of new training materials and reference guides that are in use by both fisherman and observers throughout the Pacific. Further cooperation has resulted in the American Samoa Observer Program debriefing SPC/FFA observers when they debark in Pago Pago, American Samoa. This provides SPC/FFA immediate information about a trip as well as

having an observer debriefed in a timely manner rather than months later. A couple of the many benefits that this cooperation has resulted in is that data quality has increased in both programs and we are a step closer to standardising the collection of data in the Pacific community.

Thirty years of the IATTC observer program: adapting to change in a dynamic fishery

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The tuna-dolphin issue, the earlier years

The purse-seine fishery for tunas in the eastern Pacific Ocean (EPO) dates back to the early 20th century. During the late 1950s and early 1960s most of the larger pole-and-line vessels were converted to purse-seine vessels, and by the mid-1960s newly-constructed purse-seine vessels began to enter the fishery. The unique and, to this date, unexplained bond between certain species of dolphins and yellowfin tuna in EPO was exploited by fishermen, who surrounded herds of dolphins with their nets in order to catch the tunas that accompanied them. Although they attempted to release the dolphins unharmed, they were not completely successful in accomplishing this, and the dolphin mortality is believed to have been several hundred thousand animals per year. During the 1960s and 1970s, most of the vessels were registered in the United States, and the U.S. National Marine Fisheries Service, in cooperation with the Porpoise Rescue Foundation, an organisation sponsored by the U.S. fishing industry, worked on developing equipment that would help reduce the mortalities of dolphins and training fishermen in the use of this equipment. During the period of the mid-1970s to the mid-1980s the estimated mortalities dropped to around 25,000 dolphins annually. US-flag vessels were being replaced by vessels registered in other countries at that time, so the IATTC assumed the principal responsibility of reducing dolphin mortality in the increasingly international fishery.

The first complete year of operation of the IATTC's Tuna-Dolphin program was 1979, but it was not until 1986 that the IATTC placed observers on more non-U.S. vessels than U.S. vessels. During that year observers were placed on close to 30% of the purse-seine vessels with fish-carrying capacities greater than 363 metric tons (t) ('large' purse seiners). Smaller Purse seiners rarely fish for tunas associated with dolphins. The dolphin mortality during that year is estimated to have been slightly more than 120,000 animals.

The IATTC tuna-dolphin program prior to 1992

The objective of the IATTC tuna-dolphin program is to minimise or eliminate mortalities of dolphins due to the fishery for tunas, while at the same time minimising the adverse effects on that fishery. In connection with this policy, the Commission authorised a program for dolphin research that focused on (i) recruitment and training of observers to collect data at sea on all aspects of the fishery for tunas associated with dolphins in the EPO; and (ii) workshops to evaluate and disseminate dolphin-saving techniques and gear technology.

The data collected by observers were used to estimate the abundance of dolphins and to determine the major causes of mortality. The IATTC staff relayed information on equipment and methods for minimising the mortalities of dolphins to fishermen, with the aim that they would recognise situations that would cause high levels of mortality and avoid making sets in such situations, or implement strategies to extricate themselves from such situations in cases when they could not avoid them. These non-mandatory efforts resulted in a reduction of mortality of dolphins to about 27,000 animals in 1991.

The La Jolla Agreement and the AIDCP

In 1992, most of the nations participating in the fishery signed a voluntary agreement, the *Agreement for the Conservation of Dolphins* (the '*1992 La Jolla Agreement*'). The Agreement included a schedule of limits on mortalities caused by the fishery – 19,500 in 1993; 15,500 in 1994; 12,000 in 1995; 9,000 in 1996; 7,500 in 1997; 6,500 in 1998; and less than 5,000 in 1999. It implemented a series of procedural and operational requirements for vessels, and increased the level of sampling of trips of large purse seiners to 100%. The

Agreement established the International Dolphin Conservation Program (IDCP) which was later to become a legally-binding agreement, the Agreement on the International Dolphin Conservation Program (AIDCP). The data collected by the observers, which were originally used only for scientific purposes, became a mechanism of control used by the signatory nations. The mortalities decreased from more than 15,000 animals in 1992 to less than 2,000 animals in all but one year of the 1998 – 2005 period and to less than 1,000 animals in 2006.

Not all nations signatory of the AIDCP are members of the IATTC and not all members of the IATTC have signed the AIDCP, and the AIDCP signatory parties requested that the IATTC staff serve as the Secretariat of the IDCP. The AIDCP specifies that up to 50% of the coverage of any national fleet can be performed by a national program of that party. Currently there are seven national observer programs (Colombia, Ecuador, Mexico, Nicaragua, Panama, the European Union, and Venezuela) that work with the IATTC observer program to monitor the activities of large purse seiners in the EPO.

The enforcement of the AIDCP rules is done through national regulations, and to do this the IATTC or the national programs provide the national authorities of those nations with reports of non-compliance with the AIDCP based on the observer data through the International Review Panel, a body of the IDCP. The data gathered by the observer then become the enforcement agent for the Agreement.

Although it has proven to be successful, the AIDCP occasionally encounters the problem of the legal definition of the role of the observer or the data that he or she has collected. In most nations, to prosecute a case, it is necessary that an officer or inspector point to anomalies in the fishing operations in order to have a case. However, since observers are not considered to be appointed officials, this is a difficult task for enforcement agencies. Most governments have been able to control their vessels and vessel captains with the current system, but the fact that the member nations and parties to the AIDCP have not provided a definition of the roles of the observers and their data for providing information valid for enforcement is a matter of concern to the IATTC.

Lending a hand: Providing assistance to the International Commission for the Conservation of Atlantic tunas in the formation of its regional observer program

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Observer programs are widely recognised as the best method to obtain direct information on targeted catch, by-catch, and gear interactions with other marine species. They are also effective for assessing regulatory compliance aboard fishing and processing vessels. The International Commission for the Conservation of Atlantic Tunas (ICCAT) is the coordinating body responsible for managing tuna and tuna like species populations at levels which will permit the maximum sustainable catch for food and other purposes in the Atlantic Ocean and adjacent seas.

For well over a year, ICCAT has been designing an observer program to place observers onboard carrier vessels to monitor at sea transhipments between these vessels and large-scale tuna longline vessels, which primarily target Atlantic bigeye tuna (*Thunnus obesus*). The larger program goals are to combat illegal, unreported, and unregulated (IUU) fishing (especially from tuna laundering) and to collect catch data to improve stock assessments. Data gathered by observers will also be used to help document fishing activities and assess compliance with ICCAT rules.

Developing and implementing an international observer program from scratch is a significant challenge. Given extensive U.S. experience with observer programs, the United States has been aiding ICCAT in the development of a robust observer program. At ICCAT's request, the United States has provided assistance in reviewing the request for proposals, notifying existing observer contractors of the availability of the request for proposals, and serving on a committee to provide advice to ICCAT on the selection of a contractor. The United States also

provided general information concerning contracting (including the draft U.S. observer contracting template), current best practices, safety regulations, and other critical baseline standards. Many of the United States standards were incorporated into the current program, such as the requirement for the observer to be accommodated and provisioned at the level of an officer onboard the vessel and the requirement for the observer to conduct a pre-cruise safety review of the vessel prior to sailing. Most recently, the United States was asked to provide comments on the contract with the selected service provider and on the Memorandum of Understanding with carrier vessels.

The regional observer program (ROP) framework was adopted by ICCAT in November 2005. In the future, it is possible that ICCAT will expand the program to cover other Atlantic fleets targeting tuna and tuna-like species and may be expanded to cover all oceans in the future. Discussions in this regard are already occurring among the five tuna regional fishery management organisations (RFMOs). The Inter-American Tropical Tuna Commission, the RFMO that coordinates the international management of tuna in the Eastern Tropical Pacific, already adopted a measure in 2006 to establish a similar ROP. It is expected that there will be several benefits to developing a global transhipment observer program, including reduced costs through economies of scale, simplified logistical considerations when vessels transit from one RFMO-managed ocean to another and greater consistency in data fields, collection, standards and quality.

The connection between the ICCAT Secretariat, located in Madrid, Spain, and the U.S. National Observer Program has been facilitated through the National Marine Fisheries Service, Office of International Affairs. This type of close coordination has many benefits, including ensuring that RFMOs are able to take advantage of existing technical expertise to facilitate their ability to carry out their responsibilities. Given the possibility of the expansion of internationally run observer programs for carrier vessels servicing tuna fleets, such collaboration and coordination will be essential to ensure a harmonised and consistent approach.

The Ocean Biogeographic Information System (OBIS) – a 'Leading Wave' of Worldwide Marine Species Data Integration

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The Ocean Biogeographic Information System (OBIS), the data management heart of the Census of Marine Life (CoML) currently contains 13 million records on 79 thousand species from > 200 sources provided via Regional OBIS Nodes (RONS) located in 14 countries around the world. A major objective of the RONs is to make the entire OBIS network self-funded by the year 2010. OBIS Canada is located at the Bedford Institute of Oceanography and is partly supported by Fisheries & Oceans Canada (DFO). OBIS portal can be accessed at www.obis.org (Fig. P7.1) to obtain marine species data records and tools to facilitate data usage for research, management and education purposes. Examples of various North Pacific Groundfish Observer Data and metadata were given to demonstrate that OBIS is ready and able to serve the observer data community (Fig. P7.2). Typing a name gives all locations where an organism was found, and clicking on a map gives a list of all organisms at a location. Lists by large areas like EEZs can also be produced. In addition to maps and graphics, OBIS gives data ready for import to desktop analysis programs. Information about the OBIS data collections is managed at the NASA run Global Change Master Directory (GCMD) discovery portal where collections can be obtained along with the maps and data. A schematic (Fig. P7.3) was given to show DFO Maritimes perspective on observer data. Red dots indicate the level of aggregation at which various fisheries data will be provided to OBIS. Observer data will be provided as unit area summaries so researchers can easily use national and international statistics to calculate observer coverage levels. OBIS is currently serving ~10,000 unique visitors per month. A recent user need assessment survey indicated that 'environmental impact assessments' and 'support for marine species protection policy' were the top 2 use cases. The survey and will soon be repeating the survey, this time in English, French, Spanish,

Portuguese, Chinese and Korean. An IFOC/NGO interest group is requested to: (i) stimulate observer data community use of the OBIS and GCMD portals and to participate in the OBIS user needs assessment survey; (ii) for observer data already in OBIS and GCMD, request improvements to facilitate use by world wide observer data community; and (iii) for observer data not in OBIS and GCMD, request observer data managers to create discovery GCMD metadata and to post data to nearest Regional OBIS Node. Results of this initiative could be presented at the upcoming Ocean Biodiversity Informatics Conference at the Bedford Institute of Oceanography on October 2 – 4, 2007. Major themes of the conference include quality control and open access to data. See www.marinebiodiversity.ca/OBI07 for details.

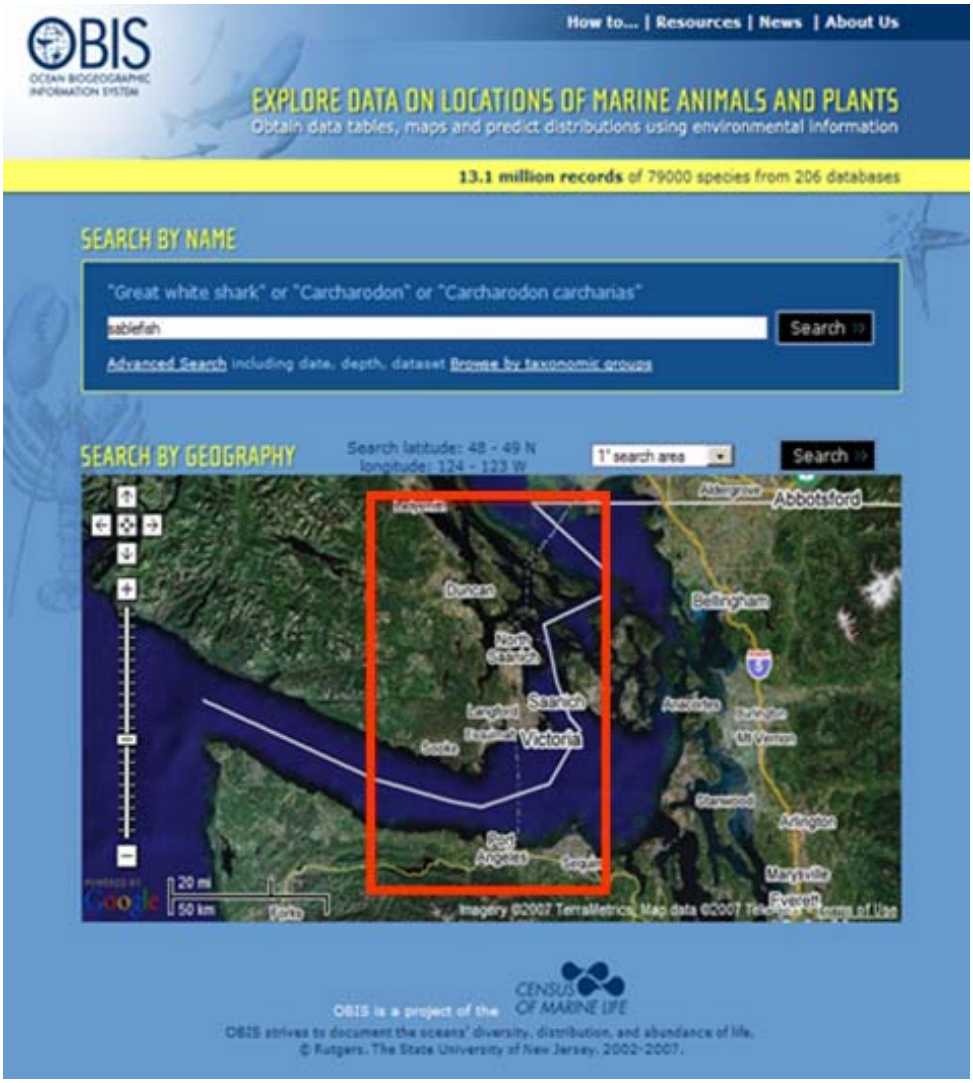


Figure P7.1: *Ocean Biographic Information System Portal (www.iobis.org)*

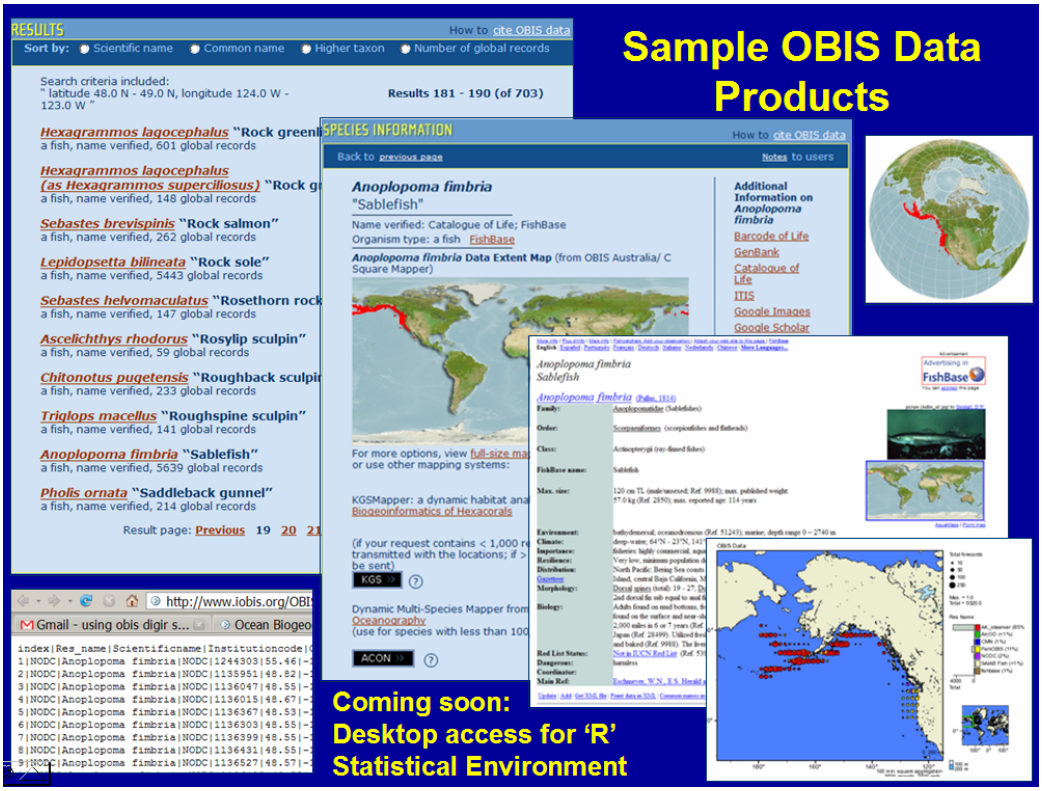


Figure P7.2: *Examples of North Pacific Groundfish Observer Data from OBIS.*

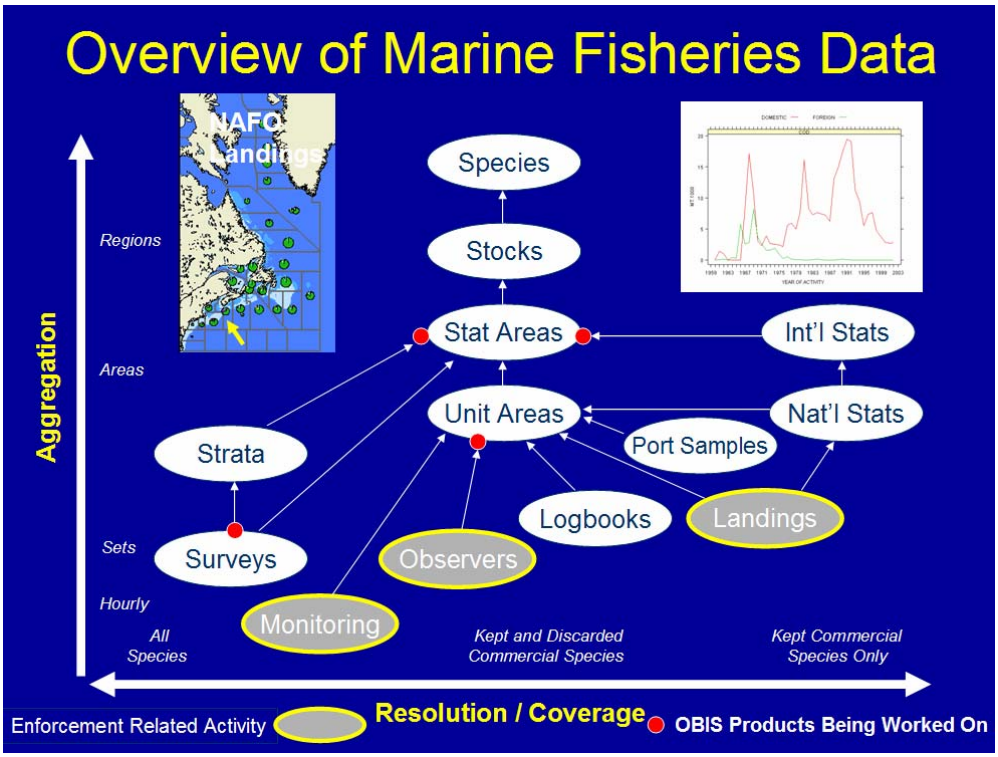


Figure P7.3: *Fisheries & Ocean Canada, Maritimes region perspective on fisheries data.*

Questions & Panel Discussion – Session P7 –

Vicki Cornish (The Ocean Conservancy) to Sara Monteiro

Comment / Question:

I was interested about the display of responsibilities of your observer program and how only 30% of the mandates require collection of by-catch information. Do you have the ability to expand the data collection program used by your observers to incorporate more information on by-catch, even if it's not one of their primary goals?

Response:

Sara Monteiro – The decision-making process in the European Commission is very complicated and I am not a good person to try to explain that. I am not aware of anything currently being developed within the Commission to handle that issue and I don't think it is currently a priority.

Bob Branton (Ocean Biogeographic Infomation System) to Kim Blankenbeker

Comment / Question:

Are you going to use the data that are collected for your own purposes and are there other international bodies that you report these data to?

Response:

Kim Blankenbeker – I suppose I should be clear that I am not actually collecting data. In principle, the information collected under the transhipment observer program could be factored into stock assessments for tuna and tuna-like species if it has scientific value or if it can otherwise be used to augment the catch data or other information that is submitted directly by ICCAT members to the organisation. As I noted in my presentation, the information collected under the program also has a compliance aspect. With respect to data-sharing, information on catch, including by-catch, is shared by ICCAT with other Inter-Governmental Organisations, including Regional Fisheries Management Organisations. The way ICCAT goes about using and sharing relevant fisheries information will likely continue but hopefully the information will be slightly improved due to the transhipment and other observer programs.

Bill Karp (National Marine Fisheries Service)

Comment / Question:

We have seen some good examples of how to train trainers, but we also often get asked to provide training opportunities for people from other parts of the world who are interested in developing observer programs. We are always delighted to provide that opportunity, but perhaps we can do something more collectively. For example, we could design a program to train observer trainers and then host the program on a regular basis (e.g., every one, two and three years) as a way to share our experiences and to help move the international observing movement forward.

Secondly, we have had a lot of discussion about issues associated with the ecosystem approach and Martin Hall and Steve Kennelly spoke about the importance of observer programs and fishery-dependent data for ecosystem modelling. However, it occurs to me that it is not just the ecosystem approach to management that we are interested in, but also the ecosystem approach to fishing – it is the fishers who really understand the ecosystem and how that relates to the way they fish and I think we can learn a lot from that. Does anyone on the panel have any thoughts on how we can harness that information through furthering our communication with people on fishing vessels who understand, on a day-to-day level, how the ecosystem affects the abundance of target and non-target catches?

Response:

Ernesto Altamirano – I think scientists from around the world should be invited to workshops and other meetings that are hosted by international organisations such as the Tuna Commission. For example, last month we had a meeting on stock assessment and invited scientists from other ocean areas to see what we do and to maybe see what we are doing wrong. Having said that, I think the scientific community, at least in fisheries, is overwhelmed with meetings and so I think there is a need for some sort of virtual meeting.

Vicki Cornish – I think it is critical to get fishers involved and thinking from an ecosystem approach but it is also important to give them information and communicate the information that is collected in observer programs in a way that helps them to be smarter fishers from an ecosystem perspective.

Glenn Quelch (European Commission) to Ernesto Altamirano

Comment / Question:

I am aware that in the Indian Ocean there is a potentially serious issue with by-catch in the purse seine fishery around fish aggregating devices (FADs). Is there a similar issue in the Pacific and, if so, are IATTC looking at it?

Response:

Ernesto Altamirano – Unfortunately we don't have abundance estimates on many of the by-catch species (e.g., sharks) in the FAD fishery in the eastern Pacific Ocean but the fishery is known for catching a lot of big-eye and skipjack (which is an under-developed fishery in the eastern Pacific Ocean). One of the important aspects of the FAD fishery is that it moves all over the place and so is very dynamic. We don't know much about the fishery but we are currently gathering a lot of information and trying to analyse it as fast as possible.

Martin Hall – Several years ago we moved into the FAD fishery and, as a result of that, we now have two tuna stocks which are in really bad shape, a significant decline in shark populations and several other species that have not been assessed yet. Instead of looking at each by-catch issue in isolation, we need to integrate the solutions and look at these from an ecosystem approach. It helps if the NGOs are integrated in their view of the world too, because, if somebody is only interested in this type of shark, or that kind of booby bird, it becomes just another single issue. The Commission has a huge list of research projects to reduce by-catch on FADs but there is insufficient funding for that. We have had some help from NOAA recently to start on some special approaches to address the shark problem and the crisis with the tuna species.

Liz Mitchell (North Pacific Groundfish Observer) to Ernesto Altamirano and Kim Blankenbeker

Comment / Question:

What laws exist to protect observers on the high seas from harassment and interference with their duties and how do you share that information?

Response:

Ernesto Altamirano – This is a difficult issue because the Tuna Commission functions in different countries but does not have specific jurisdiction in a country and is not a national authority. Also, the Commission hires the observer and puts them on the vessel but they are not a government employee. Some agreements have procedural actions written into them which prescribe what to do if an observer is harassed or interfered with his / her duties. For instance, some agreements will require a vessel to automatically have a reduced dolphin mortality limit. These agreements are legally binding and do not need further approval from the government to take effect. The ADPC also has a group called the International Review Panel that provides a report on all the infractions for a vessel including harassment or any kind of interference with the observer. The report is available on their web site and includes the actions that were taken by the nations regarding these infractions – it is hoped that this openness and transparency will make governments pursue actions towards vessels and prevent vessels from repeat offences.

Steve Kennelly (NSW Department of Primary Industries)

Questions / Comments:

Referring back to Bill's comments about ecosystem-based management, one practical way we may be able to tune that in is through the various models that people are currently developing (e.g., ECOPATH, ECOSIM and ATLANTIS). These models are data-hungry models and I don't know that the people developing these models realise the depth and breadth of information that is being collected through these sophisticated observer programs across the planet. I think we should try to get some of the modellers to our next conference so they can see the sorts of data that are available.

Response:

Bob Branton – We have some modellers at our research institute and we are really promoting the OBIS data model to those modellers. If we can make observer data available through OBIS it should also make the data available to the modelling community.

Joachim (Yogi) Carolsfeld (World Fisheries Trust)

Comments

I think the role of the World Fisheries Trust at this conference has mainly been to look at the sharing of information, experiences and opportunities among developing and developed countries. We have handed out some questionnaires and have received a few returns and I thought it might be interesting to share some of the more relevant comments from this. Questions on the survey included *"How well has this conference worked to build sharing?"* and *"What can we do to make that sharing continue after the conference?"* Clearly, there has been a great interest among the participants and I think they have all appreciated the conference a great deal, but one of the key elements that people are requesting is some kind of continuing funding so the interaction can continue at future conferences and other fora.

The experiences learned at this observer conference, such as the issue of self-reporting data, could have relevance to other situations beyond observer programs. Also, something that didn't come out very well in the questionnaire but has come out through a number of conversations is the role of NGOs. For example, one of the main roles we play is to build trust with the fishing community and we need to look for ways to make self-reporting data more reliable. There are various mechanisms that we've already applied with varying levels of success and this also needs to feed back into the observer programs and other evolving situations.

The issue of ecosystem-based fisheries management is another area that we need to feed into and, from our perspective, we should also include humans as part of that ecosystem. For example, fishers that have to forgo their million dollar salaries versus those people that have to forgo food on their table – I think this is an important component to add into ecosystem-based management models.

The other issue that came out of the questionnaire was training opportunities – there are several opportunities that are showing up and I think we also need to provide some opportunities within those training programs for countries that have usually been left off the table.

World Fisheries Trust is interested in helping assist the dialogue and, initially, we will continue the informal network with the people that we have assisted at this conference and perhaps feed this back to other groups. Please see one of us after the conference to express your interest so we can see how we can develop this network at a functional level.

SESSION B1

What can advanced technologies offer fishery monitoring programs?

(a concurrent session with Work Group 1)

Moderator:	
Shawn Stebbins	*Archipelago Marine Research Ltd. – Canada*
Speakers:	
Steve Auld	*Australian Fisheries Management Authority – Australia*
John Chouinard	*Department of Fisheries & Oceans – Canada*
Jonathan Cusick	*National Marine Fisheries Service – USA*
Erin Kupcha	*National Marine Fisheries Service – Northeast Fisheries Observer Program – USA*
Bruce Patten	*Department of Fisheries & Oceans – Canada*

Real time data entry: Electronic data capture

Steve Auld*, Gavin A. Begg, Bruce Wallner, Robert Stanley and L. Kranz

Australian Fisheries Management Authority –Australia

Data collection for an observer has alway posed its own set of problems, from a lost or wet data sheet to recording data virtually underwater on a moving platform. Transcription errors and other issues also emerge after a voyage has been completed. These range from illegible data sheets to timely data delivery. For example, are the data sheets legible and complete? How long has it been from voyage completion to data lodgement? How long between data lodgement and entry onto a computer database for analysis? Through all these processes, transposition errors occur and months may go by, while fisheries managers are requesting accurate and up-to-date information. Harnessing electronic technologies in data collection, however, has revolutionised this process and eliminated most of the problems associated with reporting inefficiencies.

The Australian Fisheries Management Authority (AFMA) Observer Program now has an electronic data collection system implemented that after six months of trials is real time, practical and cost effective. This system includes a PDA and GPS integrated to a database for direct data entry. The database is form driven and navigated by simple button selection and predetermined dropdown list values. Data validation routines test for basic typographic errors, missing data or unrealistic values.

For protection the PDA and GPS are contained in waterproof, shockproof and crushproof cases. A stand alone GPS is linked to the PDA via Bluetooth, providing instant and continuous vessel position, eliminating the need to visit the wheelhouse and interrogate the plotter. At periodic intervals during a voyage the PDA is synchronised to a laptop computer either via Bluetooth or USB cable. The laptop contains a database that imports and stores the PDA collected data in a compressed format, which can then be emailed to a server at head office. Once the data is received it is run through a further validation program to remove any inconsistencies then exported to the main database.

Fisheries managers now have the capability to receive data before the vessel has returned to port. The system has currently been developed

for pelagic and demersal longline fisheries, with further development under way for trap and trawl fisheries. Our wireless data entry system has proven easy to use and provides accurate and consistent data, allowing observers to best use their time while at sea. In comparison to traditional methods of data collection and data entry it has proven to be an extremely cost-effective method of data capture.

Observer Trip Information System (OTIS): A tool for just-in-time in-season fishery monitoring

John Chouinard

Department of Fisheries & Oceans, Quebec Region – Canada

Abstract

The Observer Trip Information System (OTIS) is a Fisheries and Oceans Canada (DFO) system developed for the purpose of monitoring designated fishing activity on a daily basis in-season, specifically in relation to small fish concentration, prohibited fish catch, by-catch, soft shell crab concentration and species at risk catch. The objective of the OTIS system is to collect and transmit real-time observer at-sea catch information daily to permit timely analysis by DFO officers in the context of relevant Integrated Fishery Management Plans (IFMPs). This in turn allows DFO to make timely decisions on the status of the fishery and to determine whether it should be closed temporarily or permanently for that season.

OTIS allows for the secure transfer of summary data directly from the fishing vessel to the appropriate shore-based Observer Company, where following internal quality control measures, the data are electronically transferred to the DFO observer data repository (database). Combined with other forms of monitoring, including those that are dependent on the vessel returning to shore for after-the-fact analysis, OTIS is a key part of DFO's fisheries sustainability strategy where risk-based decision-making under the Precautionary Approach (PA) and Ecosystems Approach (EA) can be cost-effectively supported by timely and credible "actionable" information obtained at source.

Introduction

From the fisheries management perspective, monitoring should be founded on risk-based indicators, reflected in IFMPs and designed to signal potential deviations from or potential negative impacts on the Country's adopted fisheries sustainability strategy.

Key data capture opportunities or events across the fishing cycle include pre-trip hail outs, at-sea capture of position, logbook and observer data, situation report hails (hail sit-rep), post-trip hail ins, onshore Web-based logbook entry and dockside reporting. The data from these multiple events is stored in a national integrated operational data store and/or regional legacy systems for real-time or other forms of access, sharing, comparing and reporting. Regardless of where and when a given data capture or information management event occurs in the fishing cycle, the real key to in-season fisheries management is to generate "actionable information" to support informed decision-making in time to make a difference. Fishing activity information that is gathered post-trip or post-season can be extremely valuable in adjusting fishing strategies and updating Integrated Fishery Management Plans for the next season.

Clearly though, the shorter the time lapse between data capture at source and the availability of those data for analysis and decision-making, the more effective and immediate will be the action taken by those managing the fishery. Real-time in-season information captured directly at sea can lead to direct and immediate positive outcomes in relation to the sustainability of the resource and the fishing industry itself.

DFO's Observer Trip Information System (OTIS) has been developed specifically to that end, with the full support of the fishing industry, allowing for the timely and secure capture of catch information daily at sea and its immediate secure transmittal to Observer Companies and subsequently DFO. OTIS represents an effective means of monitoring specific fishing activity on a daily basis.

Key message

A robust in-season fisheries monitoring program must necessarily be composed of a broad set of complementary information gathering strategies and activities. Surveillance vessels, vehicles and aircraft, at-sea Observers, vessel monitoring systems, video monitoring, dockside monitors, hail-in/out programs and log books each play a crucial and legitimate role at some point in the fishing activity cycle whether they are applied pre-trip, at sea or post-trip. As much as possible, it is the aim of in-season fisheries management to generate "actionable information" to support informed decision-making in time to make a difference.

Fishing activity information that is gathered post-trip or post-season can also be extremely valuable in adjusting fishing strategies and updating Integrated Fishery Management Plans for the next season. However, in an ideal world, real-time in-season information captured directly at sea can lead to immediate corrective action including the closure of a fishery. DFO's Observer Trip Information System (OTIS) has been developed specifically for that purpose.

The timely and secure capture of catch information at sea and its immediate secure transmittal to Observer Companies and subsequently DFO represents an effective means of monitoring specific fishing activity on a daily basis. The ability to conduct timely analyses of fishing activity while vessels are still at sea can lead to direct and immediate positive outcomes in relation to the sustainability of the resource and the fishing industry itself.

Conclusions

At-sea Observers and OTIS are key elements of DFO's fisheries sustainability strategy. They directly support risk-based decision-making under the Precautionary Approach (PA) and Ecosystems Approach (EA) generating timely and credible "actionable" information obtained at source. OTIS is but one method among numerous other monitoring, control and surveillance strategies. Many of these other methods, while valuable and effective in their own right, are dependent on the vessel returning to shore for after-the-fact analysis. A key advantage of OTIS is daily real-time data capture, transmittal and analysis leading to immediate mitigation of any further risk to the resource. The ability to conduct timely analyses of fishing activity while vessels are still at sea can lead to direct and immediate positive outcomes in relation to the sustainability of the resource and the fishing industry itself.

At-sea observing using electronic monitoring: The U.S. shore-based hake fishery

Jonathan Cusick[1]* and Howard McElderry[2]

[1] *NOAA Fisheries, Northwest Fisheries Science Center – USA*
[2] *Archipelago Marine Research, Ltd. – Canada*

NOAA Fisheries Northwest Fisheries Science Center is responsible for monitoring commercial groundfish fisheries off the U.S. West Coast. Pacific hake (*Merluccius productus*) is a semi-pelagic species with a large biomass found along the continental shelf in the northeastern Pacific Ocean. This species is taken by mid-trawl trawl nets for the production of surimi and round product. The hake quota is managed in three commercial sectors: shore-based catcher vessels, at-sea catcher processors and at-sea processing motherships.

Beyond managing the fishery to stay within a set optimum yield (OY), other management concerns include by-catch of fish endangered species such as salmon, over fished groundfish stocks (including widow and canary rockfish (*Sebastes* spp.)), marine mammals and other protected species. A special note of interest of managers is the by-catch of over fished rockfish species. To put into perspective, the by-catch limit of canary rockfish (*Sebastes pinniger*) was 4.7 mt in 2006 for all sectors. In order to catch the quota of over 232,000 mt OY of hake, the canary by-catch rate had to be 0.00202%. As rockfish school, a large amount of an over fished stock can occur in one haul, necessitating the need for a higher level of monitoring.

There are two observers deployed on every at-sea catcher processor and mothership vessel operating in the at-sea hake fleet. Total catch of target species and by-catch species of the at-sea fleet is tracked using observer data.

The shore-based fleet, operating predominantly out of Oregon ports, fish under an Experimental Fishing Permit that grants them special

permission to land certain species in excess of landings limits which are forfeited to the state of landing without penalty. This allows the vessel to quickly store their catch in refrigerated seawater tanks and not have to worry about sorting out by-catch to remain under landing limits. Hake's quality as a food product degrades quickly unless kept at a low temperature and sorting out by-catch efficiently from hake catch can be difficult because of the volume of the catch (~60 – 100 mt in one bag) on these smaller catcher vessels. There is no observer coverage of this fleet and the landings, monitored by shore-based samplers, are tracked with fish tickets. As the total catch of this sector is based on the fish ticket (or landed catch) weights, it is important to confirm if the total catch recorded at the plants accurately represents total catch in the fishery, including by-catch. The shore-based catch census strategy relies upon maximised retention of catch at sea, however, discarding does occur for safety, mechanical or other reasons.

The at-sea monitoring goals for this fishery in 2004 included: confirming full retention (or documenting discard if it took place), especially for any possible rare events; better characterisation of fishing activities; and providing independent verification in a cost-effective manner. Monitoring catch composition was not a monitoring issue as the catch is sampled for composition upon landing. After reviewing the potential monitoring methods, electronic monitoring was chosen as an option to experiment with as it fit the goals of the program best. NOAA entered into a contract with Archipelago Marine Research, Ltd., based out of Victoria, BC, to deploy the EM systems and they were deployed on all shore-based hake vessels during the 2004, 2005, 2006 and 2007 shore-based hake seasons.

Electronic monitoring (EM) is not just video (Fig. B1.2). It is a complete data system including up to four CCTV cameras, a GPS receiver, winch, and hydraulic sensors which all feed into tamper resistant control box that houses a computer and high capacity data storage drive.

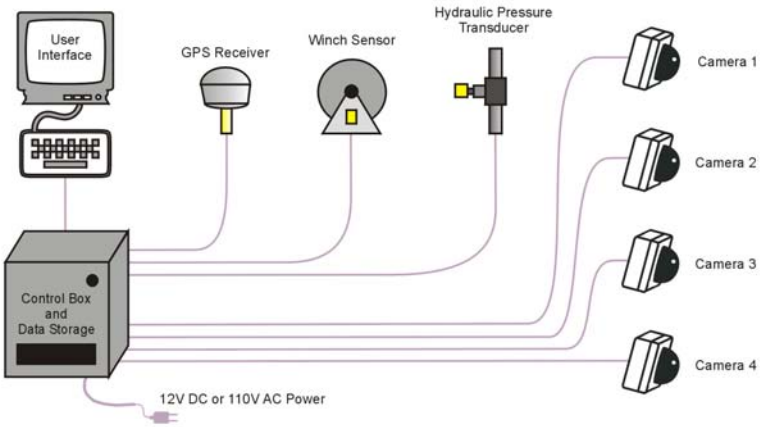


Figure B1.2: *Schematic Diagram of EM System.*

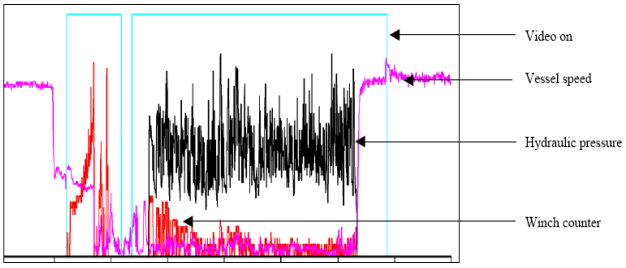


Figure B1.3: *Schematic of collected example EM data illustrating the combined data for one fishing event from setting to hauling back a net (truncated for illustration purposes).*

Field service technicians installed EM systems on all vessels participating in the main season shore-based hake fishery. Each vessel was equipped with a full sensor suite along with two or three CCTV cameras, providing views off the stern and on the deck of every vessel. EM systems were powered continuously and yielded fleet data capture success rates of over 90% for video and 97% for sensor data.

Processing of EM data occurred in two steps. Sensor data was analysed to derive detailed information on vessel location and activity (Fig. B1.3), enabling video reviewers to rapidly locate specific events of interest, such as when the net is being retrieved and when fish stowage is occurring. Image data for all fishing events was examined during codend retrieval operations for possible net bleeding and during fish stowage operations to determine if fish are discarded from the deck. A discard event was defined as an instance where more than 45kg (~100 lbs) of fish were discarded.

Table B1.1 provides a summary of the fishery for the 2004 – 2006 fishing years. The fishery is roughly the same in terms of fishing events over the three years, however the fleet size has increased and the season correspondingly decreased. Discarding is a necessary component in the fishery, hence the change in terminology by NOAA from 'full retention' to 'maximised retention'. This infers that vessels are attempting to maximize the amount of fish stowed, maximising their landings and hence, their revenue. The frequency of discarding events ranged from 13 – 20% over the three years. There was a high variation in the discard rate between vessels with some vessels accounting for a disproportionate number of the events. Summarising discard quantities over the three years using three order of magnitude categories (Table B1.2) indicates that while the number of events fluctuates annually, there is a general trend toward a reduction in discards. A more quantitative method used in 2005 and 2006 (Fig. B1.4) shows many vessels declining in the average size of discard events and that discard quantities for most vessels declined to levels below 2% of the overall landed catch.

While the frequency of discard events may continue in the 15 – 20% range due to safety, net cleaning, and other reasons, we have found that providing the fleet with EM-derived fishery data has been a valuable feedback tool to sensitise fishers and motivate them in developing ways to reduce wastage in the fishery. Fishers continue to experiment with practices that would help reduce discarding such as tying off the end of codends and adjusting net sensors to improve monitoring catch while fishing.

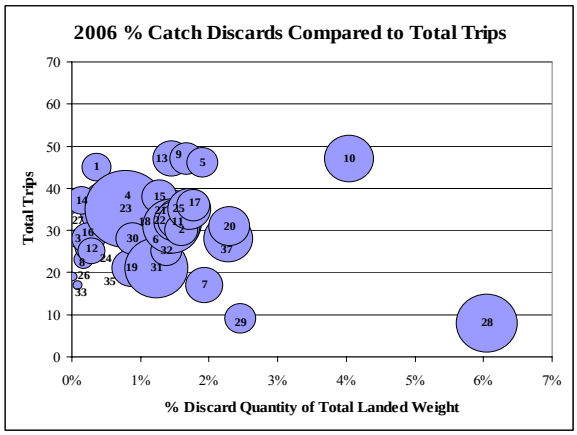
The fishery is now better characterised and independent verification of fishing activity and discard can be monitored for in this fishery at a lower cost than observers. EM data has helped managers and fishers better understand the operations and each others expectations. Overall, this technology can document discard events and may be applied as a regulatory management tool in the future.

Table B1.1: *Summary EM results from 2004 – 2006 shore-based hake seasons.*

	2004	**2005**	**2006**
Number of vessels	24	28	35
Season length (days)	~60	~60	~48
Trips Monitored	1,003	1,105	1,113
Fishing Sets (A)	1,730	1,843	1,861
Vessel sea time (hrs)	> 20,000	> 23,000	> 23,000
Video imagery (hrs)	> 13,000	> 20,000	> 18,400
Total discard events (B)	327	238	366
Overall discard % (B/A)	18.9%	12.9%	19.7%

Table B1.2: *Categorisation of discard events by amount.*

		Estimated Weight of Discard (kg)			
		45 – 450	**450 – 4,500**	**> 4,500**	**Total**
Number of Events	**2004**	89	129	109	327
	2005	14	118	106	238
	2006	138	136	92	366



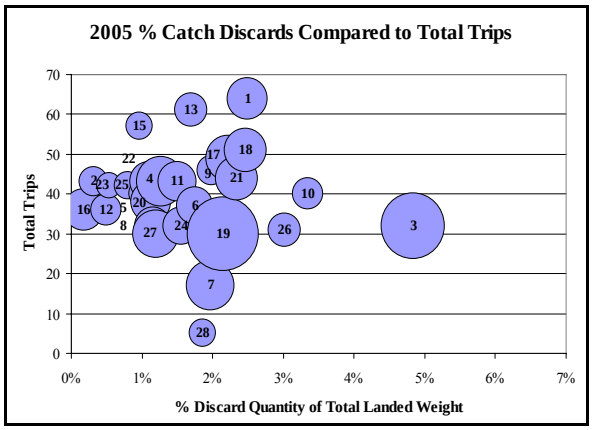


Figure B1.4: *Each vessel's (represented by a numbered bubble) estimated volume of discard is expressed as a percentage of total landings and total trips taken. The size of the bubble corresponds to the average amount of each vessel's discard events*

Observer at-sea data collection project

Erin Kupcha*, Otis Jackson, Holly McBride and Barbara North

Northeast Fisheries Observer Program & Data Management System, Woods Hole – USA

All commercial fishing trips observed by the National Marine Fisheries Service (NMFS), Northeast Fisheries Science Center (NEFSC), Fisheries Sampling Branch are required to submit preliminary trip and incidental take information within 24 hours of the end of the trip. This requirement was established to provide Fisheries managers and analysts with quick access to key data fields, like dates and area fished, primary species landed and any incidental takes of protected species. Within 24 hours of the end of each trip observers e-mail or call in the preliminary data to their Area Coordinator, who then e-mails the data to the Woods Hole lab where it is keyed in to the Observer Contract (ObsCon) database. The information provided comes directly from the observer trip, catch and incidental take data logs. Fisheries managers and analysts work with this preliminary data, until the detail logs can be processed.

Also, several fisheries are managed on a Total Allowable Catch (TAC), which require close monitoring of catch quotas. These fisheries require fishermen self-reporting and observer-reporting of the catch for species of importance. The fisheries include: Access Area Scallop (Closed Area Scallop), U.S./Canada Management Area, Regular B-Day Program and any Special Access Programs (SAPs). These programs require captains to report their daily catches through a satellite e-mail system. It also requires observers to report, within 24 hours of the end of the trip, a summary of kept and discard weights of quota monitored species. Summary information is in addition to the

regular observer logs completed at the end of each haul and against the observer's trip logs and then e-mailed on a daily basis to the NMFS Northeast Regional Office. The Regional Office compares the summary report to the captain's daily reporting of catch in order to monitor the TAC.

Fishery Sampling Branch staff worked with Data Management Systems (DMS) staff to develop an automated system to replace previous phone in and e-mail procedures and deliver clean data to the Regional Office in real time. A small hand-held computer, Personal Digital Assistant (PDA), was selected to accomplish this goal because of size, cost and the ability to upload data remotely. DMS staff developed a data entry program (ObsCon) for an HP iPAQ using the Microsoft Mobile 5.0 operating system. ObsCon has screens tailored to each fishery with appropriate error checks, providing cleaner data. A secure website was implemented for observer to upload their data directly into Oracle data tables providing quicker reporting.

While observing any trip, the observer enters data into ObsCon after the regular paper logs are completed. ObsCon includes pull down menus tailored to each program for faster, more accurate processing of data. A comprehensive error checking audit was also developed and incorporated into ObsCon. At the end of a trip the observer, either using wireless or connecting through a personal computer, logs on to the secure website, and uploads the file that was created on the PDA with ObsCon. The website verifies the data, loads it directly into Oracle tables and provides the observer with a confirmation number.

The data are loaded to an Oracle database on a secure server outside a firewall at the NEFSC Woods Hole lab. An automated transfer of data, between the servers outside and inside the firewall, occurs two times daily. Fishery Sampling Branch staff then review the data. ObsCon trip and incidental take data are ready immediately and SAP reports are sent to the Regional Office, within 24 to 36 hours of the trip landing.

Automated receipt and importing of remote data into a central database

Bruce A. Patten

Department of Fisheries & Oceans– Canada

In order to support timely decision making, Fisheries & Oceans Canada (DFO) must acquire fishery data and communicate it to staff that are distributed geographically throughout the Pacific region. Since the data to be acquired are collected at remote locations, it is challenging to make this information quickly available via our central database.

To solve this problem, the DFO developed a system called the FOS Importer. It is a system for automated receipt of text-based data. The importer can receive data from any source which has e-mail capability (e.g., a vessel at sea with satellite e-mail) provided that the data conform to a predefined format. The data messages are deciphered then imported into a central database. The importer system can simultaneously support many different message formats.

In order to begin receiving a new format of data message, we go through a configuration process. The first step we take is to define the format of the new type of data message. Once we have defined the format, we create a mock-up of a sample message for testing. The next step is to create the new import specification in the FOS importer system. The import specification defines how a data message will be deciphered and imported. If the data messages will be sent by some remote data application then this application must be developed next. Once the remote application is available, we begin testing and revising the import specification and the remote application. When we have finished addressing the issues discovered during testing, the new message format is rolled-out for operational use.

The key to the FOS Importer is the import specification. A specification consists of an Input definition, composed of Structures and Elements. This tells the importer how the received data will be structured and what fields it will contain. A specification also includes an Output definition, composed of Tables and

Columns, as well as Temporary Values. This tells the importer how to structure the data that will be output from the importer system and uploaded to the central database. The specification includes validation rules that may be applied to both Input and Output definitions.

The operational use for a message format consists of several phases. During the message receipt phase, an instance of a data message arrives at a particular e-mail Inbox. The FOS Importer has an automated task called 'ReadMail' which periodically looks for new messages in the Inbox. If any are found, it saves each message to a file on the application server and creates new import transaction records. The transaction record documents each message and is used to track the receipt and processing of the message by the importer system.

The next operational phase is the input phase. In this phase another automated process, called 'ImpBatch', attempts to deal with the import transaction. The first step in this phase is to 'stage' the message file. This means that the file is analysed and divided into one text segment for each row of data included in the file. Then the staged data rows are 'parsed'. This means that the rows are divided into separate text segments for all component structures and elements it contains, as defined by the Input definition of the import specification. Once the automated process has parsed the staged data into components, it applies the input validation rules. If it finds any exceptions to the input validation rules then the transaction is set to a 'failed' status and the automated process stops the processing of this transaction.

If the automated process did not find any input validation exceptions it enters the output phase. The first step in this phase is to map the input data records to the output data structure of tables and columns, as defined by the import specification. The particular output data values are calculated using input data values. Then the automated process applies the output validation rules. If it finds any exceptions to the output validation rules then the transaction is set to a 'failed' status and the automated process stops the processing of this transaction.

If the automated process did not find any output validation exceptions it starts the completion phase. The automated process inserts the output data into target tables of central database. If this process completes without generating an error, the import transaction record is set to a 'processed' status. But if errors were encountered while trying to insert the data, the insertions are aborted and the import transaction is set to a 'failed' status.

An import specification may include instructions to send a reply message to the address that sent the original data message. The last step in the import transaction completion phase is to send the reply e-mail message. The reply will indicate to the sender whether the data they sent was successfully imported or whether it failed to import.

The FOS importer has several benefits. Many different message formats can be supported simultaneously by the one importer infrastructure. The message format does not have to conform to exact structure of target database. A variety of communication technologies can be used to send e-mail message such as satellite, cell, landline, ADSL. Since the message format is text-based rather than complex binary formats, a variety of remote clients are supported. The FOS Importer can also be used in an interactive mode to import a text file instead of e-mail message. We are also exploring using it as a bulk updater where we modify existing records rather than adding new ones.

Questions & Panel Discussion – Session B1 –

John Carlson (National Marine Fisheries Service)

Comment / Question:

I noticed that Erin uses Microsoft and, given that software is not perfect, I was curious about the software crashes that may have occurred with the programs you have run.

Response:

Steve Auld – I haven't had any software crashes.

Erin Kupcha – We've had great success and haven't had any software issues or problems uploading the data. The software is very easy to use, even for people who are not technologically inclined.

John Carlson (National Marine Fisheries Service)

Comment / Question:

Do you make a paper back-up of all the data files when it is transmitted into the Oracle database or does the server automatically back-up the data every 10 minutes or so?

Response:

Erin Kupcha – We started asking the observers to fill-out the data on paper and also enter it electronically, but now we don't use paper at all. For the Special Access Programs, the weights of the species are listed on their haul logs, but the system backs up the information after they enter and save it, so there would never be a situation where the data would be lost.

Steve Auld – We print out a paper copy in the office but the observer doesn't do that.

Teresa Turk (National Marine Fisheries Service)

Comment / Question:

Have you had any problems with the hardware? Also, the deck can get very slimy, does all the information go directly into the system while you're out on the back deck?

Response:

Steve Auld – Yes, it goes directly in while we're out on deck. The system is usually encased in a small otter box which is waterproof, crushproof and floats.

Erin Kupcha – We use the same otter boxes. Our observers don't necessarily take them out on deck with them because it is a snapshot of the information that they've already collected on their logs. But, observers have brought them out on deck and they have had no issues.

Teresa Turk (National Marine Fisheries Service) to Steve Auld and Erin Kupcha

Comment / Question:

Have you got a database to put the data back in or are the data just outputted as flat files? I also noticed that Steve does QAC checks and I was wondering if Erin has that integrated in their system as inputs.

Erin Kupcha – The system flags anything strange that comes up within the PDA. The PDA creates a ZIP file which gets uploaded to the website and the website checks the data to make sure there is nothing strange there. Also, before the ZIP file is created, if there is any information missing the PDA won't let you save the file. The data goes directly into our OBSCON Oracle database but, because the information is already recorded on the observer's logs, we also have somebody verify what is in the logs against what is in the database.

Steve Auld – our data sits in an intermediate ACCESS database on the laptop and gets synchronised straight into the ACCESS database and emailed off, so there is always the ACCESS backup on the observer's laptop.

Teresa Turk – Have you ever lost any data using these systems?

Steve Auld – We've never lost any data.

Bryan Wood (Fisheries & Oceans Canada) to Steve Auld and Erin Kupcha

Comment / Question:

What mediums are used to transmit the data and, in particular, are there any problems using ship-to-shore phone lines or satellite phones?

Response:

Steve Auld – We generally use cell phones or mobile satellite phones which plug straight into our laptop (or sometimes they're wireless). We don't have problems with communications at all.

Erin Kupcha – Our observers don't submit any information while at sea – it is all done when they land from the trip.

Bill Karp (National Marine Fisheries Service)

Comment / Question:

In this session there has been a focus on a number of areas: at-sea data entry, which has obviously advanced significantly over the last three or four years; the video work (or EM)

which John talked about; and then information systems and information system integration. However, there are more areas of technology that are advancing and being used for monitoring and observation. For instance, last year I co-chaired a session at the ICES annual meeting on Monitoring Technologies and most of the presentations were on VMS and the use of VMS both independently and with other types of information to evaluate how fishing vessels are performing and to get a better perspective on catch and by-catch. I would be interested in the panel's views about where we are going next. I think one of the places we obviously have to go is integration of information from different sources, because there are a lot of different types of data that we need to use to address these complex problems and there are complex challenges associated with bringing those things together. Is that the major challenge facing us or are there other challenges and barriers to moving forward with technology to address this very broad field of fisheries management and observation?

Response:

John Chouinard – Integrating the information is one thing, but having the information in real time is critical for monitoring activities as they happen and to react on a timely basis and not react after the fact.

Shawn Stebbins – I was surprised that VMS wasn't represented on the panel because that has been the technological solution that has been adopted by many jurisdictions. I don't think integration of the data is a challenge anymore, I think we've overcome those hurdles and it is relatively easy. The challenges that are coming up are the integration of the different tools and techniques that we have available to us and figuring out how they can complement each other and how they can work synergistically towards providing better data and more economic solutions. We've already heard industry speak about the costs associated with technology and how they can't always bear the cost and I think we should have responsibility and look for cheaper solutions because, whether government pays for it or whether industry pays for it, we still tend to pay for it in the cost of the fish. Also, I don't think the barriers to progress are in the technology anymore but they are based on organisational, political and sometimes resource availability.

Howard McElderry (Archipelago Marine Research Ltd.) – From my experience, one of the major challenges is getting the technology from a pilot project that demonstrates how it might be used in a monitoring sense, to implementing it so it is part of a regular regime. For instance, from an operational sense there are obstacles in scaling-up from a couple of boats to 60 or 70 boats in a fleet and having the infrastructure of people around that can operate the equipment. Also, the agency receiving the information needs to have the ability to handle the volumes of video data and detailed sensor data that is created. John also alluded to the issue of enforcement agencies that are inexperienced in working with the data-types that are generated and a reluctance to shift to a fully technologically-based regime, especially when we don't have a track record of using electronic monitoring in the courts as a way of prosecuting cases. A different management regime may also be needed for technology-based approaches compared with using observers as a monitoring tool.

Simon Gulak (National Marine Fisheries Service) to Steve Auld and Erin Kupcha

Comment / Question:

We have a lot of very small vessels in the fishery I work in, so the small units you have talked about are very handy because they save space and paper. However, it seems that the biggest problem is battery life and I was wondering about your experience with maintaining a long battery life cycle. For example, for some of our boats use a 12 volt generator powered from the boat's engine and we don't always have a 110 volt source available.

Response:

Steve Auld – you can save on battery life by switching off the unit when you're not using it and you can also take a spare battery with you. The PDA has an internal memory (I think it gives you about 2 minutes to change batteries) and I've stretched out a battery for about 72 hours of actual working conditions before it went flat.

Simon Gulak – but on a 2 week trip it's probably not going to do you much good!

Steve Auld – it probably would if you took a couple of batteries, or if you could use an inverted battery charger.

Bob Stanley (Australian Fisheries Management Authority) to Jonathan Cusick

Comment / Question:

There are lots of arguable comments that the EM/video technology is cheaper than observers but it varies from case to case. Can you give us some perspective of the differences relative to an option of 100% observer coverage and given that there are two components associated with the costs of the technology solution– one being the fixed costs for the installation and the second for maintenance and analysis?

Response:

Jonathan Cusick – I've been looking at observer coverage versus electronic monitoring for the shore-based hake fishery on the west coast. The estimated costs for electronic monitoring ranged anywhere from 50 – 60% of the cost of observers. The costs of analysis versus installation are approximately 40:60 (i.e., 40% for analysis and 60% for installation).

Gregg Williams (Halibut Commission) to Steve Auld and Erin Kupcha

Comment / Question:

I noticed you both used off-the-shelf PDAs and applications and I'm curious about the decision-making you might have gone through in choosing those.

Response:

Steve Auld – We chose it because it was very small, very light and cheap (approx. $AUS 350). They're also readily available and, once you encase them in the otter box, they're as rugged as anything else on the market.

Erin Kupcha – Our data management group (Holly McBride and Otis Jackson) had several companies send them different kinds of PDAs and test them out with our software and we did the same thing with the otter box. The iPACs cost about $350 and the otter boxes are about $45 per unit (which includes a discount because we purchased 100 units), whereas some of the larger models cost about $1,900 (with GPS included) and we don't have that kind of money to spend.

Steve Auld – There are advantages with having an independent GPS. For example, if the GPS is integrated in the PDA and there is a large whale under your boat, the PDA won't work and you need an independent GPS that you can position somewhere on the vessel where you can direct it towards the sky.

Tim Lescher (Fisheries Observer – USA) to John Chouinard

Comment / Question:

I'm curious about the cost of the OTIS system.

Response:

John Chouinard – The system is currently operating but the information side is not fully developed yet. The cost of the software is currently supported by the Department of Fisheries & Oceans but we give the data to the company and they use a web-based application to send the data to the DFO database.

Shawn Stebbins – For those that are interested, the vessel information system that Jonathan used in his program is on display in the lobby and there is also a brochure that provides three examples where the equipment is being used.

SESSION B2

(a concurrent session with Work Group 2)

How to achieve fishery monitoring by integrating multiple data collection tools?

Moderator:	
Bob Stanley	*Australian Fisheries Management Authority – Australia*
Speakers:	
Dennis Tremblay	*Department of Fisheries & Oceans – Canada*
Minling Pan	*NOAA Fisheries, Pacific Islands Fisheries Science Center – USA*
Lara Hutton	*International Halibut Commission – USA*
Robert Jones	*Northwest Indian Fisheries Commission – USA*
Rick Stanley	*Department of Fisheries & Oceans – Canada*
RoseEmma Mamaa Entsua-Mensah	*Water Research Institute, Archimota – Ghana*
Bob Stanley	*Australian Fisheries Management Authority – Australia*

Designing effective fishery monitoring programs – the information management perspective

Gerry Sullivan and Denis Tremblay*

Department of Fisheries & Oceans – Canada

Abstract

Monitoring programs must be cost-effectively designed appropriate to the risks being managed and provide credible 'actionable' information to support in- or post-season operational and strategic decision-making. A key design element of an effective monitoring program is the capacity to integrate data from disparate sources and, in particular, compare and contrast data captured directly at source with data from other direct sources and with independent (indirect) verifiable data for cross-comparison and analysis. A strong fisheries monitoring program must reflect a broad set of complementary information gathering strategies and activities including surveillance vessels, vehicles and aircraft, at-sea Observers, vessel monitoring systems, dockside monitors, hail-in/out programs, log books and forensic audit. The 'bottom line' is the generation of integrated, accessible and shared 'actionable information' for making more informed decisions in time to make a difference, whether through in-season corrective actions and adjusted strategies/coverage or post-season audit assessments.

Introduction

The introduction of the Precautionary Approach, ecosystem-based management, the passage of the *Oceans Act*, the development of the new *Species at Risk Act* (SARA) and, particularly, the risk-based approach signalled new strategies for monitoring. DFO began a transition from mere data collector with an emphasis on data quantity, to information and knowledge manager seeking quality, timely and current data and the creation of 'actionable information' to support monitoring at all stages of the fishing cycle in time to analyse, draw conclusions and act in time to make a difference.

In 2001, DFO undertook the Fisheries Information Management Program (FIMP) to

respond in part to the proliferation of duplicative and overlapping data systems across its vastly decentralised regional organisational structure. The goal of FIMP was the convergence to common, shared and integrated fisheries information management systems. FIMP has resulted in the creation of an Enterprise Information System (EIS), which has evolved to an Operational Data Store (ODS) containing operational data accessible by multiple application systems supporting DFO operations.

DFO's current information management approach now supports a balance between in-season intervention and post trip/season verification and audit. Key data capture opportunities or events across the fishing cycle include pre-trip Hail Outs, at-sea capture of position, logbook and observer data, post-trip Hail Ins, onshore web-based logbook entry and dockside reporting. The data from these multiple events is stored in a national integrated operational data store and/or regional legacy systems for real-time or other forms of access, sharing, comparing and reporting.

Key message

Fisheries & Oceans Canada (DFO) has adopted a fisheries monitoring information vision and strategy targeting the generation of integrated, accessible and shared 'actionable information' designed for making more informed decisions in time to make a difference. Improving data quality, integrity, timeliness and currency through data capture at source (land-based and sea-based data capture – fishers and third parties) and converting integrated data to information/knowledge is critical to the design of an effective monitoring program. Technology advancements are increasingly capable of meeting today's data capture, information management and access/sharing needs and offer new opportunities to generate actionable information to support effective monitoring and associated decision-making.

Conclusions

New tools and techniques are beginning to yield better information faster, so that we can continue to maintain a balance between post-season and in-season fisheries monitoring methodologies. These integrated tools and techniques offer new possibilities for exception-reporting and threshold reporting as well as more forensic analysis through data mining, and permit the kinds of cross-comparisons that will yield information at a high confidence level.

The transformation from mere collectors of data to effective managers of information and knowledge implies that integrated fisheries information management tools and practices must be designed to yield 'actionable information' in order to be able to act in time to make a difference. For fisheries monitoring and broader management purposes, it is not necessarily about data quantity, but rather the right high-quality and timely data to support more informed decision-making. Data is viewed from a management perspective as a valuable asset both as a program resource and as a program output.

While capturing high-quality data in a timely manner is critical, it is equally important to provide for the management and storage of data in common integrated repositories to support access to and sharing across all disciplines concerned with fishing activity. A common operational data store and common language management system are key to facilitating quality input control and data sharing. DFO's adopted 'actionable information' strategy is resulting in the generation of higher quality integrated, accessible and shared data through multiple tools applied in an integrated fashion to maximise cross-comparison of data sets from different sources.

The essential elements that led to successful establishment of a continuous economic data collection system through the observer program

Minling Pan[1]* and Timothy Ming[2]

[1] *NOAA, National Marine Fisheries Service, Pacific Islands Fisheries Science Center – USA*
[2] *Joint Institute for Marine & Atmospheric Research, University of Hawaii – USA*

Background

Before the Continuous Economic Data Collection System was established, there was no means for the Pacific Islands Fisheries Science Center (PIFSC) to collect economic data, especially cost information of commercial fishing, on a continuous basis. The Observer Program, managed under the Pacific Islands Regional Office (PIRO), is an existing data collection system on a continuous basis that was established mainly for collecting biological data and recording interactions of fishing activities with protected species. It seemed to be efficient and cost-effective to add economic data collection on to the Observer Program to provide fishery managers with high quality, concurrent, and continuous economic data in support of conservation and management of living marine resources in the Pacific Islands Region.

However, there were many issues facing such a task. First, the Observer Program was managed under the PIRO, not PIFSC. PIRO was not obligated to collect any economic data. Second, unlike other data, most of the economic data are not observable and they need to be collected by interviewing the captains onboard fishing vessels. Observers typically did not have the experience of collecting data through interviews. Third, fishermen were not obligated to participate and provide information. Economic data collection was not a mandated program, and economic data are often viewed as personal business information.

Nevertheless, the Continuous Economic Data Collection System was added to the PIRO observer program in August 2004 on a voluntary basis. This presentation reviews the elements that led to the successful implementation of the economic data collection program through the existing Observer Program in the Hawaii longline fishery. Also, a brief summary of the economic data collected through the program and the implications of the economic data in fishery management are discussed in the study.

Keys elements for implementation

- Had strong political will from the associated agencies;
- Brought in an economist from another fishery science centre where the economic data collection had been established in its observer program for a few years to present the economic data collection program and give first time training to PIRO observer program managers and observers;
- Developed protocol and procedure for the economists in PIFSC to coordinate the works with PIRO staff;
- Provided economic data collection trainings to the PIRO observers;
- Provided outreach to fishermen and designed data collection forms within three different languages.

Outcomes

- The Continuous Economic Data Collection System was established in August 2004;
- Response rate has been improved from 30% in beginning months to 60 – 70%, and it has been stable the past 2 years;
- Economic data collected through the program have been used in several analyses and studies that are important to the fisheries management.

The use of multiple data collection tools: Monitoring the commercial fishery for Pacific halibut

Lara M. Hutton

International Pacific Halibut Commission – USA

The International Pacific Halibut Commission (IPHC) manages the commercial fishery for Pacific halibut (*Hippoglossus stenolepis*) on behalf of Canada and the United States. The delivery of the *F/V Oscar Hattie* in September of 1888 marked the beginning of the Pacific halibut commercial fishery as it is known today. The IPHC itself was formed in 1923 under a treaty convention, with a push from industry both in Canada and the US. The IPHC is responsible for the harvest and conservation of Pacific halibut throughout its range in U.S. and Canadian waters, which extends from northern California up through Alaska, and out along the Aleutian chain. To aid in managing this extensive range, it has been divided into separate management or regulatory areas (Areas 2A, 2B, 2C, 3A, 3B, 4A to 4E) which also facilitates the collection of fishery dependent data. Fishery independent data are collected on surveys conducted by the IPHC throughout this range as well, with both data sets being used in the stock assessment. Other removals are considered including sport, subsistence and by-catch and the total allowable catch for each regulatory area is set. This presentation focuses on the collection of data from the commercial (fishery dependent) fishery.

Fishery monitoring includes the collection of logbook information, tag recoveries and biological structures. Dockside sampling of the commercial catch has been the primary biological data collection tool since the 1930s. Landing patterns are reviewed annually. During this review, total poundage landed, as well as the area, and number of trips help identify key ports to staff. Twelve ports from Oregon to Alaska are staffed by the IPHC and all but one port is staffed for the duration of the eight and a half month Pacific halibut season.

Logbook collection has developed through industry recommendations and cooperative programs with tribal governments and other agencies. All vessels fishing in Canada and any vessel greater than 26 feet in the U.S. must maintain an IPHC or IPHC approved logbook. Audits of logbook data are done dockside by skipper interviews and by validating against landing records (fish tickets in the U.S. and validation records in Canada). Type and amount of gear deployed, set retrieval date, location, depth, catch and the date, buyer and port of the offload are some of the information that is collected. Canadian, Washington, and Oregon landing information is received electronically and Alaska is moving to a completely electronic system allowing data to be received directly from the buyer.

Another data collection tool is fish samples which provide age composition, fish lengths and weights at age. Lengths are collected, with a formula being used to convert these to weights, and the otolith is removed for age determination. Sampling methods have evolved throughout these years, as the nature of the commercial Pacific halibut fishery has also changed. Emphasis is placed on the sampling methods that are employed to accurately sample and provide data for stock assessment purposes for a fishery of this magnitude. Sampling targets for each regulatory area are set with the stock assessor. 1,000 otoliths (fish samples) is the current target for Area 2A and 1,500 is the target for all other areas. Areas 4C, 4D and 4E are seen as one management area and has a total target of 1,500 otoliths. These targets, along with the current year's catch limit, the port's expected landing pattern and sampling potential are used in determining the sampling rate prior to the start of the season for each regulatory area and for each port, to ensure the sample of fish is proportional in weight. For example, for the port of Homer, where the bulk of the commercial Pacific halibut is landed, the sampling rate for Area 3A is one percent, such that 330 pounds of halibut would be sampled from a delivery of 33,000 pounds. Depending on offloading practices, set sampling methods are employed to ensure both randomness and representation. One such method is tote sampling. In this instance, halibut are offloaded into totes or boxes and one tote is randomly chosen, as each tote holds about 1,000 pounds. Only one third of the tote is required to satisfy the requirement of collecting a sample of 330 pounds of halibut. The port sampler identifies three fish, randomly chooses one of the three to be sampled

removing the other two from the tote and in this manner works their way through the tote of fish completing their sample.

A third data collection tool is tagging. Tags provide information such as migration, growth rates and mortality rates. Tag recoveries have been encouraged through the development of a reward program and enhanced by field staff initiated incentives. Our Port Hardy Sampler, Rhonda Miller worked with a local business to have personalised coffee mugs made for individual's returning IPHC double tags.

Special projects have been integrated, at times, to address relevant management issues. Modifications and improvements are made in response to fishery management changes, input by the industry and for cooperative research programs. Field staff in Canada observed the use of swivels on snap gear by the fleet and to assess the prevalence of this use, collection of these data began in 2001. The use of swivels on snap gear among U.S. fishermen was later observed by field staff with collection of this information being extended to cover all areas, in 2003.

The IPHC has a history of working collaboratively with other agencies. In the past, by-catch information was collected on Canadian logs for the Department of Fisheries & Oceans in Canada. Additionally, the IPHC has a Statement of Work with the National Marine Fisheries Service Auke Bay Lab Stock Assessors and has provided sablefish logbook information from vessels participating in the Individual Fishing Quota fishery in Alaska, and has been willing to release the catch information, since 1999.

Where do we go from here? The IPHC is interested in assessing whether the presence of swivels on snap gear has an effect on the catch per unit effort. Whale depredation, as well as shark interactions, has also grown as concerns for the fleet and the IPHC is looking at ways to document and potentially deter these. GIS programming has enabled the conversion of location information to IPHC statistical areas, that used to be done by hand, to be streamlined and sanity checks to be made. Data capturing options are currently being investigated and reviewed for use in the field. Rather than the traditional paper logbook, development of an electronic logbook option for the fleet is being worked on. This will not only facilitate the recording and transmission of catch data, it will also improve the accuracy of these data.

In closing, the IPHC is fortunate to work collaboratively and agreeably with other agencies (state, provincial and federal) both in the field and in the main office. Additionally, the success of, and accuracy of the data collected through, our monitoring program can be attributed to the continued support and the strength of our relationship with industry (both the halibut fleet and processors that receive their landings).

Comparisons of observed versus unobserved landings to verify maximum retention

Robert Jones[1]*, B. Bryant[2] and Y. Gao[2]

[1] *Northwest Indian Fisheries Commission – USA*
[2] *Makah Fisheries Management – USA*

Makah trawl fisheries pursue two basic strategies – bottom trawl and mid-water trawl. In an agreement with the National Marine Fisheries Service and the Pacific Fishery Management Council, the Tribe has had an observer program in place since 2003 to monitor maximum retention. Maximum retention is defined as retention of all marketable species and all overfished species. The program has a target observation rate of approximately 15% of all trawl trips in a given year. Management is focused on avoidance of two species that have been designated as overfished: canary rockfish in both strategies and widow rockfish in mid-water trawls.

Comparisons of by-catch rates in observed versus unobserved landings by year (2003 – 2005) were conducted for each strategy to test for differences in retention of constraining rockfish species. Separate analyses (paired *t* tests) were performed for vessels that carried an observer and all vessels combined (i.e., including those vessels that had no observer coverage during the year). We also compared by-catch rates for two separate target strategies in bottom trawl (flatfish and Pacific cod) to examine whether by-catch was more prevalent in one strategy than the other. Two-tailed

Table B2.1: *Yearly comparisons of canary rockfish by-catch rates (measured as pounds of canary rockfish divided by pounds of target category) for bottom trawl vessels that carried an observer at least once during a season.*

Year	Target species	Mean by-catch rates		d.f.	*t*	*p*
		Observed	Unobserved			
2003	Primary flatfish	0.00121	0.00198	6	0.79	0.46
	Pacific cod	0.00202	0.00344	6	-0.60	0.57
	All Targets	0.00059	0.00113	6	-0.89	0.41
2004	Primary flatfish	0.00772	0.00343	5	0.79	0.47
	Pacific cod	0.03807	0.00312	5	1.19	0.29
	All Targets	0.00619	0.00127	5	1.15	0.30
2005	Primary flatfish	0.00470	0.00154	5	1.22	0.28
	Pacific cod	0.05022	0.00566	5	1.03	0.35
	All Targets	0.00265	0.00108	5	1.06	0.34

Table B2.2: *Yearly comparisons of canary rockfish by-catch rates (measured as pounds of canary rockfish divided by pounds of target category) for all observed and unobserved bottom trawl vessels.*

Year	Target species	Mean by-catch rates		d.f.	*t*	*p*
		Observed	Unobserved			
2003	Primary flatfish	0.00106	0.00143	16	-0.43	0.67
	Pacific cod	0.00176	0.00245	16	-0.38	0.71
	All Targets	0.00052	0.00085	16	-0.68	0.50
2004	Primary flatfish	0.00772	0.00750	14	0.03	0.98
	Pacific cod	0.03807	0.00663	5	1.07	0.33
	All Targets	0.00619	0.00330	14	0.64	0.53
2005	Primary flatfish	0.00470	0.00166	5	1.23	0.27
	Pacific cod	0.05022	0.00669	5	1.02	0.36
	All Targets	0.00265	0.00118	6	1.01	0.35

Table B2.3: *Yearly comparisons of canary and widow rockfish by-catch rates (measured as pounds of by-catch divided by pounds of yellowtail) for mid-water trawl vessels that carried an observer at least once during a season.*

Year	Species	Mean by-catch rates		d.f.	t	p
		Observed	Unobserved			
2003	Canary	0.00351	0.00289	2	0.27	0.81
	Widow	0.05353	0.03335	2	0.60	0.61
2004	Canary	0.00651	0.00213	5	1.81	0.13
	Widow	0.07209	0.06719	2	0.30	0.78
2005	Canary	0.01030	0.00312	5	1.26	0.26
	Widow	0.08868	0.04733	5	1.62	0.17

Table B2.4: *Yearly comparisons of canary and widow rockfish by-catch rates (measured as pounds of by-catch divided by pounds of yellowtail) for all observed and unobserved mid-water trawl vessels.*

Year	Species	Mean By-catch Rates		d.f.	*t*	*p*
		Observed	Unobserved			
2003	Canary	0.00351	0.00124	2	0.72	0.55
	Widow	0.05353	0.07671	9	-0.39	0.70
2004	Canary	0.00651	0.00175	6	2.13	0.08*
	Widow	0.07209	0.05421	15	1.16	0.26
2005	Canary	0.01030	0.00503	6	0.87	0.42
	Widow	0.08868	0.04398	6	1.70	0.14
Difference in canary by-catch rates in 2004 was of borderline significance.						

paired *t* tests found no significant difference between observed and unobserved trips for vessels that carried an observer during the season in any year. Likewise, no significant difference was measured between all observed and unobserved trips for any given year; however, one comparison was borderline significant (Tables B2.1 – B2.4). This was likely due to an increase of higher-by-catch exploratory trips – which are used to verify low by-catch areas – in that year. By-catch was not predominantly associated with either target strategy for bottom trawl.

Combining maximum or full retention policies with an observer program to verify the accuracy of by-catch accounting can greatly benefit both the fleet and the resource. In other words, if observed by-catch rates are not significantly different than unobserved by-catch rates, managers can be reasonably certain that landings reflect total mortality for overfished species and fishermen can continue to access healthy stocks. This combination can also prove very cost effective where other programs might not be economically feasible (e.g., full observer coverage). With this method, estimates of total removals can be verified, by-catch rate estimates refined, and better preseason and inseason management can be achieved. In this case, the lack of significant differences between by-catch rates in observed versus unobserved trips shows that the maximum retention program is working and landings are a reasonable estimation of actual impacts.

At-sea observing using video-based electronic monitoring: an audit-based tool for fishing logbooks

Howard R. McElderry, Rick Stanley*, M.J. Pria, D. Edwards, D. Trager, G. Cormier and John Koolman

Department of Fisheries & Oceans – Canada

British Columbia's 350-vessel groundfish hook and line, and trap line fleet is moving toward management reforms that, in turn, require an at-sea monitoring program to account for all retained and discarded catch. The traditional approaches of using observers or using video-based electronic monitoring (EM) systems as an observer replacement, were dismissed for cost and timeliness issues. Instead, an audit-based monitoring approach was developed using data from EM systems to audit fishing logbooks. Under this plan, at-sea activities would be fully monitored using EM but only a random portion of data would be reviewed and compared with logbooks. Thus, the fisher logbooks remain the key data source for retained and discarded catch and the EM imagery provides the "radar trap" threat to encourage accurate catch accounting and offers fishers the opportunity to demonstrate that their logbooks provide accurate accounting.

Over the last four years, pilot studies have been carried out to develop EM methods, build acceptance within the fleet, and gather baseline data for the audit methodology. Fishing location and timing of fishing events in the fisher logbooks is first confirmed by comparison with EM GPS, winch and hydraulic sensor data. At-sea catch (retained and discarded) recording in the fisher logbooks is then confirmed by comparing with a random 10% sample of EM imagery. Landings data from independent offload observers provides greater detail of retained catch composition for comparison with fishing logbooks.

The mechanism of the comparison of fisher logbook to video results involves reviewing the video for 10% of the fishing events by a third party to derive a piece count by species or species group for each event. The difference between each pairing of EM and logbook values is then scored from 0 – 10 as shown below.

Difference (EM – Logbook)	Difference (EM – Logbook/EM)	Score
< 30 pieces	> 30 pieces	
0 – 1 piece	0 – 4*%	10
2 – 3 pieces	5 – 10%	9
4 – 6 pieces	10 – 20%	8
7 – 12 pieces	20 – 30%	7
13 – 15 pieces	30 – 40%	5
14 – 18 pieces	40 – 50%	3
19 – 30 pieces	> 50%	0

If all of the scores are above 9, the fisher logbook catch data are considered acceptable and the audit process is complete with minimal costs. If there are any scores below 9, but the average of all scores is 8 or higher and all 'total rockfish' scores are 7 or higher, then the fisher logbook is accepted but additional investigation takes place (at the fishers expense) to improve fisher data quality on subsequent trips. If the

average score is less than 8 and or rockfish is less than 7, fisher logbook data are considered unacceptable, leading to additional investigation for feedback, escalating analysis costs and possibly 100% review of the video or the vessel having to take an observer on future trips.

While this process has added considerable complexity to the monitoring of the fishery, it appears that using the random review of video as a deterrent rather than attempting 100% review to build independent catch estimates has significantly improved the quality of information from the fishery at about a third the cost of at-sea observers or 100% review.

A review of fish monitoring programmes in Ghana

RoseEmma Mamaa Entsua-Mensah[1]* and Papa Yaw Atobra[2]

[1] *Water Research Institute, Achimota – Ghana*
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The fishing industry is one of the major sources of employment in Ghana. Fish provides 60% of the protein in the diets of Ghanaians. And Ghana has a tradition of a very active marine and fresh water fishing industry. Unfortunately the level of Ghanaian fish production is below what should provide for food security. This has been due to over fishing; large scale poaching by foreign vessels and more sophisticated gears used by the fishermen.

All fleets of the marine fishing industry exploit juvenile fish in some form. The artisanal purse seine (*poli*) and beach seine gear exploit juvenile sardinellas during certain periods of the year. The purse seine exploits adult sardinellas during certain periods when these species move into coastal waters to spawn. During the non-upwelling periods the *poli* targets the anchovies and juvenile sardinellas, which are in coastal waters. The beach seines operate from the beach and exploit adult sardinellas during the upwelling period and anchovies, juvenile sardinellas and juvenile demersal fishes during the non upwelling periods (Mensah *et al,* 2006).

The equatorial part of the Gulf of Guinea is the spawning grounds of commercially important tuna species such as yellowfin tuna and bigeye tuna. Thus there are a lot of juvenile fish in Ghanaian waters. The tuna vessels, especially bailboats that operate in coastal waters exploit a mixture of juvenile and adult tuna species.

The *Fisheries Act 625* of 2002 has created an Inshore Exclusive Zone (IEZ) that is, waters of depth less than 30m. The Act forbids trawling in the IEZ. However, the industrial trawlers, in a bid to exploit more cephalopods for export operate in the IEZ and in the process catch a lot of juvenile fish. However it is in this same area that the artisanal fishers operate. This situation creates a lot of conflicts which results sometimes in loss of lives and property as the trawlers sometimes spoil the nets of the artisanal fishers. There is a provision in the *Fisheries Act* which provides a platform for arbitration.

A Monitoring Control and Surveillance Division (MCS) was established under the Fisheries Sub Sector Capacity Building Project in with the *Fisheries Act 625* in 2002 section 15(d). In Section 94 the duties of the Monitoring, Control and Surveillance Unit were spelt out as:

- Monitoring, control and surveillance of all fishing operations within the fishery waters by whatever appropriate means including the management and running of a satellite base station for using satellite communications for data transmission relating to the activities of foreign vessels licensed to operate within the EEZ; and
- The enforcement of this Act, Regulations made under the Act and any other enactment relating to the regulation of fishing activities in Ghana.

The MCS Division with the collaboration of the Ghana Navy conducts sea patrols to ward off industrial fishing vessels from the 30 m depth Inshore Exclusion Zone reserved for artisanal fisheries. The Division also carries out quayside inspections of industrial vessels at the fishing ports of Tema and Takoradi for valid fishing licences, fishing gear, skipper's certificate, logbooks and crew composition.

The Observer programme is one of the most important components of the MCS programme. Its first objective is to control. Information gathered by the Observers is reported to the MCS Unit Operation Centre. The observers are responsible for obtaining data from the fishing vessels for fishery administration. Any violation is immediately noted and reported using the vessels communication equipment. Crews must

provide assistance to observers as specified in the law. Obstruction is a violation. The second objective of the program is to assist the Marine Research Department by collecting statistical and biological data. The Research Department contribute to the preparation of the sea trips by deciding on the type of data (statistical or biological), number of species checked and frequency of sampling.

The following are some of the problems and challenges faced by the Monitoring Control and Surveillance in Ghana; financial and budgetary constraints; lack of adequate human resources; lack of understanding of MCS by politicians and fishers; laws which are not enforced; lack of cooperation from the judiciary; lack of political commitment; absence of an MCS programme in neighbouring waters; lack of motivation and inadequate training programmes.

The Volta Lake was created in 1964 to provide hydroelectric power for Ghana; the Lake also provides water for irrigation, transport and fishing. It is the principle source of fish protein for the inland population. The fish species list for the entire lake shows about 27 families, 67 genera and 138 species The top ten species in terms of landings according to Braimah who has worked on the fisheries of the lake for a some time are as follows; Tilapia (38.1%), *Chrysicthys* sp. (34.4%), *Synodontis* sp. (11.4%), *Labeo* sp. (3.4%), *Mormyrids* (2.0%) Other species of commercial importance are *Clarias* sp, *Schilbeids*, *Odoxathriss*a sp. and *Bagrus* sp. Most of the landed fish is processed (smoked, sun dried, salted and fried) while the remaining is consumed fresh.

The fishermen fish throughout the year and use various types of illegal gear. Some of these are bamboo pipes, beach seines, purse seines, mosquito nets, traps, and poisoning to harvest juvenile fish. Bamboo pipes target gravid female *Chrysicthys* species; they go there to spawn and are trapped in the pipes. The MCS on the lake is mainly education and enforcement. Community Based Fishery Management Organisations have been formed to educate the fishers. Enforcement is done with the help of the Ghana Navy.

There are many reasons for the excess fishing effort and capacity and the subsequent depletion of the coastal fisheries in Ghana, but first and foremost is the inherent open access nature of these fisheries for artisanal operators, and the difficulties Government and stakeholder institutions have had managing the use of these common property resources. It is well known that common property resources tend to be overexploited.

Ghana has done well to put a Monitoring Control and Surveillance Unit in place as well as starting an Observer Programme. This is a good start but some of the challenges facing MCS in Ghana are the absence of an operational manual and a code of operation. A comprehensive insurance cover should be provided for other equally risky MCS operations apart from those at sea. There is inadequate training for personnel and not enough observers. It is important that there is an effective training programme for staff working on MCS. The Fisheries Regulations should be strengthened. There should also be well defined sources of funding, at the moment the budget for MCS is woefully inadequate. It is also important that Ghana has good networking and collaboration with her neighbours and the creation of comprehensive information management systems on vessels operating in the region.

Ecosystem based fisheries management and the convergence of electronic monitoring systems and traditional observer functions

Robert (Bob) Stanley*, L. Kranz, Bruce Wallner, Gavin Begg, Steve Auld and T. Lamb

Australian Fisheries Management Authority – Australia

Abstract

Ecosystem based fisheries management requires a comprehensive understanding of many disparate elements over and above the more traditional single species based systems of the past. In this new management regime, there is a need and opportunity for the use of electronic monitoring systems to enhance observer functions. The adoption of electronic technologies allow observers to better collect data that addresses the ever widening needs relative to by-catch, benthic species, predator prey relationships, protected species interactions and fishing effort. These increased and diverse

data needs are best achieved by observers in many cases. However, electronic monitoring systems potentially release observers from the tedium of many repetitive and time-consuming functions and also the need in some cases to monitor for rare or infrequent events. The needs for the development of additional observer competencies are highlighted, as is the potential these opportunities offer observers in the area of professional development. Enhancement in fisheries data collections must be achieved in a period where the operating costs for the fishing industry are ever increasing. It will be incumbent on all at-sea data collection programs to be intelligent, integrated and cost-effective. We provide an example of such integration in Australia's Antarctic longline fishery.

Questions & Panel Discussion – Session B2 –

Dennis Hansford (National Marine Fisheries Service) to RoseEmma Mamaa Entsua-Mensah

Comment / Question:

It seems that you have an uphill battle in trying to address your observer coverage and I hope to talk to you further off-line because our national observer program has been through some of the same growing pains that you're currently going through and we may be able to help you with that. Also, you mentioned there is a fund that people pay into – is that the Ghanaians as well as the foreign fishers?

Response:

RoseEmma Mamaa Entsua-Mensah – It is called the Fisheries Development Fund and it is mainly for foreign industrial vessels.

Dennis Hansford (National Marine Fisheries Service) to Bob Stanley

Comment / Question:

With regard to your electronic monitoring data you talked about the confidentiality of the metadata – how does that come into play regarding the accessibility of the data by the public and is that a concern?

Response:

Bob Stanley – I don't see it as an issue at all – quite the opposite. We're in an environment where we need our data to be transparent but at same time present the data in a way where single or individual operators cannot be readily identified by those that don't need to know the information. Metadata gives you that opportunity because it allows you to access the data within defined boundaries. We heard earlier about the hoards of data that we've got that remain unanalysed and we need to start thinking about how we can make this information available. There are plenty of research students out there wanting to do PhD's and other ways to do something positive with the data, but at the same time we need to be careful about the level of access we give out to these people.

Gerry Sullivan – Public access to information is important, but in providing that access, it is doubly important to protect the privacy of the source of the data and there are a number of techniques that can be followed to accomplish that. One way is to aggregate the data, or to strip out identifying information. You can also segregate your data repositories into blocks of information and only allow public access to certain blocks of the data. We need to be careful about not being afraid to make the data accessible but ensuring that the identity of the source of the data is not available.

Rick Stanley – This is a really complex issue and there are no easy solutions but I do think it can be solved. An interesting example of the complexity is in the condition where industry pays for the collection of the data and then hires a consultant to analyse the data – in this situation it is untenable for DFO not to provide the information to the consultant in its full resolution given that the fisher has paid for the data and hired the consultant. Yet, if you allow that exception, you're picking and choosing who is analysing the data. It is very hard not to convey fishing information in a generic sense and sanitising the information is only part of the solution.

Libby Fetherston (The Ocean Conservancy) to Bob Stanley and Rick Stanley

Comment / Question:

Do you have any comments about how you can scale-up electronic monitoring systems from pilot projects to using it fully across a fishery? I would also be interested in hearing Wes Erikson's thoughts on this from an industry perspective.

Response:

Rick Stanley – We presented industry with an outline of the basic principles for monitoring and asked them to work out the best solution and they went away for a couple of years and worked through the problems. It has been interesting to watch the evolution and John Koolman has written a paper which looks at this interaction within industry (Koolman *et al.*, 2007). For instance, when industry was presented with a difficult problem they couldn't solve straight away (e.g., 100% observer coverage), they would put it on the shelf and proceed with other things. After a while, they agreed on ITQs and then realised that, if one person had a quota for a particular species, then that species would have no value on the open-market unless the catches were being monitored and so this led them to agreeing on 100% observer coverage. When that moment came, it just moved from there and there was no more debate. Another example is the 100% rockfish retention – industry became aware that the electronic monitoring systems couldn't separate some of the species of rockfish and so they needed to be manually identified – they also realised that most of the rockfish were dead when they came onboard and so they had no arguments about storing the fish for identification. But, if DFO had asked them to do that there would have been uproar about the available space in their holds, etc. and it would have killed the process. It worked because industry solved the problem themselves – it was their idea and it flowed out of the principles they had established.

Bob Stanley – My perspective is a little different. We've gone through a series of proof-of-concept trials to test the technology to determine if it is applicable and to ensure it does not deliver disappointments in its early stages. Some of our sectors are keen to use the technology because it will save them from having an observer onboard and they are convinced it will be cost-effective and we want to maximise what we can get from the significant level of support that we currently have from industry.

Wes Erikson – Rick Stanley has summed-up the situation very well. Basically, industry had to come to the conclusions about how best to monitor themselves and, if DFO had told us how to do it, there would have been a revolution. We needed to thrash through the problems and come up with the solutions ourselves. We chose electronic monitoring over observers because most of our small fleet don't have space for an extra person onboard, nor can they afford the costs associated with having an observer which aren't already reflected in the set costs (e.g., feeding the observer). The solution had to come from everybody as opposed to one person, but we also wouldn't have done it without the hammer hanging over us.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment / Question:

What proportion of our fisheries do we currently have economic information for (e.g., the value of the fishery, the costs of monitoring and managing the fishery, and the subsidies to the fishery) and is it possible to calculate a comparative economic value?

Response:

Bob Stanley – In Australia, the Bureau of Statistics and ABARE publishes gross value of production figures for each of the Commonwealth-managed fisheries and we also have indices on the costs to industry and the information on the costs of monitoring and management.

Minling Pan – It depends on the fishery. In the Trench, the larger fish are always eaten first and the smaller ones are the substitute when the big fish are gone. Certain species will also be more valuable than others, for example big-eye and bluefin have traditionally been best for sashimi and yellowfin and albacore are the substitutes. Another example is in the Hawaii Longline fishery which has traditionally targeted yellowfin and big-eye because they are more

valuable than other species (e.g., 50 cents/pound for mahi-mahi compared with $4/pound for bigeye and yellowfin), but since one of the processors has found a way to process the mahi-mahi to sell to restaurants, the value of those fish has become much higher.

Willy Dunne (Alaska Department of Fish & Game) to Lara Hutton

Comment / Question:

I think your agency has done a really good job at managing halibut, but I noticed in your presentation that there was a focus on the halibut and no mention of the other species that are caught. We've been concerned about by-catch of species such rockfish, lingcod, Pacific cod, sharks and skates in our Alaskan state-waters during the halibut fisheries and we currently account for all the retained by-catch, but have no way of accounting for the discarded by-catch. I was wondering if you have any ideas on that or if your agency has any future plans for collaboration with other agencies on accounting for discarded by-catch in the halibut fishery?

Response:

Lara Hutton – Our agency currently collects information on sablefish catches in Alaskan waters under a Statement of Work (SOW) with the stock assessors at Aulk Bay lab, NMFS. This may be considered retained by-catch as they are caught while the fishers are targeting halibut. Under the SOW, we also collect this information for sablefish targeted sets and for sets with combined targets. In the past, we have also worked collaboratively with DFO to collect by-catch information on halibut trips. We have a history of working collaboratively with other agencies to collect that information, including ADFG and would consider doing it again if there is a need or interest.

Willy Dunne – We are interested but we don't have much money.

Lara Hutton – Yes, that is a key factor.

Wes Erikson (Commercial Fisher) to Robert Jones

Comment / Question:

I've been thinking about when I had observers onboard and, as I mentioned before, I would sometimes change my fishing patterns so it would appear that my by-catch was the same on an observer trip as on an unobserved trip. But it has just struck me what would have given me away – did you look at the rest of the trips that were being delivered. Did you compare the unobserved trips with observed trips? More specifically, did you look at the composition of catch and the weight of target species compared to fishing time?

Response:

Robert Jones – No, management are usually only keyed-in on the species of concern. For example, we centred on canary because that is what management is focussed on and what the fishers are trying to avoid in their operations. There will be fluctuations in the target catch simply based on availability, but the trip ends when they hit the 300 pound limit for canary. Also, the presentation I gave was about a side project that we did with some extra time and available data and is not the focus of management.

SESSION B3

How to address information requirements for fisheries that are difficult to monitor?

(a concurrent session with Work Group 3)

Moderator:	
Bruce Wallner	*Australian Fisheries Management Authority – Australia*
Speakers:	
Elvira Ynion-Adan	*Mindanao State University – Philippines*
Jason Vestre	*West Coast Groundfish Observer Program – USA*
Stephanie Rowe	*Department of Conservation – New Zealand*
Ivy Baremore	*NOAA Fisheries, Bottom Longline Observer Program – USA*
William Macbeth	*NSW Department of Primary Industries – Australia*
Gavin Begg	*Australian Fisheries Management Authority – Australia*
David Balfour	*Department of Fisheries & Oceans – Canada*

Illegal fishing and estimates of the total fish production in Panguil Bay, Philippines

Elvira Ynion Adan

Mindanao State University at Naawan – Philippines

Socio-economic and ecological assessments of twelve Philippine bays were done in 1990, 1995 and in 2005, firstly, to characterise and assess their status and the status of their fishery resources, and secondly, to evaluate the impact of fisheries conservation and management intervention projects implemented in these areas. One major output of the assessment was the estimate of the annual total fish production (TFP) of every bay. Based on the results of the previous and latest assessments, it was discerned that total fish production in the bay had generally declined. The fishermen themselves acknowledged the decline when they reported decreasing volumes of fish catch over the years.

The TFP was estimated using data from household interviews and from fish landing monitoring data. Production estimates were by fishing ground and by gear type, and the estimate of the total fish production was derived by multiplying the average catch per category by the category's corresponding raising factor. This estimation method led to several estimates of the TFP that were significantly different from each other and which were generally deemed to be underestimates of the true value of TFP. One of the underlying reasons for the discrepancy was the difficulty in determining the total number of gears and of fishermen using the different gears. The reliability of the different sampling frames were generally questionable and existing data are still subject for verification. For example, randomly selected respondents who happened to use illegal gears did not generally admit to using said gears, nor did they admit to catching more fish than those using traditional methods of fishing. That illegal fishing existed was evidenced by the high degree of awareness about its existence. In Panguil Bay, for example, 73% of the household respondents admitted that illegal fishing activities are still practiced by some fishermen in the bay. However, there was the tendency of respondents to pinpoint to the fishermen of the adjacent villages as transgressors to downplay or divert attention away from their own illegal activities; perpetrators, however, were found to come from both within and from without their

respective fishing villages. More specifically, dynamite fishing remained to be actively pursued; more than half of the respondents reported its continued use in the area. Data as to its number, or the number of fishermen engaged in illegal fishing, however, is not available.

The TFP estimates could be improved if the number of fishermen and gears falling under this category, and the proportion of their catch to the total catch could be determined and incorporated in the estimation process. A census of fishermen and the types and number of gears they use is needed to improve the sampling frame. This could be done at the village level in coordination with local government officials. For illegal fishing activities, continuous surveillance and monitoring of illegal fishing activities should be reported to determine their extent. To do these, local government units should allocate funds for monitoring activities and the necessary logistics to sustain law enforcement.

Monitoring small scale commercial fisheries

Jason Vestre

West Coast Groundfish Observer Program – USA

Small-scale commercial fisheries such as those fishing for neashore rockfish using hook and line on skiffs or kayaks, the longline dory fishermen of Newport Beach, California or small open access longline vessels along the Pacific Coast have often been overlooked or dismissed as unobservable. While it seems individual boats in these fisheries have minimal impact, a fleet of small boats in a small area or along an entire coastline can have a substantial impact and their practices should not be overlooked.

A small-scale commercial fishery is one that has smaller vessels (two to ten meters), fishes short trips of one to two days, lands typically less that one metric ton per trip and uses many different gear types.

Currently, in the West Coast Groundfish Observer Program (WCGOP), observers will monitor any vessel 18 feet or longer with adequate space and weight capacity to carry an observer. Many problems occur when attempting to monitor small-scale commercial fisheries. The primary problems associated with observing small vessels are space limitations, vessel weight limits, crew size and safety.

One such small fishery, the California Nearshore fishery, targets long-lived rockfish (*Sebastes* spp.) as well as cabezon (*Scorpaenichthys marmoratus*) and lingcod (*Ophiodon elongatus*) in shallow depths along the California coast. It is a live fishery where fishers usually land 25 – 250 lbs per day and less than 2,000 lbs in a two month trip limit period.

In 2006, the California Nearshore fishery had 329 potentially active licenses. The program selected only 129 of these vessels. This selection was made by excluding those licenses that were previously inactive, those showing landings of less than 1,000 lbs in the 18 months prior to the 2006 selection and finally, any license using a vessel less than 18 feet in length. Of the 129 selected vessels, 61 were observed for a two-month period and landed approximately 178,000 lbs during the entire year. Sixty-eight vessels were excluded from observer coverage due to space constraints, size or safety concerns. The remaining 61 vessels were observed for a two-month period and landed approximately 178,000 lbs during the entire year. 68 vessels were not observed. They landed approximately 211,000 lbs. While these total landings from this fishery represent only a fraction of a percent of the total west coast groundfish landings in 2006, it is some of the only at-sea data collected we have on these nearshore species.

Possible solutions for collecting data off these small vessels are electronic monitoring systems, dockside monitoring and observation from alternative platforms such as industry vessels, charters or monitoring program vessels. While dockside monitoring is currently used and supplies usable and necessary landing data, it lacks any verifiable trip and discard data often attained by the observer. Electronic monitoring is being used successfully in some fisheries, often requiring 100% retention of all catch. Logistical problems such as power source and placement of cameras are obstacles to using this method of monitoring. With alternative platform monitoring, a vessel is monitored at a safe distance and discard is transferred to the monitoring vessel directly or through a receiver. The retained catch is then sampled dockside. Though costly, alternative platform monitoring

seems to be a viable option to obtain good data from vessels too small to place an observer.

Assessing protected species by-catch across New Zealand inshore fleets

Stephanie Rowe* and Wendy Norden

Department of Conservation, Marine Conservation Unit – New Zealand

The Conservation Services Programme (CSP) places Government fisheries observers aboard New Zealand commercial fishing vessels in order to identify, monitor and, where possible, quantify protected species interactions with commercial fisheries. CSP aims to identify possible means for mitigating the incidental mortality of protected species.

In the past, placement of fisheries observers has focussed on large vessel (> 60 m), high value, deepwater fisheries with observer coverage levels ranging from 15% to 100% of various fisheries.

In contrast, there has been relatively little coverage of inshore fleets (< 26 m), which account for approximately 10% of commercial fishing harvest in New Zealand's Exclusive Economic Zone. As such, there is limited historical information on protected species incidental catch on inshore gill net, longline and trawl fisheries.

Protected species known to be caught in inshore fisheries include shearwaters (*Puffinus* species), shags (*Leucocarbo* and *Phalacrocorax* species) and penguins (*Eudyptula* species and *Megadyptes antipodes*) as well as the endangered Hector's dolphin (*Cephalorhynchus hectori*).

Observations of inshore fisheries from 1997 to 2002

Between 1997 and 2002, inshore observations were project driven and focussed on observing interactions of the endangered Hector's dolphin with inshore gill net and inshore trawl fishing operations. Observations were restricted to specific fishery areas in Pegasus Bay and Canterbury Bight in the South Island, New Zealand. Observers were requested to liaise directly with skippers and vessel managers to arrange at-sea coverage. Results of this work were variable in terms of the number of observer days achieved (see Table B3.1).

While CSP contracts the Ministry of Fisheries to place observers on deepwater fisheries, this existing relationship was not utilised to observe inshore fisheries between 1997 and 2000. Ministry of Fisheries observers were used for the 2001 and 2002 observations discussed above.

Issues that contributed to the inability of observers to achieve the planned observer days at sea included vessels exiting the fishery completely, vessels fishing outside the fisheries areas specified in the project objectives, the weather dependence of the fisheries and the lack of space on small vessels to accommodate an observer.

Following the declining success of the inshore fishery projects in the Canterbury region, this project was not undertaken in 2003.

Observations of inshore fisheries from 2004 onwards

Observations of inshore fisheries began again in 2004 and were no longer project driven or undertaken in specific fisheries areas. CSP aimed to establish ongoing observations of inshore gill net and trawl fisheries as well as intermittent observations of other longline fisheries, such as the snapper fishery.

Observers are contracted through the Ministry of Fisheries Observers Programme. Prior to an observer arriving in a port, Ministry of Fisheries staff contact local skippers and vessel managers to advise them of the placement of observers in the area. Observers then make contact with those operators upon their arrival to arrange days at sea. Observers are based in a port for up to several months at a time. As observations are not restricted to specific fisheries areas, observers are provided with a vehicle to travel between local ports.

Table B3.1 shows the planned observer coverage and the observer coverage achieved since 2004.

Observations of gill net fisheries during the 2005/06 recorded the incidental capture of three New Zealand fur seals (*Arctocephalus forsteri*) and three shags (species unknown). Observations were undertaken in the Southland and Nelson/Marlborough regions of the South Island. The 2006/07 fishing year is currently underway and, at 31 March 2007, one dusky dolphin (*Lagenorhynchus obscurus*), one Hector's dolphin and two yellow-eyed penguins (*Megadyptes antipodes*) had been incidentally killed in gill net fisheries. Observations were undertaken in Southland and Kaikoura.

Observations of the inshore trawl fishery began again in the current fishing year (2006/07) in the northern North Island and on the west coast of the South Island. At 31 March 2007, a number of petrels and albatrosses were recorded incidentally killed during trawling operations.

The snapper longline fishery was observed during the 2004/05 and 2005/06 fishing years, during which time observers recorded captures of four black petrels, as well as multiple captures of other petrel species.

By working with the Ministry of Fisheries, CSP is developing an ongoing observer programme aimed at monitoring the inshore area. For inshore gill net and trawl fisheries, observer coverage is spread throughout the country and rotated through various fishing areas each year. For area-specific fisheries, such as the snapper longline fishery, observations are intermittent.

The development of an inshore observer programme to monitor interactions with protected species in New Zealand is progressing, but there are still difficulties associated with monitoring small vessels. Ongoing difficulties include the higher cost of placing observers on inshore vessels, access to vessels, the difficulties of vessels accommodating an observer onboard and the weather dependence of the fishery. By working with inshore fishermen over the coming years, it is hoped that many of these difficulties will be addressed.

Table B3.1: *Observations of inshore fisheries from 1997 to 2002.*

	Date	Observer days planned	Observer days achieved	Protected Species Capture
Gill net observations	Oct 1997 – July 1998 [1]	150	125	8 Hector's dolphins (6 dead)
	Nov 1999 – Mar 2000 [2]	150	76 (54 in specified area)	1 Hector's dolphin (released alive)
	Jan – Mar 2001 [3]	100	20	None
Inshore trawl observations	Oct 1997 – July 1998	150	188	1 Hector's dolphin (dead)
	Nov 1999 – Mar 2000	50	75	None
	Jan – Mar 2001	50	3	None
	Jan – Feb 2002 [4]	50	6	None

[1] *Starr, P.; Langley, A. 2000. Inshore Fishery Observer Programme for Hector's dolphins in Pegasus Bay, Canterbury Bight, 1997/98. Department of Conservation, Wellington. http://csl.doc.govt.nz/CSL3020.pdf*

[2] *Reid, P.; Reid, J. 2002. Report on an Inshore Fishery Observer Programme in Pegasus Bay and Canterbury Bight, 1999/2000. Unpublished report to the Department of Conservation, Wellington.*

[3] *Blezard, R.H. 2002. Observations of set-net and inshore trawl fishing operations in the South Canterbury Bight, 2001. DOC Science Internal Series 85. Department of Conservation, Wellington. http://www.csl.org.nz/dsis85.pdf.*

[4] *Fairfax, D.P. 2002. Observations of inshore trawl fishing operations in Pegasus Bay and the Canterbury Bight, 2002. DOC Science Internal Series 86. Department of Conservation, Wellington. http:// www.csl.org.nz/dsis86.pdf*

Table B3.2: *Observations of inshore fisheries from 2004 onwards.*

	Gill net		Inshore trawl		Snapper longline	
Year	Planned	Achieved	Planned	Achieved	Planned	Achieved
2004/05	100	0	0	0	150	149
2005/06	100	83	0	0	100	58
2006/07	165	116*	250	80*	0	0
2007/08	233	-	258	-	0	-

(coverage achieved at 31 March 2007)*

Fisheries observers aboard small vessels: problems and considerations

Ivy E. Baremore

NOAA Fisheries; Southeast Fisheries Science Center, Bottom Longline Observer Program – USA

Among the many challenges associated with placing fisheries observers aboard small fishing vessels, safety is the biggest concern. There are two observer programs based out of the NOAA Fisheries Panama City Laboratory, both of which cover fisheries that utilise vessels under 35 ft in length and operate mostly in the southeastern United States. Small vessels present many unique problems, not the least of which is also the most obvious: lack of space. Some of the smallest fishing vessels can only carry three to four people, and placing an observer onboard leaves that vessel short one crew member. Observers are also burdened with increasing gear loads, not just for routine data collection and sampling, but also for protected resource protocols. Observers aboard small vessels are not necessarily provided bunks, therefore finding space for their survival suits, sampling equipment, EPIRB, turtle gear, and personal items also becomes a difficulty. Additionally, many smaller fishing vessels do not have facilities for personal hygiene, which leads to health and privacy considerations, especially for female observers. Some vessels do not carry life rafts, and observers cannot be placed aboard a vessel that is capable of fishing more than 20 miles offshore and does not have a life raft. The life raft problem then becomes an issue not only of safety, but of non-compliance. Complacency about safety issues among vessel owners and operators likely stems from the climate and relatively short fishing trips. Observer programs covering small vessels must overcome these obstacles in order to obtain vital fisheries data while maintaining observer safety.

Endangered Australian sharks and their interactions with line fishing in coastal waters

William G. Macbeth*, Charles A. Gray and Steven J. Kennelly

NSW Department of Primary Industries – Australia

Numerous species of shark are caught and retained or discarded in commercial and recreational line fisheries in coastal waters around Australia. In New South Wales (NSW), south-eastern Australia, a number of these sharks are included on the endangered species list, and several others are considered at risk of over-fishing. For example, the grey nurse shark (*Carcharius taurus*) is a critically endangered species that tends to congregate around particular inshore rocky reefs off the coast of NSW. Recent research has indicated that there may be fewer than 500 resident individuals remaining in these waters. Since many of these reefs are also productive fishing grounds for other finfish species, line fishing by commercial and recreational fishers has been identified as a key threatening process to grey nurse sharks.

The NSW Ocean Trap & Line (OTL) fishery, one of nine major commercial fisheries managed by the NSW Government, is a multi-method, multi-species fishery encompassing demersal fish and crab trapping, along with various line-fishing methods. These methods include 'setlining' and 'trotlining' (i.e., pelagic and/or bottom longlining), 'droplining' (i.e., vertical bottom longlining), handlining, jigging and trolling. A wide range of teleost species are caught by these line-fishing methods, including blue-eye trevalla (*Hyperoglyphe antarctica*), snapper (*Pagrus auratus*), banded rock cod (*Epinephelus ergastularius*), gemfish (*Rexea solandri*), yellowtail kingfish (*Seriola lalandi*) and grey morwong (*Nemadactylus douglasii*). Numerous sharks are also caught, such as wobbegongs (*Orectolobus* spp.) and gummy sharks (*Mustelus antarcticus*).

Ocean Trap and Line fishers are required to submit monthly catch returns that record the total quantity of catch by species and fishing method, along with the total number of fishing days by method. Despite these requirements, much of the catch is recorded as 'unspecified sharks' or 'unspecified teleosts' on the catch-

return forms. The reported catch of unspecified sharks was relatively stable until 2004/05 but almost doubled the following year (Fig. B3.1). Another increase is evident for 2006/07. In contrast, similar increases are not evident for other species or categories in the fishery (Fig. B3.1). Anecdotal evidence indicates that the majority of unspecified sharks comprise various species of whaler shark (Family Carcharhinidae) – a group for which relatively little is known about some aspects of their biology.

Environmental impact assessments of NSW coastal fisheries have identified the lack of local knowledge about the catches and biology of shark species as a major information gap for these fisheries. Consequently, high priority has been given to obtaining such information so that action plans can be developed and implemented to better protect these sharks. Furthermore, little is currently known about the general discarding practices for the commercial line-fishing methods used in NSW waters. The most appropriate strategy for obtaining the necessary scientific information to fill these gaps is via an observer-based research program.

A two-year observer program will be done between 2007 and 2009 to quantify the retained and discarded catches from four of the eight NSW commercial line-fishing methods – setlining, trotlining, droplining and handlining. These methods were selected because: (i) a large proportion of the total catch of unspecified sharks were attributed to set, trot and droplining (Fig. B3.2); and (ii) handlining had a large proportion of the total line-fishing effort during recent years.

Sampling will be stratified spatially into three regions of the NSW coast (North, Central and South), and temporally into four seasons per year (i.e., Spring, Summer, Autumn and Winter) (Fig. 3). A range of operational and catch data will be collected, with particular emphasis on collecting biological data for all sharks caught, and recording any interactions with endangered species such as the grey nurse shark.

The financial resources available for the program permits approximately 330 observer trips over the two-year period, which will equate to approximately 1.5% observer coverage. Detailed examination of fishing-effort data for the relevant methods in the three regions during each season of the past three years allowed the generation of a 'raw' sampling-design matrix as a first step towards determining the optimal distribution of replicate observer trips throughout the spatial and temporal divisions (Fig. B3.3 – italic numbers in parentheses). Note that, owing to their strong similarities with respect to gear configuration and operation, setlining and trotlining were combined as one method (i.e., set/trotlining).

It was decided that, for a given method, a minimum of four observer trips should be done for each spatial and temporal division (e.g., four droplining trips during Spring/Year 1 in the North region) to provide an adequate level of replication. Given this requirement, the raw sampling-design matrix was altered by redistributing trips from the 'trip-rich' method of handlining to the other two methods, and also among regions. This redistribution resulted in a final program design involving a total of between 12 and 16 fishing trips (droplining – 4 trips, set/trotlining – 4, and handlining – 4 or 8 depending on region and season), being observed in each region during each season of the two-year survey (Fig. B3.3 – non-italic numbers).

In conclusion, the main strengths associated with this line-fishing observer program are: (i) the scientifically rigorous collection of data regarding retained and discarded catches in the fishery; and (ii) addressing the lack of biological information regarding the shark species caught. The primary weaknesses of the program are: (i) it does not address all line-fishing methods used in the fishery (although the methods that target sharks are covered); and (ii) observer coverage is low by the standards of many observer-type monitoring programs in larger fisheries around the world. Despite these weaknesses, it is anticipated that the quality and quantity of data collected will be sufficient to provide a basis for more-informed management decisions regarding this fishery.

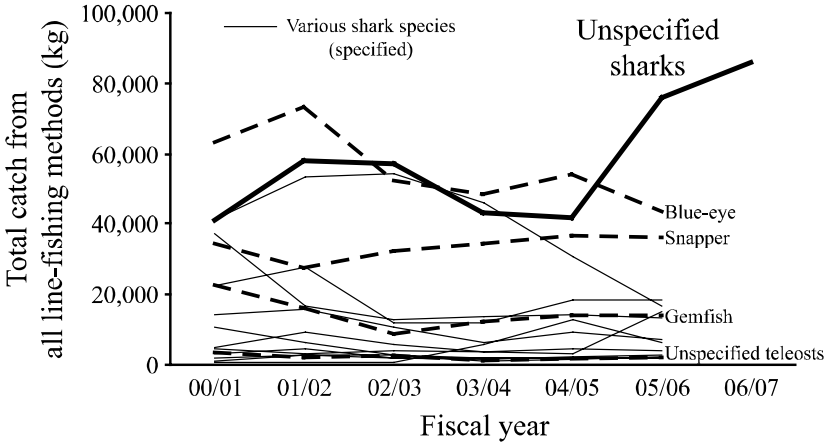


Figure B3.1: *Total catch (kg) of the main species or groups for all line-fishing methods through the period between June 2000 and March 2007 (by fiscal year).*

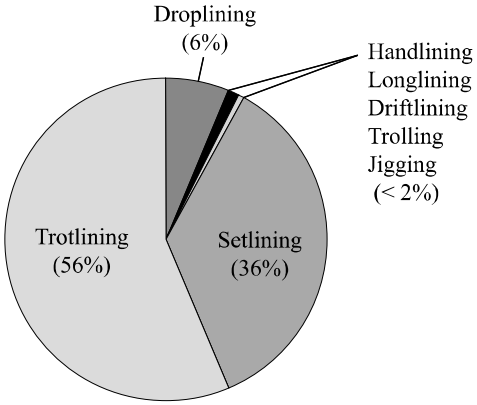


Figure B3.2: *Catch of 'unspecified sharks' by the line-fishing method. Data are for 2005/06 and 2006/07 combined (by weight; 166 tonnes in total).*

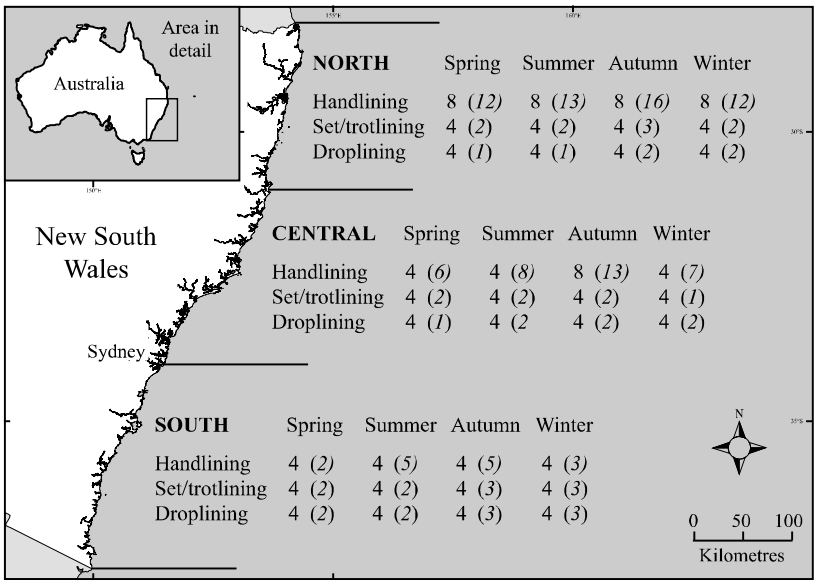


Figure B3.3: *Map of the NSW coast showing the three spatial regions for the commercial line-fishing observer program. The final distribution of replicate observer trips to be done by region, method and season each year is shown (non-italic numbers), along with the 'raw' sampling design matrix (italic numbers in parentheses).*

The use of observers in low value fisheries: What do 'snap-shot' observations provide?

Gavin A. Begg*, Bruce Wallner, Bob Stanley, Steve Auld, L. Kranz and T. Smith

Australian Fisheries Management Authority – Australia

Snap-shot observations provide a critical link to management in addressing information gaps for low value, typically data-poor fisheries. Management of these fisheries often suffers from a lack of independent data collections, where the costs of observer programs are considered prohibitive relative to the value of the resource. Ad hoc funded observer trips, however, provide a snap-shot of information for low value fisheries that can be used to establish a baseline of data for the development of effective management and monitoring arrangements. Information on target, non-target and protected species, habitats and wildlife interactions can all be gleaned from opportunistic, infrequently directed observer trips.

In Australia, Commonwealth fisheries are becoming subject to broader and more stringent data collection requirements than ever before as there is a mandate for the Australian Fisheries Management Authority (AFMA) to ensure fisheries are operating in an ecologically sustainable manner. Today's regulatory and policy environment imposes greater information demands on the management of these fisheries through ecological risk assessments, by-catch action plans, discard and harvest strategy policies. In addition, a recent Ministerial Direction in December 2005 imposed a requirement for enhanced monitoring of all Commonwealth fisheries, including those of low value, underlining the need for improved and more comprehensive data collection strategies. Coupled to this need is an ongoing legislative objective for efficient and cost-effective fisheries management.

AFMA manages more than 20 Commonwealth fisheries, worth an annual GVP of over $2.2 billion. The largest of these by value are the Northern Prawn, Southern Bluefin Tuna, Eastern Tuna and Billfish fisheries, and the Commonwealth trawl sector of the Southern and Eastern Scalefish and Shark Fishery; each of which has a structured observer program. Most of the other Commonwealth managed fisheries, however, are relatively low value (< $2M), with limited or no observer coverage. Over the past two years, Natural Heritage Trust (NHT) funds have been used to deploy observers in several of these low value, data deficient fisheries in a snap-shot manner to collect baseline information, with a focus on fisheries ecosystem, by-catch and protected species interaction data. The ongoing purpose of this activity is to enhance data collection across Commonwealth fisheries, particularly in those where there is a defined data gap and need for information.

The use of observers in this snap-shot, opportunistic fashion has provided valuable information for the management of several low value, typically data poor Commonwealth fisheries. Data collected from these observer trips have validated industry practices, assisted in the development of discard and harvest strategy policies, and enabled the benchmarking of information needs to feed into the design of future monitoring programs. However, the representativeness of data from snap-shot observations and questions about funding and the use of alternate data collection strategies for the ongoing monitoring of low value fisheries remain.

Monitoring integrated commercial fisheries – aboriginal and non-aboriginal

David Balfour

Department of Fisheries & Oceans – Canada

Abstract

Fisheries Management is extremely complex, responding to the interests of all resource users for access to fully subscribed fisheries while supporting conservation and sustainable development. Fisheries & Oceans Canada is moving forward with initiatives to support the implementation of integrated commercial fisheries on the Atlantic and Pacific coasts. This approach sees commercial harvesters (Aboriginal and non-Aboriginal) fishing under common and transparent rules where Aboriginal

interests for participation in these fisheries are addressed and where relationships are defined through annual agreements. Key to success is confidence by all resource users that reports reflect their actual catch as compared to planned shares or quotas, and in the data used to make fisheries management decisions.

This approach requires some new ways of working together based on respect and cooperation supported by credible, accurate and reliable monitoring and catch reporting data. New and innovative approaches to monitoring, auditing and tracing fishing activity in integrated commercial fisheries need to be implemented in a way that all resource users see stability and certainty in access and collectively plan and manage the harvest to maximise its value. Principles of risk management and eco-labelling need to be applied in a consistent way regardless of the individual resource users collectively forming the integrated fishery. This paper will address the key outcomes of integrated commercial fisheries and its multiple benefits to all resource users and the Canadian public.

Introduction

This paper will discuss the value of managing fisheries monitoring information needs as a total system where the data management cycle is effectively integrated with the fishing cycle, taking advantage of key opportunity points for data capture at source, whether through the use of observers or other monitoring techniques and platforms, so that data of the highest integrity, quality and timeliness are available to support the management of an integrated fishery. In turn, all resource users will see greater stability and certainty in access to the resource while at the same time strengthening long-term resource sustainability and industry viability. Using the lower Fraser River experience as an example of work-in-progress, this paper will outline the fundamental principles and elements of an integrated commercial fishery, as a basis for eventual broader application to Canada's commercial fisheries at large.

Key message

Successfully integrated commercial fisheries and effective co-management based on transparency, trust and respect is critically dependent on the availability, access to and sharing of timely, credible, accurate and reliable fishing activity data. With improved confidence by all commercial fishery participants in the integrity and reliability of monitoring information agreement can be reached on fair and appropriate co-management strategies.

Fisheries & Oceans Canada's (DFO) fisheries monitoring and information management vision and strategy directly target the generation of accessible and shared 'actionable information' designed for making more informed decisions in time to make a difference in the effective monitoring and management of Canada's integrated commercial fisheries. The Government's fisheries management policy objectives cannot be achieved without an underlying robust and complete information management regime. Accurate and credible information is a key factor in participants taking a greater role in the management of the fishery. Well-monitored integrated commercial fisheries are fundamental to the renewal of Fisheries Management.

DFO is currently pursuing policy renewal and positive change in relation to co-management and integrated commercial fisheries in the context of the Fraser River experience with a view to eventual adaptation and application of these policies to other Canadian fisheries. These policies are largely based on the operating principles that fisheries management decision-making processes must be, and must be seen to be, fair, transparent and subject to clear and consistent rules and procedures and that operational decision-making affecting specific fisheries will normally be made as close to those fisheries as possible, and will primarily involve resource users.

Conclusions

The concept of integrated commercial fisheries offers all parties of interest, whether commercial fishers, Aboriginal or DFO an effective means of co-management based on transparency, trust, fairness. Improved confidence by all commercial fishery participants in the integrity and reliability of fishing monitoring information will strengthen our capacity to reach agreement on fair access to the fishing resource while strengthening long-term resource sustainability and industry viability. Greater stability and certainty in access to the resource will, in turn, strengthen long-term resource sustainability and industry viability.

Better quality and more timely and complete monitoring information of the highest integrity is the key to achieving full and open transparency of all fishing activity and increasing the collective confidence that all commercial fishery participants are being treated fairly and equitably. Common and transparent rules based on agreed fishery monitoring and catch reporting standards allow monitoring programs to focus more on enhancing accountability and strengthening enforcement through improved catch reporting and pre- and post-landing tracking (traceability).

Accessible, shared, accurate and credible 'actionable information' designed for making more informed decisions in time to make a difference is key to all participants being able to take a greater role in the management of the fishery.

Questions & Panel Discussion – Session B3 –

Bob Trumble (MRAG Americas)

Comment / Question:

We recently completed a series of pilot observer programs for the U.S. Virgin Islands and, except for the temperature of the water, it was similar to Jason's fishery – 20ft boats and open outboards. We ran a pilot to see what limitations there were on observer coverage and what we could actually do with observers. We found we couldn't get observers on many of the boats and so, as part of the design, we set up a program called 'Captain Samples' where we had the skipper bring one cooler bucket of sorted/retained catch and another bucket of discarded catch to our observer on the shore. To my surprise, there were no differences between the 'captain samples' and the samples that the observer collected at sea. I'm usually very suspicious of samples collected by fishers but these fishers worked really hard at it and we even had fishers volunteer to have their catch sampled who had never participated in a sampling program before. Obviously the users of the data have to decide whether the potential biases would make it more valuable to have some data with flaws than no data at all, but I would be interested to hear comments from anyone that has had experience with commercial fishers collecting biological samples or whether a commercial fisher sampling program could work in some conditions.

Response:

Gavin Begg – I've also been involved in a set up where the boats were either too small or it was too costly to have an observer onboard. It becomes a decision about why you are collecting the data. For example, industry samples can be quite effective for simple data on age and growth but not as effective for discards and by-catch – it is a credibility issue. I also think most industry members know where things are heading and they do what they can to participate.

Bruce Wallner – We also did some trials in the prawn trawl fisheries in Australia to characterise by-catch and the composition of the discarded component of catch – we got crews to box up some of their non-retained catch, freeze it and post to us for processing. This was an interesting exercise and a good start-up but it was prohibitive for ongoing monitoring. There are other situations where crew sampling can work well such as for defined data on the size class of prawns, particularly where the opening dates for the season are geared to this and so there is a strong motivation from industry to participate simply because their business is dependent on it.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment / Question:

The problem is that by-catch can sometimes come in very low doses and then other times you hit a jackpot and you have a huge by-catch. The reporting can be fair and honest when the circumstances are normal, but you may lose the jackpots and sometimes the jackpots are the ones that make a difference.

Response:

Bruce Wallner – Yes – that is an excellent point and one of the issues that Will and Stephanie eluded to with respect to endangered species (i.e., how to sample species that are very occasional).

Lisa Borges (European Commission)

Comment:

I have a different example from the Dutch pelagic fishery, where industry didn't trust our observer data so they did their own sampling program (self-sampling). We compared the data and there were no differences and now we are actually planning to continue the self-sampling as a way to increase our level of sampling. As a suggestion, perhaps we could include a topic at the next conference about self-sampling (e.g., how industry can help sampling and how to prove the validity of the data).

Response:

Gavin Begg – In Australia we have a crew-member observer program for the northern prawn fishery which came about as a direct response to the by-catch issue for turtles and sea snakes. The program is currently in place and is augmented by a small amount of observer coverage. There have been some problems with the program, for instance, a crew member needs to be taken off-line to collect information on these protected species and species identification can sometimes be a problem, but generally the program is working quite effectively and has provided some good information on the interactions with these protected species.

Bruce Wallner (Australian Fisheries Management Authority)

Comment / Question:

I would be interested to hear an industry view on the issue of self-sampling with respect to the credibility issue and the validity of the samples.

Response:

Wes Erikson – Every jurisdiction is different, but in my experience, no.

Daryl Sykes – The process for setting TACs in the New Zealand rock lobster fisheries is informed by industry-generated data which is based on fishery-dependent sampling. The quality and integrity of that industry-generated data is routinely bench-marked in a very open, peer-reviewed process. We benchmark it at sea with observer catch sampling data and we also benchmark it against mandatory catch-effort landings. I acknowledge that the fishery is unique because it is a single species fishery and there have been no issues raised in relation to by-catch, but it has proven to be a cost effective alternative to observer catch sampling for the nine rock lobster stocks in those fisheries that have adopted it.

Bruce Wallner – so it sounds like it can work if there is not too much baggage.

Bryan Wood (Fisheries & Oceans Canada)

Comment / Question:

Firstly, I would like to thank Adam, Ivy, Stephanie and William for adjusting my attitude for what is a small vessel and I commend your courage. I have also really enjoyed the emphasis on safety at this conference and I was wondering if anyone would care to comment on the safety aspects of sampling sharks from small vessels.

Response:

Ivy Baremore – Sampling is not a problem if the catch comes onboard dead. However, our gillnet boats do 'strike sets' which involve setting a net around a school of sharks and bringing the sharks onboard when they are alive. In comparison, drift nets are soaked overnight or for a few hours and so most of the sharks come onboard either dead or very close to death. During a period when the striking of sharks was more prevalent, one of the crew members was bitten quite seriously and after that happened, rather than taking sharks out of the nets on the boat, the fishers adjusted their technique and now take the catch back to shore in the net to allow time for the catch to die. We tell our observers to stay out of the way and not handle the sharks until they're dead.

Jason Vestre – Occasionally a shark gets caught on a longline from one of our small vessels. Often there is only one buoy attached to the line and, because the fishermen don't want to lose the rest of the line, they usually try to bring the shark close enough to the vessel to untangle it or do what they can to get rid of the shark. But this is also dangerous because it requires help from the observer to untangle the shark and so the weight from all the crew is on one side of the vessel which can cause it to swamp.

Ivy Baremore – We also have observers on small longline boats and when a live shark is caught in these situations, the fishers do a 'kill cut' so the observers are not handling the sharks while they are alive and they do not touch anything until the whole line has been recovered.

WORK GROUPS

WORK GROUP 1

Observer Training

(held concurrently with Session B1)

Chaired by Scott Buchanan

Overview and Work Group mandate

The success of fisheries monitoring programs that utilise Observers depends largely on effective recruitment, training and development of each Observer. The design and implementation of an organised training program with adequate support materials is essential in establishing the high standards of performance required of monitoring programs. This importance is evidenced by the fact that this topic has continued to be a major theme in previous International Fisheries Observer Conferences and continues to be a major element of all Observer programs. As Observer programs mature they become more knowledgeable about the training and data collection requirements of a fishery and therefore the training and materials produced to support the program will continue to grow. Therefore, programs with an established history have the advantage of both inherent knowledge and advanced materials that aid in the training and development of Observers. New and developing Observer programs would greatly benefit from access to established knowledge and resources through a network of individuals involved in Observer programs internationally. This training network must include representatives of Observer programs that reflect the true diversity of international Observer programs to be effective.

Both mature and developing observer programs benefit from access to training curricula used by other programs, and having access to resources that may benefit their program without incurring considerable cost to develop something that already exists.

The mandate of the fisheries observer training work group leading up to the 2007 IFOC was to complete an inventory of how observer training is conducted internationally. Questionnaires were distributed to work group members and conference participants in order to inventory common training elements, international observer recruitment and training standards and international observer training resources.

Program summaries

Twelve different international fisheries observer programs completed fisheries observer training questionnaires. The number of days of coverage completed by these programs ranged from 20 to 46,000 annually. The number of fisheries observers trained by these programs ranged from 3 to 100 annually but was not directly proportional to the number of days completed by each program as shown in Figure WG1.1.

Observer recruitment

Effective recruitment of observers is the key to successful observer training programs. Many programs use a standardised application form, which aids the recruitment process. In addition extended recruitment periods increase the number of suitable applicants. Programs are advised to plan recruitment based on fishing activity. Work group members recommended that applicants be tested with real observer scenarios during the interview process, which helps to assess the suitability of each applicant.

Observer recruitment and training is organised in many different manners internationally. Both government fisheries agencies and private contractors are responsible for recruiting observers internationally. The organisation

responsible for recruitment is not always the same as the organisation that conducts training. Government fisheries agencies, private contractors, educational institutions and partnerships between organisations are responsible for observer training and development. Figures WG1.2 and WG1.3 show the how recruitment and training responsibilities are shared between organisations in the international programs that completed questionnaires prior to the conference.

Observer training programs

The average at sea fisheries observer training program is 14 days based on the programs that responded to the observer training work group questionnaire. The number of trainers required to deliver observer training programs range from 1 to 11 with an average of 4.5 trainers and 18 trainees. The majority of training programs are conducted by a small number of dedicated trainers with additional subject matter experts from outside organisations. Figure WG1.4 shows the number of days required for observer training and the number of trainers dedicated to the delivery of each program that responded to the training work group questionnaire.

Core observer training programs elements

The core or required observer training program elements do vary with the mandate and design of each monitoring program. The actual time required to train observers for each core element will depend largely on the scope of the fishery. As an observer program matures and is more familiar with its subject fishery, the time required for the delivery of the training program may increase with the addition of enhanced training materials and modules.

Observer training work group members worked together to define the core training elements that each fisheries observer training program should ensure they completed with each new fisheries observer that joins their respective programs. These elements are listed and defined below:

- *Species identification* – identification of targeted and incidental organisms encountered in the monitored fishery.
- *Gear types* – Description of the fishing gear and electronic aids used by fishers in the monitored fishery ~ collecting fishing effort information.
- *Navigation* – How to collect and verify positional information in the subject fishery ~ definition of a fishing event.
- *Total catch estimates* – Techniques used to estimate the total catch size from a fishing event in the subject fishery.
- *Species composition estimates* – techniques used to estimate the catch weight of each species (taxa) captured from a fishing event.
- *Catch utilisation estimates* – Techniques used to estimate the weight of catch that is retained and released in the subject fishery.
- *Random sampling* – techniques used to collect samples of the catch in a fashion that is representative of the catch.
- *Biological sampling* – How to collect and perform the biological samples required by the mandate of the monitoring program.
- *Data reporting* – How to report catch, biological and compliance data collected in the subject fishery.
- *Fisheries management* – A description of the current management regime of the subject fishery and the related observer duties that fall out of this.
- *Safety* – Marine emergency duties training and practical information on how to perform observer duties in a safe manner aboard commercial fishing vessels.

First Aid training

- *Compliance monitoring* – Familiarisation with the regulations of the subject fishery. How to identify and report compliance issues.
- *Code of conduct* – Confidentiality of observer data, professional conduct, unbiased data collection.
- *Observer duties* – Prioritising observer duties and time management of each task.

Table WG1.1 outlines the average number of hours that the work group members allocate to training their fisheries observers for each core training element. This time includes introductory modules as well as testing and hands on experience for observer trainees.

Enhanced observer training programs elements

Enhanced training modules are developed as programs become more knowledgeable about their subject fishery and the work environment of their observers. These training elements

ensure that the program's observers have a higher level of understanding of the issues related to the fishery that the work in and are better prepared to deal with their work environment. Observer programs can use data auditing tools to identify data issues and develop training solutions, which may require cooperation between a number of organisations. These enhanced elements may be considered core elements depending on the mandate and maturity of the observer program.

Observer training work group members worked together to define the enhanced training elements that each fisheries observer training program should ensure they completed with each new fisheries observer that joins their respective programs. These elements are listed and defined below:

- **Program overview** – overview of the structure and administration of the program and agency.
- **Vessel orientation** – Hands on orientation aboard fishing vessel(s).
- **Marine mammal and seabird reporting** – how to identify seabirds and marine mammals and collect sightings reports.
- **Communications** – communicating with members of industry and what communications are required of the observer by their program.

Table WG1.2 outlines the average number of hours that the work group members allocate to training their fisheries observers for each enhanced training element.

Observer training program successes

A number of successful enhancements that have been implemented by observer training programs conducted by the work group membership include hands on vessel orientations for new fisheries observers, commercial fishery industry involvement in observer training programs and presentations by experts covering the uses of fisheries observer data. In addition, cooperation from other fisheries agencies and programs to enhance resource materials and the incorporation of adult learning techniques into training programs has improved the training programs conducted by the work group membership.

Observer training program resources

Work group members and conference participants were solicited for the training manuals, field guides, workbooks, exercise books and training videos that they use for their Observer training programs. A preliminary list of these resources is included at the end of this work group session report.

Observer career development

Work group members have outlined a number of initiatives that have been used to promote the professionalism and the career development of their observers. Initiatives include:

- Performing observer briefings, debriefings, upgrade and refresher training sessions.
- Encouraging observers to enrol in certified marine emergency duties training programs.
- Ongoing first aid certification.
- Relying on senior observers to conduct observer training, briefings and debriefings.
- Using observers to work as technicians on research surveys and new fisheries projects.
- Promoting observers to new positions within the program or organisation.

Observer training Work Group mandate

The observer training work group members provided their thoughts on a number of questions related to the purpose and direction of the work group. In addition, work group session participants provided their thoughts on these questions and helped to form the marching orders for the work group moving forward from the 2007 IFOC. A summary of the outcomes from these discussions was provided back to the conference and is outlined in the work group summary session.

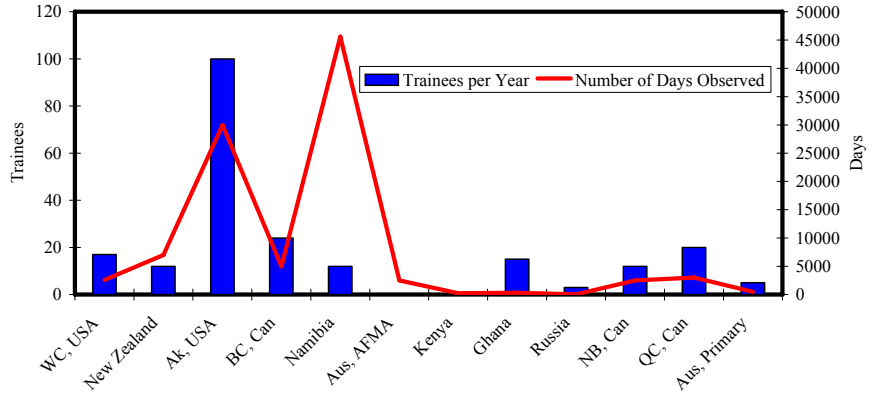


Figure WG1.1: *Overview of days and trainees per year by program.*

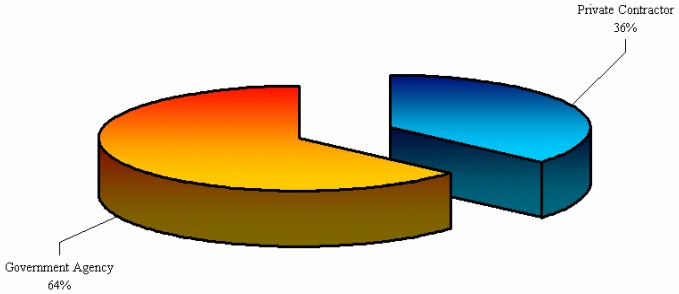


Figure WG1.2: *Organisations responsible or observer recruitment.*

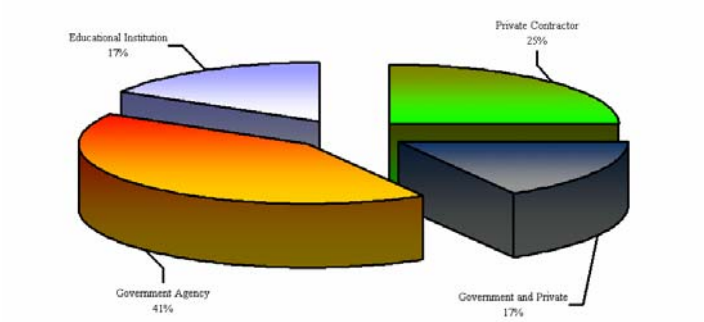


Figure WG1.3: *International observer training organisations.*

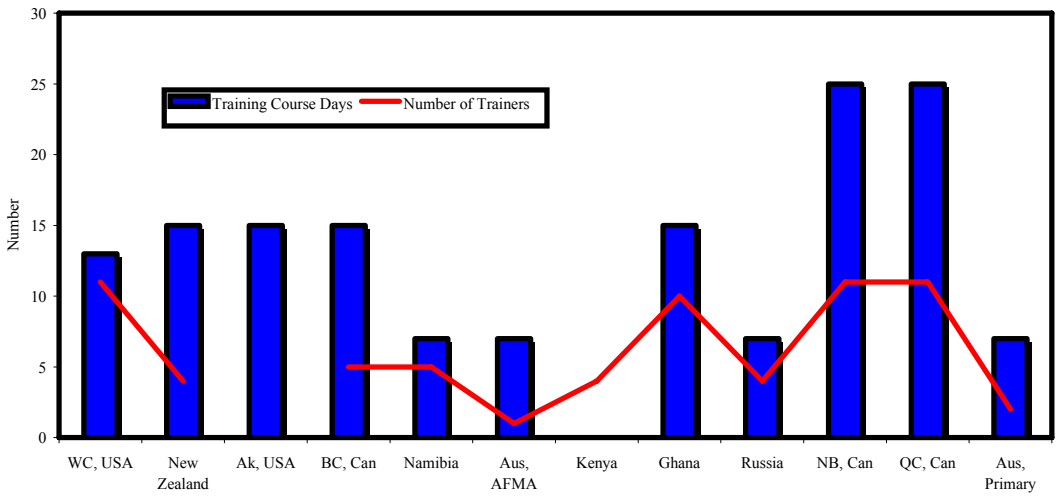


Figure WG1.4: *Number of days and trainers per training program.*

Table WG1.1: *Average hours for core observer training elements.*

Core Training Element	Average Hours
Species Identification	10.5
Gear Types	4.0
Total Catch Estimates	5.0
Species Composition Estimates	11.0
Reporting Catch Utilisation	3.0
Random Sampling	1.0
Data Reporting and Data Flow	7.5
Biological Sampling	4.5
Fisheries Management	4.5
Safety	14.0
First Aid	2.0
Code of Conduct	1.5
Navigation	3.0
Observer Duties	7.0
Compliance Monitoring	4.0
Total Hours	82.5

Table WG1.2: *Average hours for enhanced observer training elements.*

Enhanced Training Element	Average Hours
Conflict Resolution	2.5
Fisheries Science	1.5
Species and Habitat Associations	1.0
Program Overview	2.0
Vessel Orientation	2.0
Communications	3.0
Marine Mammal Reporting	2.0
Seabird Reporting	1.0
Total Hours	**15.0**

Topic	Title	Organization	Contact
Observer Duties	Groundfish Fisheries Observer Resource Manual	Archipelago Marine Research Ltd.	scottb@archipelago.ca
Observer Duties	West Coast Groundfish Observer Training Manual	Northwest Fisheries Science Center	http://www.nwfsc.noaa.gov/research/divisions/fram/observer/observermanual/observermanual.cfm
Observer Duties	North Pacific Groundfish Observer Program Observer Sampling	Alaska Fisheries Science Center	http://www.afsc.noaa.gov/FMA/document.htm
Observer Duties	South Africa Observer Manual	BirdLife South Africa	http://www.birdlife.org/news/news/2007/05/seabirds_south_africa.html
Observer Duties	Sea Turtle Observer Manual	NOAA Southeast Fisheries Science Center	http://www.sefsc.noaa.gov/seaturtlefisheriesobservers.jsp
Observer Duties	Commercial Shark Fishery Observer Program	University of Florida	http://www.flmnh.ufl.edu/fish/Sharks/csop/csop2.htm
Observer Duties	Northeast Fisheries Science Center Observer Program	NOAA Northeast Fisheris Science Center	http://www.nefsc.noaa.gov/nefsc/directorate/divisions/femad/fishsamp/fsb/
Observer Duties	CCAMLR Scientific Observer Manual	CCAMLR	http://www.ccamlr.org/pu/e/e_pubs/om/toc.htm
Observer Duties	Alaska Marine Mammal Observer Manual	NOAA Alaska Regional Office	http://www.fakr.noaa.gov/protectedresources/observers/mmop.htm
Observer Duties	Best Practices for the Collection of Longline Data to Facilitate Research and Analysis to Reduce Bycatch of Protected Species	NOAA, NMFS	http://www.fakr.noaa.gov/protectedresources/seabirds/llreport0307.pdf
Observer Duties	At sea hake manual	NOAA, NMFS	http://www.st.nmfs.noaa.gov/st4/nop/trainingmanuals/Northwest/at_sea_hake_manual_edit_final_web_2006.pdf
Observer Duties	Biological Data Collection Manual for Ministry of Fisheries Observers	Ministry of Fisheries, New Zealand	Andrew.France@fish.govt.nz
Program Design	Observer Programme Guidelines	FAO	ftp://ftp.fao.org/docrep/fao/005/y4390e/y4390e00.pdf
Species Identification	Incidental Fish and Invertebrates of British Columbia	Archipelago Marine Research Ltd.	scottb@archipelago.ca
Species Identification	The Identification of Commercial Groundfish Species of British Columbia	Archipelago Marine Research Ltd.	scottb@archipelago.ca
Species Identification	Guide to Marine Mammals of Alaska	Alaska Sea Grant College Program	http://seagrant.uaf.edu/
Species Identification	Northeast Pacific Flatfishes	Alaska Sea Grant College Program	http://seagrant.uaf.edu/
Species Identification	Noretheast Pacific Rockfish	Alaska Sea Grant College Program	http://seagrant.uaf.edu/
Species Identification	Biological Field Techniques for Lithodid Crabs	Alaska Sea Grant College Program	http://seagrant.uaf.edu/
Species Identification	Biological Field Techniques for Chionoecetes Crabs	Alaska Sea Grant College Program	http://seagrant.uaf.edu/
Species Identification	Field Guide to Sharks, Skates and Ratfish of Alaska	Alaska Sea Grant College Program	http://seagrant.uaf.edu/
Species Identification	Marine Mammals, Turtles and Seabirds of the Pacific	NOAA, Pacific Islands	http://www.fpir.noaa.gov/DIR/dir_mammal_turtle_seabird.html
Species Identification	Guide to Rockfishes of the Northeast Pacific Ocean	Alaska Fisheries Science Center	http://www.afsc.noaa.gov/race/media/publications/archives/pubs2000/techmemo117.pdf
Species Identification	Identification of Skates, Sculpins and Smelts by Observers in North Pacific Groundfish Fisheries	Alaska Fisheries Science Center	http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-142.pdf
Species Identification	A Field Guide to Alaskan Corals	Alaska Fisheries Science Center	http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-146.pdf
Species Identification	Sea Turtle Species Identification Materials	NOAA Southeast Fisheries Science Center	http://www.sefsc.noaa.gov/seaturtlefisheriesobservers.jsp
Species Identification	Shark Identification Materials	University of Florida	http://www.flmnh.ufl.edu/fish/Sharks/csop/csop2.htm
Species Identification	Identification of Seabirds in the Southern Ocean	CCAMLR	Onley, D., and S. Bartle. 1999. Identification of Seabirds of the Southern Ocean: A Guide for Scientific Observers Aboard Fishing Vessels. Te Papa Press, Wellington.
Species Identification	A guide to common offshore crabs in New Zealand waters	Ministry of Fisheries, New Zealand	http://www.fish.govt.nz/en-nz/default.htm
Species Identification	A guide to common deepsea invertebrates in New Zealand waters	Ministry of Fisheries, New Zealand	http://www.fish.govt.nz/en-nz/default.htm

WORK GROUP 2

Observer Safety

(held concurrently with Session B2)

Chaired by Mike Tork and Eric Matzen

Safety Work Group objectives:

- Establish a process for resource sharing:
  - Safety training resources (trainers, lesson plans, safety equipment);
  - Develop safety training, and issued safety equipment, guidelines for observer programs;
  - Information about accidents and 'close calls' as a means to help other programs avoid similar situations.
- Identify common safety problems and provide suggestions for improvement.
- Identify and establish links with other maritime organisations involved with safety for workers at sea.

Observer safety was a very visible part of the 5th International Fisheries Observer Conference. There was an entire room dedicated to sharing safety training resources, safety equipment, and ideas. After most delegates had been through a tour of the safety room and discussions had occurred, the stage was set for an involved work group session.

Mike Tork, Safety Work Group Chair, mentioned that during the meeting it was difficult keeping up with all the discussions and ideas being shared because of the high delegate turnout and participation. Mike thinks that with more focused discussions, future work group sessions would be more productive. Despite some discussion focusing on very program specific issues, there were many constructive comments and ideas shared that the work group might develop further.

The work group felt that it was important to foster networking between programs and individuals with an interest in observer safety and observer safety training. The International Fisheries Observer Conference meets every 2 – 3 years but only a handful of individuals interested in observer safety communicate between conferences. One way to promote continued communication and networking would be to utilise either the Conference or the National Observer Program's website by providing more contact information, resource information, and lesson plans. Used safety equipment which might normally be thrown away could be passed on to other programs via a posting on these websites.

Law Enforcement – There was a discussion of the need for more law enforcement support when dealing with observer safety issues. One participant voiced the concern that observers should not take the enforcement role in these issues. The Observer Safety Work group will promote continued discussion on this topic.

A discussion initiated by John LaFargue focused on sharing observer trainers across programs, or 'cross training.' When safety trainers interact they are able to share ideas and brainstorm solutions to some of the larger safety problems common to many programs. Both networking and cross training would help improve the safety culture.

There was discussion about the development of 'best practices' for observer safety training and policy. The general feeling seemed positive for developing standards, but with the mindset that we are not trying to place any particular program out of compliance, but rather trying to raise the bar for all programs. The idea was to

make guidelines for observer safety standards achievable and flexible enough so they could be raised over time. If the standards were not so high that they alienated programs, they could be built on as programs improved.

Many comments were heard from delegates from several countries and programs that the observers were the best trained people onboard commercial fishing vessels. We can congratulate ourselves on that, but must also recognise that this lack of training and experience on the part of the industry detracts from the overall safety of the observers. It was mentioned that programs can deliver the best possible safety training to the observers, but without industry outreach and proper training of the operators and crew we are missing much of what goes into safety on commercial fishing vessels. If the boat is operating in an unsafe manner, or if the crew is inadequately trained or equipped to deal with an emergency at sea, then we have not done all we could to ensure the safety of our observers. With outreach we could have an impact of the fleet's safety practices. By providing an example of practicing good safety habits (wearing a PFD), being knowledgeable and willing to discuss safety issues, observers could have a positive influence on the behaviour of the commercial fishing community.

It was mentioned that often there are situations when the crew can not comfortably voice safety concerns to the captain, so the crew appreciates it when the observer raises those safety issues since it makes conditions safer for both the crew and the observer. There were many comments from many different observer programs from around the world that voiced the same concern of a poorly trained fleet that they were required to observe. Some poor fleet practices such as, overloading and the lack of maintaining proper wheel watches were discussed. Involving the fleet in observer safety training along with a good outreach program might address many of these safety concerns.

Observer health was discussed and the importance of considering both the mental and physical aspects of the job was raised. When we talk about observer health often the discussion tends to focus on the prevention of injury, but observer are more often encountering diseases like scurvy, bed bugs, lice, scabies, unsanitary living/eating conditions and communicable diseases that need to be addressed.

Some comments expressed the need for observer training to help better identify unsafe vessels. Included in this discussion was talk about how to recognise unsafe vessels due to age, structural problems, or construction material.

It was recognised that wood hull vessels pose their own set of safety issues and concerns. The concern was also expressed that vessels, due to the depletion of some fish stocks, and in some cases the regulations themselves, are being forced to fish farther and farther offshore even though the vessels are not designed to safely fish in those waters.

There was also talk of developing a standardised vessel safety checklist, but many voiced a concern that a standardised checklist could not be tailored to suit all programs and all situations.

In summary, there was considerable input from conference delegates during the Safety Work Group Meeting. Several common problems and concerns were identified and starting points for solutions to those problems were developed. The National Observer Program, or Conference, websites might be a good tool to promote many of the issues discussed during work group meeting. Forums or postings could be developed to share ideas, lesson plans and training techniques, resources, vessel safety checklists, and could serve as a hub for communication as well as a place to post available or surplus safety equipment that could be shared. The work group will continue to work towards the development of safety standards and best practices for all programs with the idea that these are guidelines and achievable goals to aim for. Outreach and safety training for operators and crew should be considered by the work group. Work group attendees agreed that parties interested in developing and improving observer safety training should maintain contact between conferences.

WORK GROUP 3

Observer Professionalism

(held concurrently with Session B3)

Chaired by Keith Davis

**This synopsis is not complete. A full report of our 2006 – 2007 findings will be available later this year. Please send your requests to Keith Davis:* lblegend@yahoo.com*; H.C. Box 3B, Concho, Arizona USA 85924*

Background

The integrity of a fisheries observer program is directly linked to the conduct, morale, and performance of its employees. Moreover, the stature and stability of a program has direct bearing on the quality of its produced data outputs and upon the confidence and respect levels of the scientists, managers, and policy makers who utilise these data. Consequently, it is in the best interest of many of the stakeholders to attract, meld and maintain a corps of highly knowledgeable and skilled fisheries observers.

Since the inception of the Fisheries Observer profession, individuals of various perspectives and observer programs from around the globe have undertaken a variety of initiatives to achieve their own observer professionalism goals. Nevertheless, many observer employment issues were not formerly attended to on an international level until the 2000 Canada/U.S. Fisheries Observer Workshop, held in St. John's Newfoundland.

Early on during that conference, the *Observer Bill of Rights* (OBR) document was formulated from discussions held at a substantial break-out session. The following day, the outlined initiatives (rights) in the OBR were presented to the conference delegation by two Canadian observers and two American observers (of which, two are present members of the Observer Professionalism Working Group (OPWG)), and the panel was moderated by Teresa Turk (the OPWG Steering Committee Liaison). Following the panel presentation, there was a lengthy question and answer session clarifying some of the presented items while outlining possible provisions that may help observer programs accommodate these 'rights'. Nevertheless, all OBR discussions were presented simply as suggestions.

For the following two IFOC meetings (New Orleans 2002 and Sydney 2004), several presentations were given that specifically dealt with additional observer professionalism issues. During the Closing Session of the 2004 Sydney conference, the Steering Committee recommended changing part of the future structure of the IFOC by synthesising working groups that could dig deeper into some of the major reoccurring issues and produce some clear outcomes that build upon the conference proceedings.

Mission

The primary objective of the OPWG is to comprehensively investigate and prioritise the international working knowledge of observer employment practices in order to outline a framework that may foster the proficient professional development of fisheries observers and preserve and strengthen the integrity of the Fisheries Observer profession.

Foundation

In May 2006, the IFOC Steering Committee initiated the three standing working groups, and shortly thereafter, each working group's Steering Committee Liaison (SCL) chose their Working Group Leader (WGL) to coordinate the group's activities.

Table WG3.1: *Members of the Observer Professionalism Working Group.*

Steering Committee Liaison:		
Teresa Turk	National Observer Program/International	Washington D.C., USA
Working Group Leader:		
Keith Davis	Fisheries Observer	USA
Members:		
Rueben Beazley	Fisheries Observer/Union Representative	Newfoundland, Canada
Larry Beerkircher #	Operations Manager	Southeast, USA
Dawn Golden	Trainer/Debriefer	Pacific Islands, USA
Chris Heineken #	Training Director/Deployment Coordinator	South Africa, Africa
Elwin Kruger	Operations Manager	Namibia, Africa
Tracey Mayhew	Observer Union Representative	Alaska, USA
Jon McVeigh	Debriefer/Trainer	West Coast, USA
Tom Nishida #	International Fisheries Research Officer	Japan
Mike Orcutt	Operations Assistant/Port Supervisor	British Columbia, Canada
Glenn Quelch	Fisheries Legislation Monitor/International	European Union
Courtney Sakai #	Oceana Campaign Director/International	Washington D.C., USA
Bob Stanley	CCAMLR Technical Coordinator	Australia
Elaine Ward*	WFT Social Equity Expert/International	British Columbia, Canada
Sara Wetmore	Data Quality Control	Northeast, USA

(*) Elaine Ward began consulting us in March 2007 and became a member in May 2007
(#) These OPWG members were unable to attend the 2007 IFOC meeting

The Observer Professionalism Working Group's SCL and WGL worked closely over the next few months to draft the group's terms of references and to carefully select the OPWG members. Our goal with constructing this group was to be expansive in our geographically representation, while creating a vantage that is broadened among interested stakeholders. We completed membership selections in October 2006 (see Table WG3.1). While many of the OPWG presently hold significantly higher roles within fisheries management schemes, 11 of 16 made their start as fisheries observers, with the group's observer experience reaching beyond 100 years in all.

4OPWG Survey

Overview

The founding content in our survey was derived from the outlined goals and initiatives addressed in the 2000 OBR document, and the 2002 and 2004 IFOC proceedings were carefully sifted through in order to identify additional observer professional development approaches. Additionally, many online references were made when designing its structure, clarifying its content, and considering general biasing issues. An initial draft of the survey was synthesised in November 2006, when all OPWG members had an opportunity to review and comment on it before the group's first conference call meeting in December 2006. We had a final draft in early January and it was on the IFOC website by mid-January.

At our second conference call meeting in March 2007 we initiated our three survey analysis committees each tasked with reviewing, analysing, and providing developmental research upon the three thematic sections of our survey (*Wage and Benefits*, *Support and Opportunities*, and *Employment Standards*). We began to analyse in April 2007 and have continued to integrate in new responses as they are submitted. Since our survey will remain open for several months following this conference, this analysis is not complete.

Analysis

(a) Respondent identification

As of the 2007 IFOC, we have received 41 responses to the OPWG survey, with responses originating from 10 different countries. The scope of respondents' experience has been quite geographically broad, spanning across many of the world's seas.

Our aim was to reach the stakeholders with the most vested interests in observer employment practices, with our main emphasis on hearing from observers. Of the 41 responses, 56% have been submitted by Observers, 29% from agency Staff members, 5% from observer Contractor/providers, 7% from Data

Analyst/end users, and 3% from a perspective Other than these options.

(b) Definitions

Survey respondents have defined the following terms upon their own experience and we have outlined a concise impression of submitted responses:

(i) Professionalism:
- Maintaining the appearance of expertise, while representing oneself and conducting ones job in a manner of high moral and ethical standards, such that the integrity and respect of the employee and the profession is not biased or compromised.
- Expressed knowledge of and adherence to the terms of reference, the bylaws, the standard of work, the codes of conduct, and the myriad of regulations set by ones profession.
- Exhibiting personal responsibility in one's work, and commitment to one's *professional development* with the ability to self-regulate.
- Acting with no conflicting interests.

(ii) Professional Development:
- The intentional ongoing advancement of an employee's professional knowledge and competency by way of regular: trainings, skill maintenance, accessibility of resources, career path opportunities, inclusion in workshops/conferences, and evaluations and recognition.
- This is the responsibility of both the employee and the employer.

(iii) Experienced Observer:
- A 'seasoned veteran' observer who: has demonstrated and continues to demonstrate his/her working knowledge and skills regarding all parameters of fisheries observer work within a bioregion, is well respected among employers and peers, has a good data sampling record, and has handled well all encountered conflicts and safety concerns while at sea.
- Since 'experience' is often considered a function of time, many respondents have submitted their suggestions for an adequate time of work that defines an 'Experienced Observer'. A rough average of these suggestions is approximately 1 year of fulltime observing or approximately 200 sea days.
- Some observer programs signify a veteran experienced observer with a title such as 'Senior Observer'. These observers often take on more responsible mentor-like roles, such as: advising, coordinating, and directing their colleagues in the field.

(iv) Professional Observer:
- A dependable, well respected, observer who is dedicated to the observer program's objectives, ethics, code of conduct, who consistently collects high quality data, who never compromises the integrity of their data or their profession, and who always practices a high degree of safety.
- This person may think of observing (and/or fisheries science/management) as a career and assuredly possess qualities that make them a leader amongst their colleagues.

(v) Observer Living Wage:
- A wage that allows an individual and his/her family to live, function, and sustain economic efficiency among their community.
- For seafarers such as observers, wages should be comparable to other professions (i.e., government) with similar risks and demands, the scale must reflect at-sea experience, and considerations should be made for the down time (land time) in between assignments

(c) Social equity

Elaine Ward, of World Fisheries Trust (WFT), acts as the OPWG Social Equity Expert. To gather information regarding social equity issues specific to the Fisheries Observer profession, WFT had synthesised a questionnaire that has given us much insight into these matters.

- Recognised Social Equity issues:
  - Absent data, disaggregated by sex, age, ethnicity and class.
  - Discrimination in the workplace based upon sex, age, ethnicity and class.
  - Lack of gender balance, gender policies and gender-sensitive indicators among many fisheries monitoring programs.
  - Sexual harassment, particularly onboard fishing vessels.
  - Privacy/security of accommodations and bathing facilities while at sea.

- Medical examinations to determine aptitude for work.
- Parental/family leave, day care, and maternity leave provisions.

- Ways to ensure social equity among fisheries monitors:
  - Promote respect for the human rights and dignity of all worldwide observers.
  - Identify the factors affecting the equal participation of women and other minorities.
  - Identify the means to ensure that both sexes and minorities participate equitably as decision-makers in programming and all stages of project lifecycles.
  - Ensure senior management is committed to GE and adequate resources set aside to promote it via accountability frameworks and gender policies.

** For a complete WFT Gender Analysis and Impact Assessment, please navigate to Appendix 1.*

(d) Wages and benefits

This part of our study addresses topics such as: Remuneration policies, reimbursable items, and initiatives set to promote the health and general welfare of observers. The following were highlighted by respondents (% is combined 'Works Well' and 'Desire' responses):

- Paid Trainings and Debriefings (94%) – Observers are provided salary for attending trainings and debriefings related to their profession.
- Reimbursables – Observers are reimbursed for travel (94%) to and from a vessel, and lodging (89%) and food (89%) allowances when deployed.
- 'Stand-by' Land Based Pay (86%) – Observers are compensated for while on land in between vessel deployments.
- Experience-based Compensation (83%) – Observers salary/wages are based upon their working experience.
- Health Insurance (83%) – Observers are either provided with health insurance or are compensated so that they may provide it on their own.

(e) Support and opportunities

This part of our study addresses topics such as: conflict resolution instruction, grievances procedures, counselling options, awarding credit where due, inclusion in professional forums, and assistance for advancing themselves among careers in fisheries management. The following were highlighted by respondents (% is combined 'Works Well' and 'Desire' responses):

- Vessel Profiles Provided (92%) – Observers are provided with information that sketches a profile of the vessel that they will be deployed upon.
- Performance Evaluations (92%) – Observers are regularly evaluated upon their performance and this information is fed back to the observers.
- Support to attend Professional Forums (89%) – Observers' attendance and involvement at professional forums (i.e., the IFOC) are supported.
- Career Advancement (84%) – Observers are provided the opportunities and resources to advance their professional development and careers.
- Publication Credit (71%) – Observers are credited in final publications that use their data and these publications are available for observers.

(f) Employment standards

This part of our study addresses topics such as: national training, codes of conduct, eligibility and competency statutes, data base and data collection standards, employee retention decrees, and rules concerning the observer/ fisher working relationships. The following were highlighted by respondents (% is combined 'Works Well' and 'Desire' responses):

- Rules for Observers assisting Fishers (73%) – The Observer/Fisher relationship is well defined with rules that outline how observers can and can not assist fishers.
- Employee Retention Standards (64%) – Observer programs have standards that mandate how their observer employee force is retained.
- National Training Standards (53%) – A set of observer training standards that each observer program in that nation adheres to.
- National Code of Conduct Standards (50%) – A set of observer Code of Conduct standards that each observer program in that nation adheres to.

Discussion

This section combines responses from the *Short Answer* part of our survey (which either exhibit additional observer professionalism issues or build upon topics previously presented) with discussion points raised during our 2007 IFOC breakout session.

Prioritised observer support entities:

On a scale of 1 – 3 (1 being the highest priority), the three major observer supporters (Contractors, Agencies, and Labour organisations/observer-advocacy groups) were rated upon their expected responsibility to the livelihood of observers. Following is a prioritised list with the averages of their ratings:

1. Governing Agencies: Average rating – **1.30**
2. Observer Providers/Contractors: Average Rating – **2.00**
3. Labour Organisations/Observer Advocacy Groups: Average rating – **2.36**

Eligibility and Competency Standards:

- Education: Some suggest that a college degree be required for observer employment, and some state that there is no need for a degree. Nevertheless, many do agree that some sort of post-secondary academic science and math based training be required.
- Many agree that at-sea (or remote field) experience be preferred.
- Physical, emotional, and mental abilities to perform the job, independent work ethic, and seaworthiness were all said to be important when rating observers.
- Regular employee evaluations were suggested.

Additional initiatives that may foster fisheries observer professional development:

- Consistent and increased funding for observer programs.
- Increased enforcement of existing observer program regulations.
- Observers provided with: insurance, performance-based bonuses, full-time employment, retirement plans, and support for stress management and counselling.
- Unbiased placement of observers on to vessels.
- Hiring locally when possible.
- Recognition and transferability of sea-day credit from one program to the next, as well as to other seafaring professions.
- Establishing national and international standards for employment and trainings.
- Engaging observers in program outputs.
- Fisheries Observers as educators on vessels.
- Minimising bureaucratic complexities.

How can programs learn from one another regarding Observer Professionalism?

- Via shared experiences, protocols, technologies, and training methodologies, programs may learn to refine procedures, reduce redundancies, and promote the practices that produce the highest of quality outcomes.
- Share and improve upon observer safety and survival training techniques.
- Identify the provisions that are needed to foster heightened employee retention.
- Through building a broad work force and a network of available work opportunities, paths towards full-time year-round employment may be identified.
- Employee exchanges can increase knowledge transferability.
- Identify the pros and cons of the various observer service delivery models.

Future of observers and the fisheries observer profession:

- As fisheries continue to be stressed and remedial measures are sought, the observer profession may expand and be more recognised, and the demand for highly skilled fisheries observers could increase.
- Heightened observer transferability between programs and fisheries, a more diversified job, with heightened retention and efficacy of execution, can create more career advancement opportunities and job security for observers.
- Automated technology (electronic fish boards, digital data-collection systems, etc.) and heightened offshore communications may improve upon observing.
- Establishment of national and international standards may help to enable collaborative management upon trans-border stocks and work towards more-harmonised databases and data collection procedures.
- On the down side, some see fisheries closing and observers losing their jobs, and some have mentioned that if consistent funding is

not secured, standards will be compromised and fishery observation products will lose their viability.

Outlook

Considering the tremendous quantity of international working knowledge regarding observer professionalism practices, the Observer Professionalism Working Group has taken on quite a task to comprehensively gather, categorise, and prioritise it. Nevertheless, we have initiated an important iterative process aimed at promoting the proficient development of fisheries observers which will help to preserve and to heighten the integrity of the Fisheries Observer profession as a whole.

We are confident that the design and structure of the OPWG Survey is as clear and complete as can be to this point. However, with considerations to our analysis, we have identified certain limitations to the survey. Firstly, although we are contented with the diversity of perspectives among respondents who have submitted to date, we acknowledge that our sample size is small and may not be fully representative on an international or a national level. Most wide scale surveys have a response rate of around 3 – 4% for studies that have a well-defined universe and a population which is land based.

Communications and correspondences with observers, our primary respondent group, can be very challenging because of the transient and predominately sea-based nature of the profession – we have not received as many surveys as we would have liked from observers in particular. Additionally, we have noticed that responses from fisheries observers and staff members working in the same program have sometimes been quite different and or even contradictory. Some of these variations may simply be the result of a difference of perspective, but some may bring to light communication barriers. Finally, we have noted that a few respondents have had trouble with a couple of the survey questions, assumedly due to misinterpretations of terminology or wording.

We have acknowledged these issues and will continue to account for all of them as best we can. We would like to receive a larger total number of responses with even a broader international range and this is precisely why we have decided to keep our survey open for several months following the 2007 IFOC and will continue to reach out in order to build a broader base before we close it. We would like to recognise and thank all respondents who have taken the time to share their perspectives with us to date and hope to encourage more response in the coming months. Please contact us if you have anything to add concerning our endeavours or need clarification regarding any facet of the survey.

With consideration for these limiting factors and that our analysis is far from complete; the OPWG has taken our first steps. Although our representation is far from absolute, we hope to, as Bob Stanley says, be a sort of ‘light on the hill’. We have: begun to better define certain important observer employment terminology, outlined some of the top ‘works well’ or ‘desire’ for initiatives that have been highlighted (so far) as fostering the professional development of observers, and have begun to build a plan as to what steps we will take in the future in order to continue to work towards these ends.

By combining, from the different sections of our analysis, the highlights that have been brought to light so far, we have created a flow diagram to summarise what we have noticed (see Fig. WG3.1).

Social equity issues may arise among execution of any of the listed initiatives, and should be considered. Each observer employment initiative listed in this diagram has been selected, by at least the majority of respondents, as a principle that they either ‘Desire’ or indicates ‘Works Well’ at fostering the professional development of fisheries observers.

Though we may still be, and essentially always should be, in a gathering stage, we have begun to assemble a foundation to our purposes and have started to construct a plan that works towards helping this process along. Before the next IFOC meeting, we plan to dig deeper into the initiatives outlined in the *Observer Professionalism Framework* and begin to explore the specific provisions that are needed in order to implement these objectives. Additionally, we have initiated three new projects aimed at opening avenues that may help increase the overall professional development of fisheries observers:

- *Guardians of the Sea, a collection of observer short stories* – While helping to raise international public awareness of the Fisheries Observer profession from the observer perspective, we aim to raise funding for future Observer Professionalism projects and offer career-advancement opportunities to observers.

- *Fisheries Observer Exchange* – Although much more complicated than it may sound, we aim to build a network of observer programs and contractors willing to participate, then probe into the parameters by which educational exchanges can work for all parties, draft a plan for its implementation, and work towards facilitating exchanges.

- *Observer Professionalism Central* – We will work towards creating an on-line site that will act as a public reference library of fisheries observer related publications and will act as a job site where observers and contractors from around the world can meet, observers can post their experience (i.e., sea days, fisheries, gear types, etc.) and employers can post their profiles.

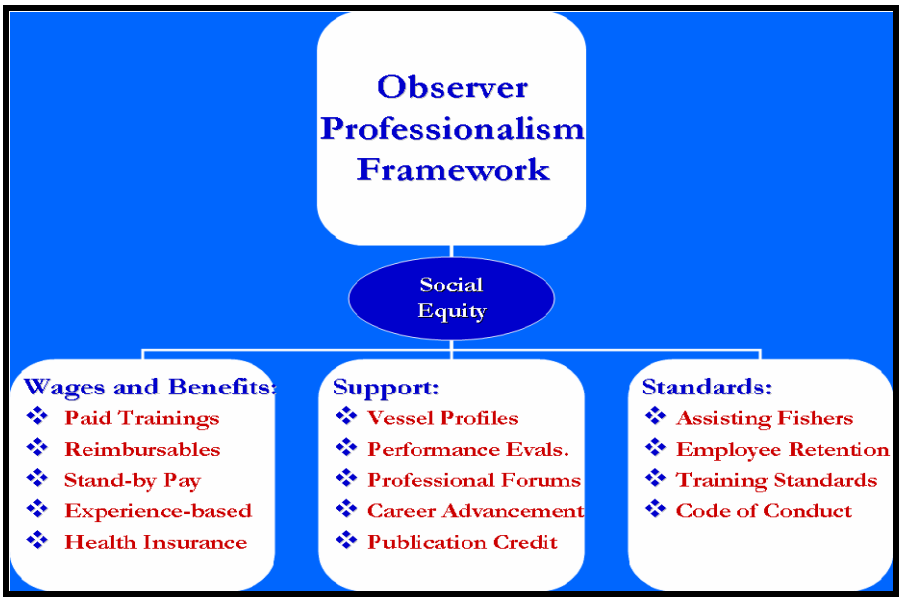


Figure WG3.1: *Summary of issues highlighted in the Observer Professionalism survey.*

CLOSING SESSIONS

SUMMARIES OF CONCURRENT SESSIONS

Speakers:

Breakout Session 1:	*Shawn Stebbins*
Breakout Session 2:	*Bob Stanley*
Breakout Session 3:	*Bruce Wallner*
Work Group Session 1:	*Scott Buchanan*
Work Group Session 2:	*Mike Tork & John LaFargue*
Work Group Session 3:	*Keith Davis*

There were three work group sessions at the conference which were held concurrently with three of the regular panel sessions (referred to as the 'Breakout Sessions'). Conference delegates chose whether to attend the work group or breakout session. This section is a summary from the moderators of each of the six concurrent sessions. Because more people attended the breakout sessions than the work group sessions, more time was devoted to summarising the work group sessions. There is also a separate chapter in these proceedings for each of the breakout sessions and work group sessions, and a summary is provided below. This is followed by a question and a panel discussion.

Summary of Breakout Session B1

What can advanced technologies offer fishery monitoring programs?

Presented by Shawn Stebbins

Technologies are relevant to every observer program, whether it is a newly established program or an amateur program. The themes that were covered in this session included (i) how data are collected; and (ii) how are data communicated.

There were a variety of presentations on how data are collected which ranged from hand-held devices that deliver information to a laptop and are later delivered to a centralised database using a cell phone or satellite phone; one agency was using a wireless GPS in connection with a PDA; and another focused on the delivery from the collector to a centralised database. A number of the presenters also discussed the receiving vessel/tool that is used to deliver the information, which is usually a large integrated database. There have also been technological advances in the automated delivery of the data into the database which allows the data collector to take responsibility for the delivery of the data.

It was obvious that the scope and capability of the tools that are available today is increasing and we have reached a point where we have confidence in the technology. There have also been significant improvements in the software and we are experiencing less system crashes and other conflicts. There is still hesitancy about giving up the paper versions of the data, but we are gradually moving towards a paperless data collection or at least removing it as early as possible in the data collection and transmission process.

The cost of the technological equipment is also decreasing to the point where these technologies are more accessible to a variety of programs and not just the large government agencies. More importantly, there have been significant improvements in the quality of data that are collected which has been possible by allowing for electronic validation of the data at the point of entry which minimises or eliminates the need to transpose the data. The technologies have allowed us to short-circuit these processes and we are getting quality data right from the start.

One of the points that came out of this session was the potential for cost savings through the use of technology and this is an important driver in getting industry to adopt the technology. For instance, there are decreases in labour costs and the costs associated with data storage and reporting. There is also a much quicker turnaround of the data and so the data are

available to managers much quicker than in the past.

Another relevant point that was discussed in relation to these automated processes was the potential to collect much larger volumes of data but we also need to be prepared to handle this volume of data. The technology can also free up the observer to do other work such as the collection of biological samples.

PDAs are relatively cheap solutions and two of our presenters are currently using PDAs and are very happy with them and neither of them has lost data (which is one of our biggest fears). On the down side, there are still issues about battery life and power supply and there are also issues with available memory.

The technology is here and the biggest challenge now is to get agencies to adapt to and implement the new technologies, which will involve updating management and regulatory structures. We need to look for creative ways to integrate the new technologies with our traditional methods of data capture and make for a better data collection system.

Summary of Breakout Session B2

How to achieve fishery monitoring by integrating multiple data collection tools

Presented by Bob Stanley

There were a number of key messages that came out of the presentations:

- The integration of the product of multiple data collection tools is best achieved through conscious and considered design. That design process will in many cases be iterative.
- There are presently a number of tools and there is a real prospect that there will be others that might come on the scene and we don't need to be limited to the here and now.
- The tools that we use must be relevant, robust and, if possible, be both flexible and extendable. As we evolve and develop, we can't keep investing in new tools because it is cost prohibitive.
- Monitoring does cost, and industries capacity to pay for monitoring is finite – it is not a bottomless hole.
- The involvement and consultation with all stakeholders is preferred, and in many instances critical, to the successful implementation of these integration strategies.

Standards and monitoring

Gerry Sullivan of DFO gave a presentation about the multiple streams of data creators and, underpinning that, was a whole series of standards and rationalisations at various levels within the DFO environment that they had to embrace. Figure S1.1 is a simplistic model based on Gerry's presentation and is something that we should all re-examine on a regular basis, i.e., what are the standards we need to embrace and how are we might implement those standards?

The challenges on the horizon:

The following are some challenges that lie ahead, but I haven't had a chance to caucus with the panel so this is my interpretation from the presentations:

- Taking these initiatives and developments in the data collection sphere and making them long term, core business for management agencies.
- Data ownership, access and privacy.
- Data management and the maintenance of long term data sets. Data that just sits in a repository is valueless if it is not accessed, not maintained and not kept relevant. This is an ongoing challenge to keep this maintenance going.
- The development of the linkage mechanisms to the data sets that might make these data more relevant and valued in a wider context. There are many large data sets out there in oceanography etc. (e.g., OTIS, etc.), which are worth linking with our observer data.

Concluding remark:

Without comprehensive integrated data collection and data management systems, we will be sailing stormy waters.

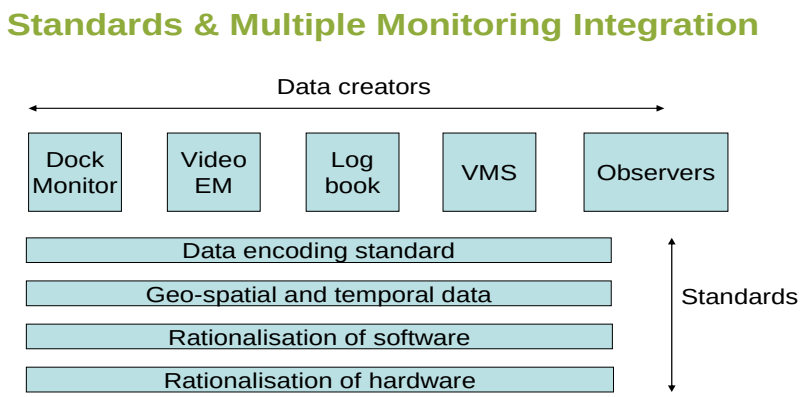


***Figure S1.1**: Simplistic model of multiple data collection/monitoring programs and the standards and along with software and hardware rationalisation at DFO.*

Summary of Breakout Session B2

How to address information requirements for fisheries that are difficult to monitor?

Presented by Bruce Wallner

It is difficult to do justice in five minutes to a one and half hour session that had seven very excellent and entertaining speakers and a vibrant panel discussion after that. In fact, we had people queuing to ask questions and the discussion continued into the break. This is my interpretation of the session and I apologise if I miss any key points or have skewed anything.

The problems:

There was an exposition of some of the problems that make fisheries hard to monitor:

- Small vessel size – from small motorised canoes to vessels up to 5 – 7 metres
  - Logistics (e.g., space for gear).
  - Safety.
  - Weather.
  - Rare events (i.e., there is an increased risk of missing rare events if an observer has less chances of getting onboard a vessel).
  - Unequal allocation of trips (i.e., there is a tendency for observers to go on the most capable boats and there is also a resistance from the owners of the more comfortable boats who tend to get more observers on their boats compared to the less capable boats).
- Fishing is patchy:
  - Space and time – spatial and temporal distribution of the fishing activity makes it difficult to collect meaningful samples where there are ephemeral fisheries that are highly variable in space and time.
  - Programs that target rare or patchy species. For example, two presentations focused on endangered species (Hector's dolphin and some of the endangered sharks) and showed the difficulty in monitoring rare events where they are spatially and temporally patchy.
- Affordability
  - Low value fisheries – i.e., the cost of monitoring can exceed the value of production.
  - Poor countries/lack infrastructure and know-how. For example, we had a presentation from a speaker from the Philippines which highlighted that some of the developing countries do not have the technological knowledge or basic funding for even a very elementary observer program. Our speaker spoke about the fact that they have no data and they had to use a consumption survey of households in order to get an estimate of the catch.
- Missing sectors – how can you monitor a fishery effectively if you're only concentrating on one sector?
  - Recreational.

- First nation/traditional sectors – David Balfour gave an outline of the need for government structural reform to ensure everyone is on the same page with respect to monitoring whole of catch.
- Uncommon (or illegal) gear types.
- IUU.

- Poor industry cooperation – there is a need to structure a plan and communicate it with industry.

Where to look for answers:

The session started to look at where to go for answers and, although we did not find the answers, a number of potential areas were identified as to where the solutions may lie:

- Innovation and technology:
  - electronic phenomenon can be an attractive option for small boats.
  - alternative platforms – i.e., having an observer on another platform (not the boat) and observing from a distance.
- Careful program design:
  - understanding proportional catches and coverage, e.g., making sure the business model matches the small fishery scenario – small fisheries are distinct and need to be planned differently.
- Communication with industry:
  - especially important for small fisheries, e.g., the speaker from New Zealand showed that the redesign of their program based on communication with industry enabled the program to be rolled out.
- Self reporting/'captain's samples':
  - When it is not possible to get an independent sample, how can you make self-reporting work and what are the advantages of 'captain's samples'? The two industry members from the audience spoke on this and gave completely divergent views, which highlighted the importance of building an audit process into the design of a program.
- Census versus snap-shots – these can often be the same, i.e., the snapshot can become the basis for the census.
- Appropriate business models and governance structures.

Other issues:

- The 'gorilla in the room' – i.e., conventional safety concerns are well documented in manuals and has been a strong emphasis at this conference, however, no one has addressed the issue of drugs on boats and there is no instruction manual for this.
- Dealing with risk – on small boats there is a temptation to allow observers to make a choice about whether they feel safe to go to sea on a small boat which can raise a cascade of issues relating to litigation and occupational health and safety from the employers perspective.
- Monitoring the illegal – how do you monitor illegal fisheries?
- Industry role in the information game – how do we engage industry with respect to self reporting?
- Knowing what you don't know – often small fisheries are so poorly monitored that we don't know what we don't know.

Summary of Work Group 1

Observer Training Work Group

Presented by Scott Buchanan

I've brought back different ideas from each of these conferences that I've attended (St John's, New Orleans and Australia) and have applied what I've learned to our programs to make either our training program better or our data auditing processes better. Yogi expressed the need to develop systems to share information between conferences and to have ongoing sharing of information and I think this is why these work groups have been formed. The following is an overview of the Observer Training work group session but it is also about why training and the ongoing sharing of information is important:

Overview

- The success of observer programs depends on effective recruitment, training and development of its observers.
- As observer programs mature the training and support materials improve.
- All programs will benefit from access to knowledge and resources through a network of individuals involved in international observer programs.

I originally had the third dot point as 'developing and new programs will benefit from

access to knowledge …', but through the week here I've realised that it is really all programs that benefit – even the mature ones. The new and developing programs don't have to re-invent the wheel by gaining access to information from developed programs and the mature programs really need to go forward with increasing their level of accuracy and the scope of their programs and I think users and the fishing industry will demand that.

Training Work Group Mandate

The Training work group mandate is about sharing expertise internationally by:

- Identifying common training elements.
- Identifying international recruitment and training standards.
- Identifying international training resources.
- Making publicly available training curricula and resources available to international observer programs.
- Establishing a network of observer training and subject matter experts.

With the formation of our work group, I believe we are well on the way to achieving this and with the outputs and marching orders we received from our session earlier this week, we can accomplish that.

Work Group membership

The work group consists of the following members:

- Scott Buchanan, AMR, Canada.
- Howard McElderry, AMR, Canada.
- Janell Majewski, WCGOP, USA.
- Andrew France, MOF, New Zealand.
- Mike Vechter, OTC, USA.
- Charles Cheng, BirdLife, Taiwan.
- Dennis Hansford, NOP, USA.
- Katuuo Zebaldina, FOA, Namibia.

Katuuo (Zebby) unfortunately could not be here at this conference but she has provided quite a bit of input into the process and the development of the work group to date.

Program summaries

Thank you to all the programs that have completed the program survey. For those programs that haven't completed a survey, you can complete them through the conference website after the conference. The surveys will help us to build a better inventory of how training programs are put together and executed internationally.

Work Group structure

Flowing out of the work group session meeting, we now have a better understanding of the definition of our work group structure. This is a living work group that will continue to operate in-between conferences and is comprised of the following levels:

- *Core Members* – responsible for completing inventories, development of suggested guidelines for key elements such as recruitment strategies, training strategies, training curricula and observer development strategies.
- *Auxiliary Members* – ensure participation of observers, representatives from all continents and intergovernmental agencies to effectively complete the international program characterisation.
- *Subject matter experts* – e.g., seabird identification.
- *Subscribers* – i.e., the people that use the data to help them develop their programs or move them forward.

Outputs

The requested outputs from the work group are:

- A completed inventory characterising how recruitment and training programs are conducted internationally.
- Complete descriptions of core and enhanced training elements employed internationally, with direct links to subject matter experts and resource materials.
- Completed inventory of training standards employed internationally. Recruitment, training curricula, certification.
- Training and resource materials to be organised by fishery type and region so they are easily accessible to the users.
- Information should be web-based rather than a technical report.
- Key information to be available in different languages.

Summary of Work Group 2

Observer Safety Work Group

Presented by Mike Tork and John LaFargue

Summary from Mike Tork

First, I would like to thank all in attendance. This was a very successful conference and the steering committee did a lot of work to contribute to that success but without delegate attendance and participation it would not have been nearly as successful as it was. I would also like to thank the people that helped develop and set up the safety room. Thanks to John LaFargue, Jon McVeigh, Jason Vestre, Eric Matzen, Gord Perkins, Jim Benante, Jonathan Cusick, Peggy Murphy, Ted Harrington and Curtis Farrell. The purpose of the safety room was to raise safety awareness and to demonstrate that it can be relevant and fun. I think we were successful at doing that. So thanks to all that helped. I could not have done it by myself. Peggy, Ted and Curtis work in the United States Coast Guard (USCG) Commercial Fishing Vessel Safety Examination Program and I appreciate their participation at the conference. The USCG has actively supported the National Marine Fisheries Service's (NMFS) goal to improve observer safety. I would encourage each one of you to get similar agencies involved in observer safety in your programs as well. I would like to specifically thank John LaFargue for all of his help. I really appreciate John's enthusiasm and passion for safety but most of all I appreciate his friendship. And last, but not least, I want to thank Vicki Cornish for the lead role she took developing improved, consistent NMFS wide safety standards and safety training. I want to encourage everyone here to go home and do the same thing in their programs. Dr. Martin Hall made a very good point during his opening remarks that I think each one of us can apply to our own programs regarding safety improvement. That point is: take that first step; it doesn't have to be a huge step but take a step. A lot can be accomplished one little step at a time.

In addition, I would like to thank each member of the Safety Work Group for their help in developing the goals and concepts for observer safety at the conference. Thank you Jason Vestre, Julian Hall, James Dalton, Vicki Cornish, Ebol Rojas, Dr Tosan Fregene, Dr Lizette Voges, Wayne DeGruchy, Brad Justin and John LaFargue.

Why the big deal about observer safety? Have you ever noticed that the folks that are involved in safety training are very passionate about their work? There is a reason for that and it is what they do that can save lives. Commercial fishing vessels go down on a regular basis and sometimes with observers onboard. Safety trainers know that the message they're delivering can, and does, save lives. I don't want to take anything away from the importance of accurate, unbiased, representative data. That is all very important to observer programs, but good safety training can save people's lives, not just produce data that is a little more accurate. It's not unusual to find that the observers are the best safety trained individuals onboard these vessels. Fishermen are changing. They are no longer the experienced, long time fishermen we have seen in the past. In fact many have no, or very poor, safety training with little at sea experience. Take this lack of experience and training and couple it with the enormous number of days observers spend at sea worldwide and you can easily see that the potential for tragedy is high. Let me illustrate this point. Between just Namibia and the U.S., which is not to imply that these are the only two observer programs out there, approximately 100,000 sea days are completed by observers each year. That is 273 observers out every day, 365 days a year, in just two observer programs! Given the inherently dangerous nature of commercial fishing you can easily see how much liability each observer program incurs. Right now, as we speak, there are more than 273 observers at sea between just these two programs. I wonder how many observers are at sea every day of the year worldwide? Staggering when you think about it. I'm sure everyone can see that there is a lot at stake here and that we have a big job ahead of us.

Please keep in mind that I'm not up here telling you we have the best program. Only a few years ago we did not have good, consistent observer safety training. In fact some of our programs had poor safety training, including mine. No one should feel bad because their program is not as far along as it could be. All you have to do is start improving your program one step at a time.

There are many of us that would be glad to help you do that.

Part of the Safety Work Group's goals were to develop some ideas to help improve safety training without over-burdening individual programs. A lot of programs are resource poor and have small staffs, but there are some easy, inexpensive solutions that can help you get your program on the right track. Some of the ideas we came up with are:

- Set minimum standards for safety training and safety equipment issued to observers. I'm always a little reluctant when people talk about setting standards, but I think it could be done if they were achievable for most programs and flexible enough so that they could be raised over time.
- Share resources (trainers, training aids, training materials, equipment). Training materials and lesson plans could easily be shared through the conference website, which will remain 'live'. If for nothing else, go there for contact information.
- Share trainers across programs.
- Increase safety awareness and attitudes for both fishermen and observers.
- Develop a questionnaire that might help identify programs that could be helped without draining that program's resources.

Again, we can help you with trainers, sharing equipment and sharing lesson plans. Please go into the safety room and grab some of our business cards before you leave. There are also many handouts and lesson plans available in the safety room so please stop by and grab as many as you like. There is a lot of helpful information in there.

The last point I'd like to make concerns the T-shirt slogan. Several people asked me how the slogan came about. When we first came up with the current slogan there were two different suggestions, one from the East Coast and one from the West Coast. Although the difference between the two seems minor, I think it highlights two separate attitudes between the coasts. The West Coast has what I would call the 'peace, love and flowers' approach and they wanted the T-shirt slogan to say *"Go Safe **and** Go Home"*, whereas the East Coast, with more of an 'ultimatum' type approach wanted the slogan to be *"Go Safe **or** Go Home"*.

Thank you very much and I really appreciate everyone's enthusiasm and participation.

Summary from John LaFargue:

Mike just about covered everything. I did write down a bunch of notes yesterday during our work group meeting. It was hard keeping up with everyone's ideas and input. We had more than 60 people in there with lots of good ideas and some important problems discussed. Last night I was thinking about everything we discussed and ways that we could address some of these problems. Some of the issues that came up may be outside the scope of this group, but there are some things that we can work towards.

One thing we can do is increase the networking that we do. We all meet here every 2 – 3 years but only a few of us end up communicating back and forth. We need to foster this network. One way to do this is to utilise the NOP web site and put up more safety contact information and safety materials that we could all utilise. We should also support more cross-training (that's my little plug again). When safety trainers interact with each other, we swap ideas and brainstorm ways to address some of the larger safety problems. Both networking and cross training will help improve safety culture, but requires all of us to contribute.

I also feel that we need to keep raising the bar with safety training – everyone talks about minimum standards but I don't like 'minimum' and I feel the same about safety training as I feel about the limbo…the bar can never be too high.

I think we need to continue doing outreach to help new programs. I hear of new programs starting up every year, but rarely do I hear of them reaching out to very many established programs for assistance with safety training or knowledge of safety gear. There is no reason to reinvent the wheel. When we started our program there were only three of us and we didn't have time to start from scratch. We just piggybacked onto someone else's good information and ideas. We tried to improve from there. We should try and network with new and evolving programs, communicate what we already have and share resources. They can keep advancing safety training/culture versus starting from scratch.

We also need to do more outreach with the industry – we can be as safe as possible, give

observers the best equipment and training, but if observers are going on unsafe vessels or going on vessels with unsafe practices, then all our efforts are only going to do so much good – we need to do more industry outreach. One of the things that we've found is that in our trainings we use a life-sling instead of a throw ring – it helps bring people back on the boat if there is a man-overboard situation. We didn't intend for this to happen but some of the biologists that went through our training liked it so much that they bought it for their surveys and then the boats that they chartered liked it so much that they bought it. Now some of the boats we observe have life-slings and that's directly from our safety trainings. We can have an impact on the fleet's safety.

We need to keep fostering a stronger safety culture. We need to change the way observers and observer programs think – sometimes it is not just observers that have a poor attitude to safety but the whole observer program. We need to start from the top and work down – we look up to senior staff for safety support, safety equipment and funds, but when we go on research cruises or see photos of senior staff without PFDs on deck, that doesn't give a strong message for observers to wear their PFDs on deck. In the NOP mixer I asked how many observers actually wore their PFDs while out on deck, only three replied that they did. When I asked them if their program had a policy that required them to wear their pdf while on deck, they all replied yes. So we need to start changing that practice, that's a challenge we have. Program staff needs to lead by example. If I can wear a PFD for a whole conference then everyone can wear it at sea.

One thing that kept popping up in conversations both outside and within the group was that observer health, both mental and physical, is also part of safety. We need to train better health practices and talk about harassment and health issues on boats. We tend to get focussed on safety equipment and emergencies but we've started seeing more and more diseases on boats and we need to start addressing those issues.

I heard a few programs talking about how they were ashamed of their safety program. I don't think anyone should be ashamed of their program – we've all started somewhere. A few years ago, Mike was saying they weren't very far along and a few years ago we weren't even a program. We all need to keep advancing safety training and increasing safety awareness – there's no reason to be ashamed of anything – we can work together – we're all part of the same safety tribe and we can rely on each other for knowledge, materials and other resources.

Summary of Work Group 3

Observer Professionalism Work Group

Presented by Keith Davis

Need

The integrity of a fisheries observer program is directly linked to the conduct, morale, and performance of its employees. Moreover, the stature and stability of a program has a direct bearing on the quality of its data products and on the level of confidence that scientists, managers, and policy makers have when utilising this data.

Mandate

The Observer Professionalism Work Group (OPWG) has been established by the IFOC in order to formally assemble the working knowledge of Fisheries Observer employment (professionalism) practices on an international basis.

Mission

Our primary focus is to comprehensively investigate and prioritise the working knowledge of observer employment practices in order to outline a framework to foster the development of proficient and professional Fisheries Observers.

2006/2007 actions

- *June 2006:* OPWG mandated by the IFOC.
- *October 2006:* OPWG founded.
- *November – December 2006*: Objectives solidified.
- *January 2007:* OPWG Survey created and disbursed.
- *April 2007:* Survey analysis begins.

- *May 2007:* Survey findings reported, discussions made, and future objectives charted at the 2007 IFOC.

Survey overview:

- *Purpose* – To gather together the various issues and initiatives which have bearing on the professional development of observers.
- *Design* – The OPWG survey is derived from all past pertinent observer conference publications, beginning with the 2000 'Observer Bill of Rights' (OBR) document.
- *Scope* – We aimed at receiving responses from many of the stakeholder groups (primarily from observers) and from a broad geographical range among observer programs.

Survey analysis

Respondent identification

- 41 responses to the OPWG survey, originating from 10 different countries.
- The scope of respondents' experience has been quite geographically broad, spanning many of the world's oceans.
- 56% surveys were submitted by **Observers**, 29% from agency **Staff** members, 5% from observer **Contractor**/providers, 7% from **Data** Analyst/end users, and 3% from a perspective **Other** than these options.

Definitions

Survey respondents have defined terms based on their own experience and we have outlined the main points of the submitted responses.

Social Equity

Elaine Ward, of World Fisheries Trust (WFT), acts as the OPWG Social Equity Expert. WFT had performed their own investigation to gather information regarding social equity issues specific to fisheries observers.

Wages and benefits

Address topics such as: remuneration policies, reimbursable items, and initiatives set to promote the health and general welfare of observers.

Support and opportunities

Address topics such as: conflict resolution instruction, grievances procedures, counselling options, recognition where due, inclusion in professional forums, and assistance for advancing themselves among careers in fisheries management.

Employment Standards

Addresses topics such as: national training standards, codes of conduct, eligibility and competency statutes, data collection standards, employee retention goals, and rules concerning the observer/fisher working relationships.

Observer professionalism framework:

Social equity issues may arise among execution of any of the following highlighted initiatives and should be considered:

Wages and benefits:

- Paid trainings.
- Reimbursables.
- Stand-by pay.
- Experience-based.
- Health insurance.

Support and opportunities:

- Vessel profiles.
- Performance evaluations.
- Professional forums.
- Career advancement.
- Publication credit.

Employment Standards:

- Assisting fishers.
- Employee retention.
- Training standards.
- Code of conduct.

Discussion points:

- We have initiated a vital iterative process and we are far from finished.
- How can the OPWG better its international representation?
- What outcomes can be generated from the OPWG?

Future projects:

- Guardians of the Sea, a collection of observer short stories
  - Build international awareness of the Fisheries Observer profession.
  - Raise funding for future Observer Professionalism projects in order to offer

career-advancement opportunities to observers.

- Fisheries Observer Exchange
  - Build a network of observer programs and contractors.
  - Examine ways to establish educational exchanges.
  - Draft a plan for implementation and facilitate exchanges.
- Observer Professionalism Central A
  - An on-line site that will act as a public reference library for fisheries observer related publications.
  - Will act as a clearing-house where observers and contractors from around the world can meet.

Contact:

For a full OPWG report, please contact:

- Keith Davis – lblegend@yahoo.com, or
- Teresa Turk – Teresa.Turk@NOAA.gov

Questions & Panel Discussion – Summary of Concurrent Sessions –

Jerry Cygler (East West Technical Services) to the Panel

Comment / Question:

There are some very ambitious projects and ideas but who is going to fund them?

Response:

John LaFargue – A lot of the projects we want to do on safety will be relatively cheap. Cross-training with other programs can be expensive and so far Mike Tork from the north-east and our team in Alaska have been supporting cross-training and paying for it out of our own budgets. Cross-training at an international level will be more expensive but if there is a host, or a country that is starting up a program that feels the need to have some cross-training and learn from us and have our materials, then maybe they could contribute some money towards that. I think there is money for safety out there but sometimes people don't know where it is.

Howard McElderry – The Steering Committee for this conference has been fortunate to see a surplus carry-over from the conference in Sydney and we are expecting the same to occur into the next meeting. As we develop these inter-sessional processes, I think the Steering Committee is aware that there also needs to be a funding commitment to allow for the infrastructure to be put in place and to accommodate some of the web-based and sharing resources.

Jim Benante (Pacific States Marine Fisheries Commission)

Comment

I think safety is paramount in observer programs and I have really enjoyed the focus on safety at this conference. I would really like to see a safety room at every conference and to keep a safety culture as part of every conference and discussion involving observer programs. I have a few suggestions for the next conference to increase the safety room fun factor, for example, we could have a prize for the winner of the immersion suit race and, depending on the location of the conference, an after-hours activity could involve donning life suits and getting into life rafts as teams. Finally, a general comment: we can never lose sight of safety in the pursuit of our respective program's excellence.

Reuben Beazley (Teamsters Union/Seawatch)

Comment / Question:

I think there are different standards for training depending on the goals of the observer program. Do you have different groups of standards depending on the goals of the program?

Response:

Scott Buchanan – Yes. During the work group session on Observer Training there was a discussion about defining the core elements and enhanced training elements of a program. The time spent on each of these will be proportional to the mandate of the program and the training programs are going to be proportional to the budget of the program. Therefore, rather than moving forward with establishing international training guidelines, we suggested providing an inventory of what is currently out there to allow people in the developing programs, or those that administer them, to make their own decisions about what works and what doesn't.

Georg Hinteregger (Observer)

Comment / Question:

I think we need to recognise the limitations of the Observer Professionalism questionnaire. The questionnaire asked for opinions but we don't know the facts and I think in the future we need to survey what the actual conditions are for observers in different countries. For example, does it include health care, does it include vacations, who pays for it, etc. The 41 surveys that were submitted from a field of thousands of observers is a small sample size and there could also be bias in the people who responded to the survey. I would like to see us recognise what we've accomplished but also what we haven't accomplished and to go beyond that.

Response:

Keith Davis – Even though the survey has limitations, the information we have gathered is the basis to target specific areas of professionalism. For example, yesterday Kim Dietrich bought up the issue of observer retention and, based on my experience in the United States, observers live transient lifestyles, yet in other programs they are more stable (for example in Newfoundland, there are four observers with 96 years of experience). Perhaps we need to outreach to the countries that retain their observers and share information on how we can do that.

Georg Hinteregger – Have you begun to examine why the response was so low? I personally had difficulty responding to some of the broader questions and I heard from others that had similar difficulties. I hope as you continue to use this survey that you reshape it so you can get a better response.

Keith Davis – We have also discussed the idea of creating surveys that are mandatory to complete. If observers were required to complete a survey before they went to sea, we would get a larger response and more solid information to build on.

Mandy Kardas (North-East Fisheries Program) – I think observers already have a lot of work to do and more paperwork is not a good thing. Another way to get the information could be via management or the observer providers – perhaps they could talk to their observers and provide the information to you via an online form.

Martin Hall (Inter-American Tropical Tuna Commission)

Comment / Question:

Observers do a very specialised job and I wonder if we should be thinking of ways to train observers in preparation for when they decide to make the transition to land-based jobs. People going to sea often work crazy schedules so it can be difficult to find time for such training but, for example, we have a closure of the fleet for 6 weeks for management reasons which would be a good opportunity for such activities. We could also talk to former observers that have found other jobs and use this information to help design a relevant training program.

Response:

Tracey Mayhew – Yesterday we talked about ways for observers to get credit for their sea time, similar to what happens in the U.S. Coast Guard and Merchant Mariner Documents. Apparently some countries already credit observer's sea time using some sort of formula and we will definitely be looking further into that.

Gavin Begg (Australian Fisheries Management Authority)

Comment / Question:

I was interested in the comments made about not being too prescriptive with respect to certification. One of our RFMOs in Australia is looking to set up an observer program for the next 5 years and part of the process is international accreditation of observers. I see these working groups as a starting point to come up with some standard guidelines for accreditation of international observers and to set the benchmark at an international level and I would be interested to hear any thoughts from the panel about this.

Response:

Bob Stanley – Within New Zealand and Australia there is a move towards competency-based training and accreditation and I think it is a model that could be applied throughout the observer environment. It requires recognition from a national training body and then identifying the competencies that are relevant to the various program's requirements. Some programs will require significant technical competencies and others may require only a few core competencies and so the first stage is to gather a list of the competencies required and then determine the need for the training program.

Bruce Wallner (AFMA) – There is a fundamental issue about the ambitions of these workgroups into the future. We need the RFMOs to recognise these workgroups as the authority rather than reinventing the wheel every time a new observer program starts up. To do this, the work group needs to publish a standard that the RFMOs can refer to. Also, with regard to the point that Yogi talked about earlier about the sharing of knowledge and participation from countries with newly developed programs, currently the developed countries are leading the pack and putting offers out there to do extension into the developing world but I feel it is only lip service. There also needs to be a communication strategy to make it work and funding will be required to do that.

Tracey Mayhew – You're absolutely right and we have already started to explore this in the Professional Work Group. On Monday we talked about how we can turn this international and really make a difference and this needs organisations such as the FAO to get involved. The FAO are already starting to recognise the International Fisheries Observer Conference so we thought they would be a good starting point but we would like to hear any suggestions for other organisations.

Howard McElderry – In this afternoon's session we will be looking at the relevancy of the IFOC process and how some of the outputs from this might work in a broader arena.

Bruce Wallner – The real challenge will be communicating with the countries that aren't at this conference which may be the ones that need it most and that should be part of the communication strategy and an ambition of these work groups.

Bob Stanley – That was the logic behind the connection with organisations such as FAO because many of the countries that need assistance are driven from the top down and the FAO has a broad, overarching brief that can influence thinking and development in those countries. It would be inordinately difficult for a single individual or group to push the development and progress in these countries.

Mike Tork – With respect to the cost, the sharing of ideas and lesson plans on safety are either free or very cheap.

Elaine Ward – I think we need to be very careful about the language we use and the use of the term 'developing countries' within international fora like this. We are all developing countries. Also, a comment with respect to the people / countries that aren't here – the objective in any kind of development exercise is to be participatory and bring in as much diversity of information as we can. I think this conference has gone a long way in doing that. However, we can always do better in that area and I challenge all of us to do what we can to see that the playing field is more level all of the time.

Tracey Mayhew – I think it is the responsibility of all of us who attend this conference or are involved in other international organisations and meetings, to get the word out to those folks that aren't here and to talk about it so that we can bring them into the fold. I think that is something all of us have a responsibility to do after we leave this conference.

Alan Sinclair (Fisheries & Oceans Canada)

Comment:

I've heard a lot of discussion and concern at this conference about whether the information from the observer surveys is used and whether it is credible. As an end-user of data I have been blown away by the types of discussion that are going on in these workgroups and it makes me feel that we are certainly on the right track in terms of using this information. These data are essential and are being used all the time, but we probably take it for granted so we need to think more about providing feedback to the people that are collecting the data. Also, in terms of

future roles for fisheries observers, in our lab we have many people working either on contracts or in fulltime positions with the Canadian government who have been observers – it is seen as a great thing to have on a resume and if we could hire more people with observer backgrounds we would. I also know of an observer in Nova Scotia who ended up as a Deputy Minister in the Nova Scotia government.

Joachim (Yogi) Carolsfeld (World Fisheries Trust)

Comment:

I have had a bit to do with the FAO and the World Bank and I think we need to raise the profile of observers and this conference and bring in specialists from other areas and integrate more with other components. Observers are considered a specialist group and this conference is mostly considered a technical meeting for a special kind of occupation but, in reality, there are many implications of observers that are appropriate to other areas (e.g., ecosystem-based management) and we need to advertise that more widely and have it published in the proceedings as a way to increase the profile of the conference and get more international participation. The other question we need to address is why we only got 10 replies to our questionnaire – perhaps questionnaires are not the best way to communicate with the developing world and focussed interviews may be a better way to get opinions flowing.

CONCLUDING SESSION

Moderator:

Steve Kennelly	*NSW Department of Primary Industries – Australia*

Speakers:

Sandra Vieira	*Alaskan Observers Inc. – USA*
Daryl Sykes	*NZ Rock Lobster Industry Council – New Zealand*
Elizabeth Fetherston	*The Ocean Conservancy – USA*
Lisa Borges	*European Commission*
Alan Sinclair	*Department of Fisheries & Oceans – Canada*
Martin Hall	*Inter-American Tropical Tuna Commission – USA*
Howard McElderry	*Archipelago Marine Research Ltd. – Canada*
Lisa Desfosse	*National Marine Fisheries Service – USA*

Summary of the conference

Steve Kennelly

NSW Department of Primary Industries – Australia

Introduction

This final session is kindly sponsored by the British Columbia Ministry of the Environment, who have also been very generous sponsors of the entire conference. I have been given the task of moderating this wrap-up session for the conference, and to give you a summary about what we have learned over the last few days. We've selected a panel of people from various sectors that have contributed quite a lot during the week, each of whom will give a five minute talk about what they have learned, and their ideas for future directions for this conference series. This session will also provide an opportunity for people to raise issues that may not have already been raised this week.

I deal occasionally with Forestry these days, and we often say that fish are just like trees, except that fish are invisible and move around a lot. That is, fisheries researchers are dealing with something that is invisible and is effectively owned by the public until it is brought out of the water by commercial or recreational fishermen. Because of this, we have significant issues about fish as a publicly owned resource.

The structure of the conference

The basic structure of this conference was formulated by the steering committee along the lines of how you would structure an actual observer program. That is, we tried to schedule our sessions in this chronological order:

- Why we do observer work;
- How we do it;
- What we do;
- What do we get out of it; and
- How can we do it better.

I think the committee has been fairly successful in achieving this structure. The following is a summary of what I learned from each session and some of the quotes that people mentioned that I think were relevant or were key points in our discussions.

Why we do observer work

We do observer programs so we can learn about things like by-catch, discarding levels, stock assessments and other key aspects of fisheries. These programs have led to an increasing variety and diversity of data that are collected and an increasing variety and diversity of uses for those data. One of the drivers for observer programs are 'ENGOs' (Environmental Non-Government Organisations). We heard that ENGOs are *"an equal opportunity complainer!"*, but they are also vital and pivotal, and perform a key leveraging role in representing the public's desire to conserve 'certain' species. I've put 'certain' species in

inverted commas because we've heard a lot about sea birds, sea mammals and sea turtles this week – which are the charismatic fauna that we all know and love – but there are also a lot of other by-catch species that should also be important to the public and us, such as juvenile fish and other species that are caught and discarded. Often these species are put to one side for the sake of more charismatic species that generate a lot of interest from the public and therefore greater funding for ENGOs and other agencies to use.

We heard a quote from Wes Erikson *"…fisheries need to be sustainable but they also need to prove it"*. This is what observer programs do – they provide industry the opportunity to prove that they're sustainable. We also heard a quote from Paul Parker about: *"…aligning conservation with cash"*, which is something that works not only from an NGO perspective but also from an industry perspective.

Something we heard early on from Martin Hall is that humans are adaptive and flexible and can solve big problems. About 90,000 year ago, the first humans in the Upper Semliki Valley in Zaire started fishing using harpoons. Since then we've learnt to fish very well, but we've also learned how to solve many of our fisheries problems. One thing I got out of Martin's talk is that we need to be optimistic that we can solve our various fisheries problems. We often hear negative stories about by-catch, but I've put together a book (which will be published very soon) that brings together a lot of the success stories about reducing by-catch. The book consists of eight chapters on methods that have actually worked to reduce by-catches, and that have been implemented and are operating in the world's fisheries. Martin's chapter in the book is pivotal because it is all about how to implement the by-catch reduction techniques to reduce by-catch. I know that I am giving another plug for the book, but I think its publication is quite timely.

How do we do observer programs?

Observer programs should be designed carefully and incrementally and pilot programs can often be used quite effectively to develop the observer programs. Someone said we should: *"…collect better data, faster and cheaper"* and that is what we are striving to do with observers. Wes Erikson also said *"….there are many ways to fool observers"* and observers need to be aware of this. I agree that it can be easy to fool a new observer but once they've been out there for a while I think it becomes a lot harder to fool them. Wes also said *"…honesty is the best policy"* – just after he said *"there were many ways to fool observers"* – and I think honesty is important in this whole debate. When people start being honest with each other is when we will start seeing solutions – this is something Martin Hall has also been saying all week.

We are seeing individual responsibility leading to more industry ownership of monitoring and, at this observer conference in particular, we have seen the trend for more observer programs to be run by industry. An example is the new developments using cameras on boats to do audits.

Observers work in very difficult situations such as onboard small boats, in freezing weather, in huge seas, cramped conditions and hostile environments, and one of the big messages that was pushed at this conference was 'Go Safe or Go Home'. This message was driven home by John LaFargue's group and I really believe that these people have saved lives this week – I think people will be more safety conscious from what they have learned at this conference and, over the next few years, this will save lives.

Uses of observer data

The uses for observer data have expanded considerably. At the 3rd and 4th International Fisheries Observer Conferences people wanted to see more information on how observer data are used and we've now seen some amazing developments in this field. For example, we heard about how we're getting observer data integrated into many applications across the world. In fact, observer data are now one of the major sources of information used in fisheries science. We also heard that observer data need to be *"…integrated, accessible, shared, actionable information"* and that *"….extrapolations of by-catch estimates need to be appropriate to spatial and temporal variation"*. However, in doing all this, we also need to be mindful of the biases, inaccuracies and precision of observer data.

We also heard about various observer programs that are going on throughout the world. For example, we heard about programs that are occurring in the Azores, Ghana, the Philippines, Namibia, Kenya, Vietnam and other places. Some of the more recent programs are showing 'growing pains', but the message came through that the more advanced programs, such as those in Canada, had the same problems when they started out years ago and one of the key purposes of this conference is for these new programs to learn from the experiences of the more mature programs. This led to our discussions on the internationalisation and sharing of information, during which we heard about the efforts by the European Commission, the Western and Central Pacific, IATTC, etc. to link programs. Following from this, there were three key issues that came out of the last session: (i) the need to establish international efforts to 'train the trainers'; (ii) trying to roll out OBIS around the world through a future working group; and (iii) trying to incorporate observer data into ecosystem-based models for ecosystem-based fisheries management.

Finally, one thing that Mike Tork said the other day is *"….if you build it they will come, and come, and come"* and we have seen this in the incremental increases in the number of participants and quality of presentation and discussions at these observer conferences. Everyone throughout the world is now starting to appreciate the importance of observer work and that importance is growing at each conference. Every two years we have this stocktake of our field and we have seen amazing progress in the awareness of observer programs, the use of observer data, and the internationalisation of observer programs which, maybe, hopefully, is due in part to this forum.

An observer's perspective

Sandra Vieira

Alaskan Observers Inc. – USA

Yesterday afternoon the observer representatives attending this conference got together to discuss and share each other's opinions about the conference. At first it was slow-going getting the thoughts to flow, but we managed to formulate some opinions regarding the conference anyway.

Collectively we were thrilled to see the results of our data collections being used throughout various programs. It was a way to validate what we all work so hard, out at sea, to do for the fisheries and our contribution in protecting our oceans' natural resources.

A few concerns that were discussed were the minimal observer attendance we saw here at the 5th International Fisheries Observer Conference. We discussed a number of ways that we might build interest within the observer community to attend future conferences. One would be to have sessions geared more towards observer-exclusive topics such as: methodology of sampling; its difficulties and solutions; how to deal with space constraints and hazards on the various vessels observed throughout all our programs; and how to cope with trip lengths – i.e., being out at sea for extended periods of time and not go crazy. Other topics could include: discussing personal experiences in conflict resolutions; stories of past experiences in confrontations with vessel crews and how the observer resolved them; and sharing and suggesting how others of us might have handled it differently.

A big topic that was discussed was the interest of other observer programs throughout the world. As a like-minded group of individuals, we seem to be inherently adventuresome and curious of other programs in the world. Actually, more so we are curious about the different types of observer programs. A strong suggestion was made that a grocery list of programs could be described – either in a presentation forum or probably more reasonably, in written or electronic form – describing the different observer programs throughout the world, discussing the different fisheries, their target species, their by-catch, the different manner of handling the by-catch (i.e., whether the discards do not affect the fishers' general quota, are deducted from the quota, or are not discarded at sea but later at the dock).

Another topic of interest was potential benefits of cross-training of one program with another, which may be, ultimately, an all-inclusive certification for easy international deployment.

Another interest was for an informal forum – a round table, so to speak. Such a session could allow observers to speak frankly about their personal experiences and receive feedback from

our counterparts throughout the world. An appropriate avenue to get this suggested forum started would be to use the already well-established Association for Professional Observers website.

A concern that was noticed was that approximately 50% of the observers that attended yesterday afternoon's informal gathering had originally submitted abstracts for the plenary sessions and some were diverted towards the poster forum, thereby giving the feeling to those observers that their interests were not warranted for the plenary session. It is understood that there are far too many topics that people here at the conference are personally passionate about, so possibly the poster forum is a way to present all of the numerous thoughts. However, maybe an observer-specific discussion panel is warranted in addition to the discussion panels that we have seen.

But I must share that we, as the observer contingent here at the 5th International Fisheries Observer Conference, were happy to meet, speak and interact with folks of various positions within the fisheries community.

I would like to take this opportunity to thank all of the sponsors and steering committee for providing us with such an opportunity.

I believe we all look forward to the next conference.

An industry perspective

Daryl Sykes

NZ Rock Lobster Industry Council – New Zealand

This has been quite an amazing week for me and I need to put it into context again. I have been a commercial fisherman in New Zealand since 1971 and have had 21 years experience in the lobster, set-net and line fisheries. I came ashore to become essentially a full-time fishermen's representative and advocate, and then moved on to become a fishery manager and a research program manager. I've been to a number of international conferences over the years but I haven't been to one yet that has both informed me and challenged me as much as this one has. It has been very interesting to me to be an observer of observers. I am normally in the situation where I am buying observer services and am part of a group that determines what those services might be. I salute and admire both your passion and your professionalism – and I say that most sincerely. I again thank the organising committee and the sponsors of this event for enabling my participation – I know that I'll leave Canada tomorrow taking more with me than I've left behind and I thank you all very much for that.

I'm going to leap ahead two years and talk briefly about the next observer conference, wherever that may be held, and suggest a number of things that maybe you might want to include in that forum. At the very top of my list is the safety room. As I have said, I've been to a lot of conferences, both internationally and domestically, and I've never seen anything like the safety room – it was an awesome display with a great message behind it. I agree with the comment that Steve made about the awareness of safety that will be carried from this forum and distributed amongst the people that you come in contact with – I would encourage you to stay with that.

In terms of sessions, just based on what I've heard in the discussions this week, there have been a number of suggestions, including general topics on 'Occupational Health & Safety' – the sort of issues that relate to diet and fatigue-management and how you survive onboard fishing vessels, whether it be for days or months. Another session to think about is 'Business Relationships'. I don't know if you realise that you are now in the business of fishing – you are as much a part of the fishing industry as I am – and because it is a business you need to be able to negotiate business relationships. One of the business relationships that I've heard about this morning is the nature of employment contracts. I run from the proposition that fisheries management is not about managing fish but it's about managing and modifying human behaviour. I think one of the business relationships that you need to transact and have the skills to transact is the interaction with vessel personnel and with the supply chain. It's not just on the boat – you also need a relationship with where the fish are going and how they are transported.

I'd encourage you to also consider a session on 'Widening the Terms of Reference for Observers'. This is not a criticism but just an

observation. I have a sense that there is quite a narrow focus by observers of the work that they do and I would like to encourage you to contemplate widening the terms of reference so that observers in their training are given a better appreciation of the public policy and operational frameworks within which the business of fishing is transacted. You should also use your Observer Professionalism group to try finding opportunities for contributing to the areas that will improve your career path within those policy and operational policy frameworks, improve your personal safety and your individual and collective professionalism. In doing so you're also going to improve the quality and effectiveness of the management and decision-making that arises from the use of the data that you collect.

Another suggestion is to have a session where some examples of data use and application are played out for you. I think we all go to sea with expectations and quite often they're not met. I go to sea with an expectation of a good catch and sometimes it's not a good day – you go to sea with an expectation that you're making some important contribution to the quality of management decisions and you don't see the results of that and I think that this feedback is absolutely critical.

Training and Certification was an issue that came up before lunch. I believe that there are pathways for training and certification. I did some checking over lunch and found that in North America at least, you don't have a formal industry training organisation within a government agency, but those do exist in Australia and New Zealand and there are some very useful templates down there that you might want to have a look at. It seems to me that it doesn't really matter where you get your project design from, as long as you are contributing to the competency standards that make up those training programs. I'd encourage any of you that are keen to pick that up to have a talk to Andrew France from the Ministry of Fisheries before we leave.

In terms of my role as being a manager and a research program manager, I'm purchasing observer services. At the top of my list is not so much who gives me that information, but what that information is. I think there is a role for observers to play in the process of what I call the information needs analysis. One of the real tensions that I observe in observer programs is this tension between the need to inform good science and the need to ensure good compliance. My personal experience is that they are not necessarily compatible and it may be that you need to consider a number of different career pathways – that is, a scientific observer role versus a compliance observer role. It seems to me that it is important that you identify yourself to the owners and operators of vessels to whatever role you are adopting because the role that you take on really shapes the relationship.

I have a number of other observations that I also want to make. One thing that was absolutely amazing to me right from the first day was the focus on discards. I had never heard raised before the notion of a public interest in discards other than for sustainability. When someone talked about the public interest in discards relating to waste, that really got me thinking a lot about the way we look at some of our observer services and observer coverages in New Zealand. I need to think about that some more but I want just wanted to acknowledge that, from my point of view, that is a different perspective from where I am.

My final comment is in relation to the role of environmental NGOs, and I look to you Yogi. The attitude, tone and the imperatives of the environmental and conservation organisations that I've witnessed here this week are more acceptable and more productive than anything I have experienced in my fisheries career, with two notable exceptions in New Zealand where I believe the environmental NGOs are making a very positive contribution to fisheries management and to the business of fishing. However, I salute you and your organisation for what you have done and enabled by way of your contribution to this conference. You haven't actually achieved a convert here, but you have certainly given me cause to rethink my relationship with environmental NGOs back in New Zealand – and believe me, they should thank you too.

So thank you all very much. As I said, I'm taking a lot more away with me in the way of ideas and concepts, and I encourage you to chase the conference in two years time, wherever the venue is. Please make the effort and I look forward to seeing you all there.

Comment from Steve Kennelly

I'm not sure that Yogi would agree that he represents the environmental NGOs but it turns out the timing is just perfect because our next speaker is going to talk about that from that perspective.

An ENGO's perspective

Elizabeth Fetherston

Ocean Conservancy – USA

I do a lot of travel for my work with The Ocean Conservancy and go to a lot of fisheries meetings and this conference has really been very productive for me. This conference has been terrific to be a part of and I feel honoured that my organisation acknowledges the role that this kind of information plays and where we can find a way to fit into this whole process – it has been really great to hear all the amazing programs that are going on in so many places. It was so neat to hear about the observer program in Ghana and I'm certainly taking away lots and leaving very little for you folks. I was here to observe and learn and to take some of that back and adapt that to where I work.

Yogi said something interesting earlier when he talked about the role that ENGOs play in facilitating trust between groups that may or may not have a lot of it, and play a role in making bridges between fishers and government agencies. I certainly hope that I aspire to do that type of thing in my region and I've learned a lot here from the fishers that have participated and from the managers from around the world about what I can do to make sure we have the best fisheries monitoring systems we can in my region and translate that into sustainable fisheries – I thank all of you for your contribution, whether or not my fishers agree when I get home.

I think there is so much that has gone on here that is relevant and you just need to be creative enough to apply it to your own situations. I have most of your business cards and I will attempt to email you and get you to help me do that. It has been incredibly informative and I can't stress that enough – it's been such an interesting place to be as a former observer and now here trying to learn about how to make electronic monitoring systems come together and how fishers might accept such strategies.

I'm just going to close with one thought – Paul Parker from Cape Cod talked about the urgency of the issues we have in the United States and how important it is to really solve these problems and come together to fix what is going wrong with our oceans and promote what is going right. I think the ENGO groups that I've interacted with here play a pivotal role in the communication to fishers of, not only the urgency of the need to solve problems, but also the need to really participate fully in the data collection systems and embrace the idea of fisheries monitoring.

Thank you all for your contribution to what I get to go home and do – I appreciate the thoughts you guys have shared both openly here on the floor and more informally at the social functions.

Comment from Steve Kennelly

It's important that people stay in contact after the conference. It never ceases to amaze me when you have a conference and people come up and ask if you know something on a particular topic and you can point them into the direction of the world expert on the topic who is also at the conference. People are always giving of their time at these things which doesn't really happen in any other forum, so it is really quite special.

A European perspective

Lisa Borges

European Commission

I want to start firstly by thanking the steering committee in inviting me to give this talk, and also for co-chairing and for the financial support that you gave me to be here. I also want to make my position a littler clearer – I started as a fisheries scientist but two months ago I moved into a fisheries management job in the European Commission, and in the hope that I'll stay in the job for little longer, I want to make it clear that this talk is my opinion and has nothing to do with the European Commission.

When Steve asked me to do this talk, I joined with my European colleagues to talk about what

I should say and I thought I'd talk about their and my reactions about some of the talks given here. I heard a lot of talks and some specific facts and words really hit us – for example, '100% coverage' and '1000 shrimp trips sampled per year'. Basically, this is a very different reality to Europe, where we have very small programs

There is a clear distinction, at least in Europe, between scientific programs and compliance programs and I'm glad the industry people have raised this. I'd like to show the difference between my talk and Sara's talk – we have compliance in Europe at the Commission level but all the programs I know are actually scientific programs to collect data for stock assessment and to improve our scientific knowledge of the fisheries. I think this distinction is pretty important and again this is a very different role for an observer on a vessel.

With respect to the scientific programs, although we have a very small coverage and a small number of trips, we actually do a lot of things that are pretty cool. We are 27 countries with very different cultures and language and social realities, but we do manage to work together. We have a lot of workshops within ICES and within the Commission. We do a lot of work on standardising methods – and I tell you, data and methods can be very different between a Portuguese and an Estonian – different cultures and different observers can really impact on that. We do a lot of work on standardising methods between groundfish surveys for observer programs and discard surveys, and we also do a lot of standardisation after that, of the data, to improve our stock assessments. We put our data together and take a lot of effort to have good quality data, so I think that this is something we can learn from each other.

From my perspective, I think the good things about this conference include being able to see the different realities because from that, you can learn about solutions or help others to solve their problems. I particularly like this conference because it's a very relaxed environment – you can have a joke, which really breaks the ice and helps a lot of people to talk who wouldn't be comfortable talking anywhere else, but they have a lot to give.

My thoughts for the future of the conference – I think it should be an Observer's conference and I think all the issues that relate to observers should stay in the conference and include observers. But, to come back to scientific versus control/enforcement programs, they're very different issues and in Europe we like to keep those roles very separate. Perhaps a specific panel session or workshop could be dedicated to scientific issues versus control/enforcement or, alternatively, talks could be separated according to the two types of programs. One of the comments I heard was to have the talks mixed between scientific and compliance.

I think we should be more international and open to even more countries because it creates diversity. I also think we need more industry participation and fisheries management at the conferences. I learned a lot from the industry panel, which I hope will improve my job. I'm not sure about having more workshops and therefore more concurrent sessions – as you might want to participate in both sessions and it is difficult to choose. However, I identified three workshops that we should talk about at future conferences: (i) Law & Confidentiality / Enforcement Issues; (ii) Data Issues – quality, bias, users; and (iii) Self-Sampling Programs (industry participation would be crucial for this).

A perspective from an end-user of observer data

Alan Sinclair

Department of Fisheries & Oceans – Canada

This has been an amazing four days and I really appreciate the opportunity to participate. I've learned several things but I'm only going to talk about a couple because most of them have already been covered by other speakers. I think the idea of being part of a solution to fisheries management issues is a very important one, and I congratulate our keynote speaker for bringing this to everyone's attention – I kept reminding myself of that one phrase throughout the whole four days. Once a problem is recognised, be it turtle by-catch or dolphin by-catch in purse seines, or whatever, we don't gain much by trying to describe it in more excruciating detail. What has to be done is that everybody has to work together to find a solution. Being part of a solution is what it's all about.

One issue that comes to mind is the issue of confidentiality and accessing confidential data. This is probably because I'm on the side where I can actually look at confidential data by spending a lot of time analysing commercial fisheries industrial information, for which our Ministry, at least in our specific region, has specific rules as to who can see this data and who cannot. There are reasons for these rules and, although it may become more open or it may not, the point is that those rules are there. Agencies like my own (Fisheries & Oceans Canada) are in a position to basically address these issues by coming to a table and providing analyses that are meaningful and that help find solutions. It gets a little bit frustrating when we're criticised for not sharing the stuff, but it's really not our own decision, as analysts, to share confidential commercial data. Nevertheless, I think that we can do a lot.

The other very important issue here is all of the metadata issues that go along with it. It's not a simple matter to just say: *"Here is an Access database, or an Oracle database, of tow by tow commercial fisheries data"*, whether it has the confidential stuff removed or not. It's not an easy exercise to go ahead and do any kind of analysis on that without understanding the metadata. So, I really think that agencies like our own have a very important role to play here and I think people just need to trust us to do a good job, and we have to encourage ourselves to do so.

Another thing that really surprised me about this conference is how much discussion there was about fisheries management, along with lots of really good examples of things that work. I think Ray Hillbourne has given a few talks lately about how important it is in the world of fisheries management to advertise successes and make sure that people are aware of them. There were definitely some examples at this conference of things that work – for instance, drawing that line in the sand, or having the suitable stick, that an agency would put forward to industry to challenge them to find solutions to problems and, it turns out that fishermen are very inventive in finding efficient and effective solutions to important fisheries management problems, and this needs to be congratulated. Observers, of course, play a very important role – not simply in providing good data, but also in areas of outreach, education, reaching forward and extending information between management agencies, the fishing industry and the ENGO communities, that collectively make this work. We also saw some examples of fisheries management systems or approaches that don't work. We saw what happened to the Irish in the North Sea when collecting information to try and estimate discards – all of a sudden things took a turn for the worse. We also heard a lot about the initial phases of observer coverage in the British Columbian hook and line fishery – when all of a sudden the fishing strategy of the vessels for observers was changed remarkably and was probably an impediment to collecting reliable data, and maybe even going in the wrong direction. I don't think that that was the main intent of this conference, but it's a theme that was there. If this conference was just on fisheries management, I don't know that we'd hear of all of these examples in such a candid and forward manner. That's a really good outcome here in my opinion.

I have two suggestions for potential themes for additional work – which is what I thought we were trying to do here – but that's okay – and this is DFO's opinion:

To deploy or not to deploy – what is the question?

The session yesterday on deploying observers on small vessels really brought the following thought up in my mind: *"Holy cow! How are you going to put an observer on a kayak, and do you need to have an observer on a kayak?"*. For a lot of presentations in that session, it would have been interesting if the first slide had said *"What is the question?"* That is, what are we trying to do here and, therefore, why are we putting someone at sea, risking their life and everything else? So, we have to define the issue. Is it simply to get more accurate data? Or are we looking for outreach, liaison, education, etc. – are we trying to mitigate a problem? As you get these questions defined in your mind, it will allow you to decide whether you need to put an observer out there, or if electronic monitoring might work, or whether, in fact, fishermen may simply buy into the system and do all this data collection themselves, as I think is happening with rock lobsters in New Zealand.

Then there are really important issues about vessel size – obviously safety; and, thirdly, costs that have to be borne in mind. I think a session theme around this third issue would be very

helpful for planning observer programs or monitoring programs, or this type of activity in general, and would facilitate frank and open discussions regarding the issue, as this conference obviously is able to do.

Catch Estimation from Partial Observer Coverage

My second suggestion has to do with catch estimation from partial observer coverage. I know that there is a very large study going on in NMFS on this and I think in two years time they'll probably have the book written on this issue. However, it might not be fully communicated all around the world, or it may not take into account a lot of the issues that are out there. Obviously the classic statistical approach to this issue is to redefine your sampling frame and consider randomisation and representative sampling and use various ratio estimators to improve your estimates. We had a session where there were a number of presentations on this – one that looked at estimators and estimator qualities, and then others that used all different kinds of estimators. That is, is it the catch rate of the species that you're interested in that is used as the bump-up factor or is it the landed catch of the directed catch that is used as the bump-up factor? Obviously, you'll get different answers depending on what you do, so we seem to be embarking on this in a big way, but then there are really important issues of bias and precision. What happens when you put the observer on the boat and the boat leaves port and turns left while everyone else turns right – how representative is that? Can you actually get there, or are we fooling ourselves that you can come up with useful numbers? Are there alternative approaches? (I put that as a question mark but I'm sure there are other ways to do this and I think this would be worthwhile of a session and one that could be frank and honest and look at the realities of the issues).

So, again, I want to thank you for the opportunity to come here and for listening to my short speech.

The keynote speaker's perspective

Martin Hall

Inter-American Tropical Tuna Commission – USA

We have had a very good week here and I was left speechless by Steve's presentation last night, which is a rare event. However, if I could have continued, I would have asked you to remember that the things that I described are the work of a dozen people, some of whom we have met, and another dozen or so in the national programs. We have many observers at sea and another 30 guys from the sea turtle program (you've met some of them). So, everything is a group / team activity. The fact that one happens to be a face here should not cover the fact that there is a lot of effort that goes on behind that. My best quality as a manager is choosing the right people and delegating and trusting in their judgment, which I've been very lucky in doing.

In the newspaper clipping about this conference, if you have had a chance to read it, I have a quote that says *"humans and scientists are evolving"*. Even though there are obvious differences between human beings and scientists, I think we're still inter-breeding – or trying to in some cases! So the quote is a bit inaccurate but it's a fantastic quote to see.

I was very happy to see at the conference friends from Pakistan and Sri Lanka thinking of the future of their countries and the role of observer programs in those circumstances. Imagine if we were talking about a stormy day and then imagine what it is like to have a few very stormy years. It is clearly encouraging that they are here. I'm also very happy to see our friends from Taiwan and Korea, and industry, government and major industrial fleets – we need to manage the oceans and they are here and they are very committed to doing so. I appreciate this very much and I wanted to say so at some point. Although all of the other countries represented here are very important, I wanted to make a special point of this because it means that we have succeeded in something that we have been trying to achieve for years. And if we let Lisa Borges take care of the European Union, in two years time we'll have all the European Union observer programs sorted out. Then we'll see the data and start criticising the quality!

Instead of preparing for this big wrap-up session, what I did was get together with a group of the Latinos present, which includes Latin Americans and Spaniards, and we also had some input from our friends from the Philippines and Vietnam and we just had a discussion with all of them about which things could be useful given their situation and where they are, and we put something together to help in the development of new programs.

A Technical Report

There are observer programs in all stages of development. There are always programs which are about to start and so the first help for somebody that wants to start a program (and that would be the case in some of the countries I have mentioned), would be something like a technical report from FAO, without fisheries science but which contain the ingredients you need to think about to put together an observer program. For example, logistics – what elements you need; planning – how to plan, what to sample, what to sample for, how to decide this; personnel – all the observer personnel issues (and I'm not going to go into details); operations; and quality control issues. All of these processes provide something that is a combination of knowledge from programs that are already in place and operational. At the IATTC we frequently hear from people who are about to start an observer program we spend many hours explaining our program, but it would be nice to have some sort of document outlining protocols in place.

It was mentioned previously that training of trainers be done so that education is administered in a consistent way. And then there are ways to fund observer programs – all the different options that are currently in use in different countries could be outlined so that those starting can figure out what their options might be.

Standardising data forms, databases, definitions by gear. Regional adaptation of the best practices

It was mentioned before that standardising data forms is another very important issue for everyone. We were very lucky to hear about the best practices being done across many languages. This is something we would like to encourage very much and adapt it regionally, as we are currently trying to do.

Gender equality issues: approaches

Some of the people mentioned gender equality issues and the ways to approach such issues. An approach involving looking for the best vessels and the best crews to start the insertion of women, for instance, in those boats, would be useful. Eventually, when the fishers see that everything works okay and nothing happens, then things become a lot easier to implement.

Develop communication systems with fishers to provide feedback on results

Very important to all involved was the idea of bringing things back to the fishing community, which would increase the levels of observer acceptance. So, getting the information back to the observers is not only important to the observers, but getting it to the fishers afterwards is equally important – these are the two stages of dissemination of results that need to be satisfied.

Building capacity

Building capacity with respect to all observer programs includes some issues which are purely technical. The issue of training in communicating with fishers is quite unique. We usually make very sure that observers, managers and scientists have the right approach and the right attitude – not arrogant or imperative, but curious and open – and in the past we have given workshops to train trainers in our observer programs. We have also trained 140 people from different countries who want to interact with fishers to reduce sea turtle by-catch – explaining that the fishers need to know something about turtles but they don't need to become turtle biologists. They need to be trained in what is important for what they are doing.

A suggestion from some was to train observers for outreach duties at sea and ashore. The at-sea part is being done in our case (via the turtle program), mostly because of the urgency of the issue – we cannot wait. We're not trying to get high quality data for mortality estimation, so those observers are told to intervene – teach/educate and so on. But the idea was to extend it to shore activities, or periods where they could work at schools and transfer the experience to others.

Training in the legal framework was another issue. This is important so that observers are aware of what legal instruments are supporting them.

Veterinarians, observers and fishers

Something new that was brought was the issue of handling / dealing with animals. We had over 50 people the other day who spent many hours together examining this issue for the case of sea turtles and the feedback has been fantastic. We think this issue is something that is coming in the future. I'm very thankful for the organisers for accommodating this because I want you see how much we learn in a little a bit of time and how much we can gain by training with veterinarians. What can be learnt in animal handling can spread to all observers and eventually to the fishers. We can eventually try to come up with the best possible ways to really make sure turtles and other animals survive release.

Observer training

Observer training is very important for all of the items in this brief list and most programs will be similar:

- Program motivation: explanations of goals, policies, etc.
- Identification, biology ecology (relevant).
- Vessel and gear. Mitigation in use.
- Procedures for data collection: manuals, definitions, priorities.
- Behavior at sea, expectations.
- Debriefing, incentives.

Placement meetings

There was an emphasis on the importance of observers meeting with the skipper and crews before leaving (and before new observer programs begin) so it is very clear what the observers are expected to do, suppose to do, what to avoid, and how the observer-crew interaction should happen.

Observer programs: socio-economic variables data collection

We had some input from people from the Philippines, Vietnam and other countries regarding the idea of understanding and collecting some socio-economic variables in some of their fisheries that might be relevant to an observer program. This is something outside the data I would normally collect in our observer program, but we should know more about what these issues might be. For example, the issues of health and safety are so incredibly different in such situations. I was thinking of some of the worst risks for our observers, which is not survival in cold water, but probably melanomas and skin cancer from the tropical sun. Therefore, we need to figure out health issues by region, by fisheries, and by other reasons accordingly.

Observers career paths

I have already mentioned observer career paths. I think that, because observers are very specialised in a narrow area of work, maybe we can do something about planning for their future when they want to change. We have observers of a very high quality – still working after many years – who we're very lucky to still have observing, but if they want to do something else, we should be behind them.

Regional observer programs as a tool for regional integration, ecosystem management and comparative studies / division of labour

A very important value of observer programs is that they are becoming an instrument of regional integration. Nobody thought about that when the programs started, but now we have people in a lot of different countries that meet and interact regularly with each other. In the past they were talking the same language; gathering the same data; sharing the same problems, resources and species – but there are no organisations managing these resources because they're inside specific jurisdictions. So, through this regional observer program, maybe something is happening and in November we'll try to give another small push towards the idea of creating special regional integration via observer programs.

Comparative studies

Comparative studies are extremely important to see why by-catch issues happen. We recently had a fantastic example with entanglement of turtles in longlines. In two regions we saw data regarding turtle entanglements as very different. The materials of the longlines were different – one was monofilament and one was polypropylene – and the difference in entanglement rates was 17 fold. So it can be

very easy to compare such studies and come up with quite simple solutions to by-catch problems.

What can countries in less developed observer programs offer

What can other countries offer to countries that are in a more advanced stage in terms of observer programs? Maybe one of the most important, from the point of view of research, is a lawyer-free environment. I suffer with my friends from the US (I don't know if Canada is so bad) with the total impossibility of doing research in some cases because of all the legal hurdles that have to be jumped through. I understand it's a legal system and they have to do things right, but it becomes so complicated that it discourages research. We are fortunate to have the opportunity to do research and we are sharing the opportunity with all of them, so come and work with your fantastic colleagues from Latin America and with the fantastic fishers from the region to do the things that you want to do.

The other thing we do is work from the bottom up. In many cases, we don't have a strong legal system forcing things so we need to work the other way and maybe find cheaper and more practical ways to do things – we're very flexible and we try to keep the regulations open. We need to work with the fishing community because we cannot do it against them: we cannot do it with a top-down approach.

The last thing in Latin America is a total eagerness to learn and to work in collaboration, so you can see how easy it is to get things working with others. We have established a great relationship with researchers from the US, Spain, Japan and we're prepared for similar relationships with many others.

Fishers involvement

To finalise these issues, perhaps the most important thing we have is the fishers' involvement, and that has already been mentioned. Building trust was number one by everyone – if we learn to trust each other then we can work together – no doubt. Communication both ways is very important, as is providing opportunities for that to happen. The motivation for fishers to cooperate is one of the issues that is very different between countries – an issue that has to be sorted out. We can provide examples or help each other, but this is a major problem for many countries.

We have been lucky to have very supportive governments in our region and that is something that has been, again, surprising because we have no official government involvement. However, they have been patient and willing to accept these programs run by mixtures of private industries, ENGOs and other strange characters.

Alan mentioned the constructive participation of environmental groups. We mentioned the significance and importance of the ecological view and the fact that they can do an amazing amount of good when they join forces and push together.

The last point here, which is something that is important to remember when we discuss observer or by-catch mitigation programs, is that we are all working in a very different context from an economic point of view. The threat to turtles or other by-catch species in many of these countries is not the fishing communities, it's the poverty and lack of development that pushes people to catch and eat them and to prevent them from taking mitigative actions that are expensive. So we need to keep in mind that one of the best things we can do for conservation is development, and sustainable fisheries form a basis for such development; and observer programs are the basis for sustainable fisheries. There is a chain and there is a connection and I'm very glad and happy to see so many people understand where we start and where we finish.

Comments from Steve Kennelly – as I said last night, everyone always benefits when Martin Hall stands up – it's always a pleasure to have him involved in these things.

A perspective from a (soon to be retired) conference chair

Howard McElderry

Archipelago Marine Research Ltd. – Canada

It's quite humbling to be speaking after you Martin – my general concluding remarks will not be as insightful as what you have just offered. I would like to take the opportunity to recognise you for your role in working with World Fisheries Trust to identify the delegation that we were able to fund to bring here. Grant funds for this purpose came late in the process, and being able to identify people and get them here on a short time frame really involved a concerted effort. Martin, you were instrumental in making that happen and we really appreciate it.

My second general comment pertains to the safety room and its influence on the conference. When we were planning the layout of activities in this conference facility we had this empty room that we couldn't really figure out how to use. About 3 – 4 months ago the Steering Committee got his idea to make it into a safety room, featuring equipment and techniques promoting working safely at sea. Through the enthusiastic involvement of Mike Tork, John LaFargue and Gord Perkins the project got legs and they did a fantastic job of acquiring equipment, organising the space, and enlisting volunteers to help out. What I especially appreciate is how they brought the safety theme into the conference. It started out as a bit of fun to have an immersion suit race on the stage but evolved to have a strong impact, creating the awareness that safety at sea is really important. For those of us that are not actually working on the vessels (my job's a desk job) and it's a chilling experience to have this touch you. I am very appreciative of your efforts in helping to make at sea safety such a strong theme for this conference.

My main aim here was to provide information about the International Fishery Observer Conference Series and some thoughts arising from this conference. Some of this information has not been previously communicated and it may be useful to help seed discussion in this session.

As chairman for this conference it became evident early on during the planning stage that we really needed to construct a vision, mission statement and goals for IFOC. The steering committee developed these based on an implicit understanding of outcomes from the previous four meetings, as well as incorporating our views on how the international fishery monitoring community would be best served by this meeting. My intent here isn't to discuss the IFOC vision in detail but simply bring them to your attention and make the point that this is the framework from which the Steering Committee worked.

Vision Statement

"To enable the development of effective fishery monitoring programs, where necessary, to ensure sustainable resource management throughout the world's oceans."

Mission Statement

"IFOC was established and has been maintained to share and develop best practices within fishery monitoring programs and promote their implementation globally, and establish dialog between those responsible for monitoring fisheries and those who rely upon the data they collect."

Goals

The goals identify the various dimensions of how IFOC would interact:

- Provide a broad focus on fishery monitoring methodologies, including fisheries observer programs, emerging technologies, and other fishery dependent data collection approaches.
- Target the international community of those involved in the collection and analysis of fishery-dependent data, including observers, observer program staff, scientists, fisheries managers, monitoring contractors, fishing industry and ENGO's.
- Provide a linkage between effective fishery monitoring programs, sustainable resource management, and public acceptability of fisheries.
- Develop results-oriented sessions that include a broad range of fisheries monitoring topics, addressing the diversity of the field, and emphasising leading-edge areas.

- Provide a participatory process among delegates.
- Provide a forum for delegates to share up-to-date information on fishery monitoring programs in their region.
- Provide a forum for scientists, managers, policy makers and others who work with fishery-dependent data.
- Publish conference proceedings and disseminate broadly.
- Establish work groups for certain important observer program topics that would benefit from inter-session communication and sharing of resources.
- Maintain a dedicated IFOC website for dissemination of conference materials and other fishery monitoring program resources.

In looking through the goals I think that the Steering Committee has done a reasonably good job in trying to organise the conference so that it reflects these goals. I would encourage the Steering Committee of the future conference to look at them, think about them and to decide if these are really the way they want to go, and then work with it.

Conference delegates by country

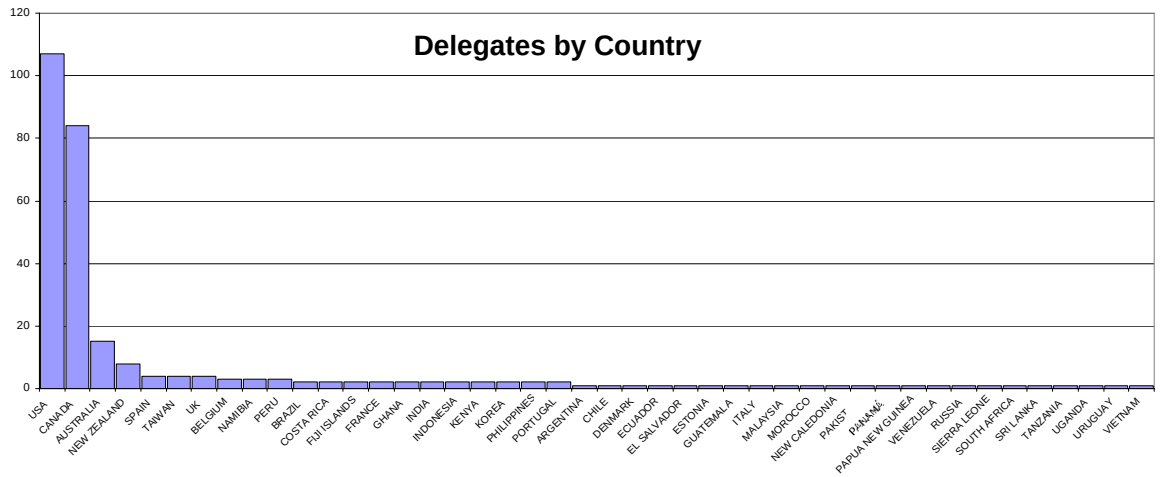
As this conference aims at international participation, it is useful to examine the breakdown of the conference delegates by country. In general terms, this conference attracted about 260 delegates from 45 countries. The following histogram shows that one or two delegates represent most of the countries. I think it's by virtue of the location for this meeting that Canada and the United States make up the largest portion of the delegation.

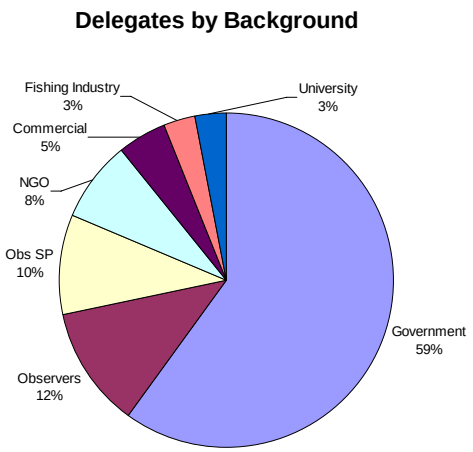
It is useful to examine participation in the planning process: if this is an 'international' conference, then what does this actually mean? What levels of country participation are we likely to achieve?

Background of Delegates

Another goal of the conference is to attract delegates from a diversity of backgrounds. This morning I summarised the delegation list according to a number of different categories shown in the following pie chart. I used the broad-brush approach for the government category – including government fisheries agencies, groups like the IPHC and other fishery organisations that are either governmental or quasi-governmental. Then I tried to distinguish observers from observer service providers (SP) (i.e., the people within observer programs that orchestrate them); ENGOs; Commercial (including fishermen themselves and people that work directly or closely with the fishing industry); and then Universities.

The conference met its goal of attracting a very diverse delegation although strategies should be considered to increase participation by observer and fishing industry delegates.





Suggestion for conference identity

My final comment, from the perspective as chairman and conference organiser, is to change the name of this conference series from the "International Fisheries Observer Conference" to "International Fisheries Observing Conference". I believe this better reflects the broader focus on fishery monitoring programs without detracting from the recognition that observer programs are the best fishery monitoring tool available. This slight name change better reflects what the direction the conference series has been heading and would likely broaden conference participation.

A venue for the next conference

Lisa Desfosse

National Marine Fisheries Service – USA

Firstly, on behalf of NOAA, I'd like to thank the organisers of the conference – I think they've done a wonderful job and I think it's been a very successful conference. I would also like to thank everybody from the 40-some countries that have attended – I think this is a great forum to get together.

My role here is to discuss the location and timing of the next conference. NOAA is very interested in hosting the next conference in the United States – John Boreman has committed staff and resources and everything else that we would need to put together to make it happen and his thought is to hold it in the northeast New England area which is between Maine and Massachusetts – a very nice area.

We would propose to hold the next conference in the fall of 2009 – sometime probably in September/October, which is a good time in the New England region. One of the reasons we propose to move it up a little into the fall is that there is planning for an ICES conference in the summer of 2010, which will focus on fishery-dependent data and would include some observer topics as well. Therefore, we would like to separate these a little bit in time and maybe provide a good lead into the 2010 ICES conference. Bill Karp has a little more information on that and we might want him to come up a little later to talk about it.

We have also discussed with the current steering committee the potential of looking at the membership of the committee and maybe reformatting it a little bit. I think one thing we would be very interested in is getting some additional international participation on the steering committee. You saw the break-down of the attendees and I think the steering committee reflects that as well with plenty of US and Canadian participants. I would personally like to see some other countries be represented on the steering committee, so if anybody does have an interest, please get in touch with me. If any other countries would like to step up to host it, then that is fine as well but, as I said, NOAA is very interested in being the host in 2009.

Questions & Panel Discussion – Concluding Session –

Jonathan Cusick (National Marine Fisheries Service)

Comment / Question:

One of the things we've talked about is how to keep the communication flowing between the different individuals, programs and nations. Workshops are one way to do that but the outcomes are often in the grey literature or are not published at all and remain internal to an organisation or even internal to a program. I think it would be good to get that information out somehow. I don't know if the plan is to keep the fisheries observer web page up and going, but that would be good place to start. We could use it as a forum to post PDF files of program-level information that would be useful for people to refer to. For instance, there is a lot of information within NOAA on the National Observer program and U.S. observer programs but it can be difficult to find that information and the observer web site could be a used as a clearing house for such information.

Response:

Steve Kennelly – We set-up the observer website in Sydney with the intention to keep it as a perpetual site – we passed it onto Archipelago and they will pass it on to NOAA after this conference. It is always difficult to know if these conferences will run at a loss but we were fortunate to have some surplus funds after the conference in Sydney and it looks like there will something to bank after this conference and these funds can be used to help fund the website and other out-of-session processes.

Howard McElderry – We intend to continue the website. The conference-specific material will be removed from the web fairly quickly and will be replaced with the Conference Proceedings soon after.

I-Hsun Ni (National Taiwan Ocean University)

Comment / Question:

I agree with the idea that this conference be made more international and also with the section from Howard's mission statement that this conference is about the sustainability of oceans and fisheries. I have 3 suggestions in relation to this: (i) I already see a 'big happy family' in the north-west Atlantic and the north Pacific demersal fisheries but I think we need more focus on the tropical and sub-tropical areas, particularly on the large pelagic fisheries on such species as tuna; (ii) an expanded steering committee which includes other nations that have large fishing fleets (e.g., the European Union, Japan, Taiwan, Korea) and the international fisheries organisations (e.g., ICCAT, IATTC, CCSBT etc.) – such an expanded Steering Committee may work better towards a whole world approach; and (iii) consideration be given to having a workshop at the conference where observers from countries that are less developed can get trained.

Response:

Steve Kennelly – If people want to be on the steering committee they should see Lisa Desfosse after the conference or send her an email.

Glenn Quelch (European Commission)

Comment / Question:

The offer by NOAA to host the next conference in 2009 is a very generous offer, but I wonder if we moved the conference away from the Americas on one occasion to somewhere such as Africa, if we might facilitate the participation of the ACP countries more easily – it would certainly encourage participants from Europe and perhaps the Middle East.

Response:

Steve Kennelly – That would be an interesting place to have a conference. It seems that the next conference will be happening in the U.S. but we would be open to offers from other countries to host the conference after that.

Bob Trumble (MRAG Americas)

Comment / Question:

We've shown some really good successes at the conference but I think we develop our successes by evaluating our failures. It would be very useful to have a "lessons learned" session at the next conference where people could discuss the ideas they had which seemed like a good idea but turned-out wrong. By focusing on some of our mistakes we can produce some explicit examples that new programs can focus on to help them from making the same mistakes.

Response:

Steve Kennelly – This is a brainstorming session and all the ideas get recorded and used by the steering committee to frame-up the next conference. For example, the three working groups we had at this conference were established based on ideas that were generated at the final session in Sydney.

Georg Hinteregger (Observer)

Comment / Question:

I've been going to these conferences since the one in Newfoundland and I've seen we've made quantum leaps and progress in certain areas such as electronic monitoring systems. But we seem to continually put aside the topic of service delivery models and I would very much like to see a panel at the next meeting that looks at the different service delivery models from around the world, how they impact cost, data quality, industry compliance with regulations, observer morale and quality of life and the retention of experienced observers. I know there are differences in cultures, economics and politics and it can be a delicate topic for some of us but I think it is overdue and needs to be looked at.

Response:

Howard McElderry – We actually called for papers on that topic for this conference but we didn't get enough response to deal with it. It is a complicated subject and it probably needs a different strategy to draw up the expertise to cover it.

Steve Kennelly – Since I have been involved in this conference series I have seen a trend towards increased quality of the abstracts that are coming in. It is amazing to see the rapid progress that is occurring in this field – it has only been two years since the last conference and yet the progress is quite substantial.

Bill Karp (National Marine Fisheries Service)

Comment / Question:

This is the first of these conferences that I've been to since the initial workshop that Howard and I co-chaired in Seattle in 1998, so I've really seen tremendous changes and maturation in this process and I would like to offer my personal thanks to everybody that has been involved – the steering committee, Chair and everybody that prepared posters and papers and participated at the conference. I'd also like to take this advantage to remind you about the ICES/FAO conference on the collection and interpretation of fishery-dependent data which is being planned for the fall of 2010. We do not have formal approval from ICES yet but funds have been committed by NOAA, the Marine Institute of Ireland and we are also negotiating funds from the Norwegian Institute of Marine Research. I would like to invite anybody who is interested in working with us to contact me after the conference.

Response:

Steve Kennelly – NOAA's involvement in this conference series is quite special and NOAA always contributes generously to this conference every two years. Certainly Canada have put a lot of money into this year's conference and Australia contributed a lot to the last conference but the U.S. have contributed a lot of money to every IFOC conference and it is because they really care about this issue and want to see it working throughout the world. I think it is important we recognise NOAA's contribution and embrace the forthcoming conference in New England.

Joachim (Yogi) Carolsfeld (World Fisheries Trust)

Comment:

I think it would be very useful to have a designated representative from this conference to specifically take the suggestions that have been made at this conference to the next

conference and to raise the profile of the group that were brought to this conference by the World Fisheries Trust (with funding from the Canadian International Development Agency). This should also be aggressively planned for and sold at all other relevant venues. One of the other components of that is to take the industry champions from this conference and get them to communicate the benefits of observer work out of here and I encourage the next conference committee to build on that. I also think it is important that people provide feedback, not only to us, but to the committee and I would like to work together with the committee in terms of how to make the next conference better in terms of the international participation. Other small suggestions I would like to make are to turn the panel table to the side so the panel can also see the presentations and to also include a panel session for the posters.

POSTERS

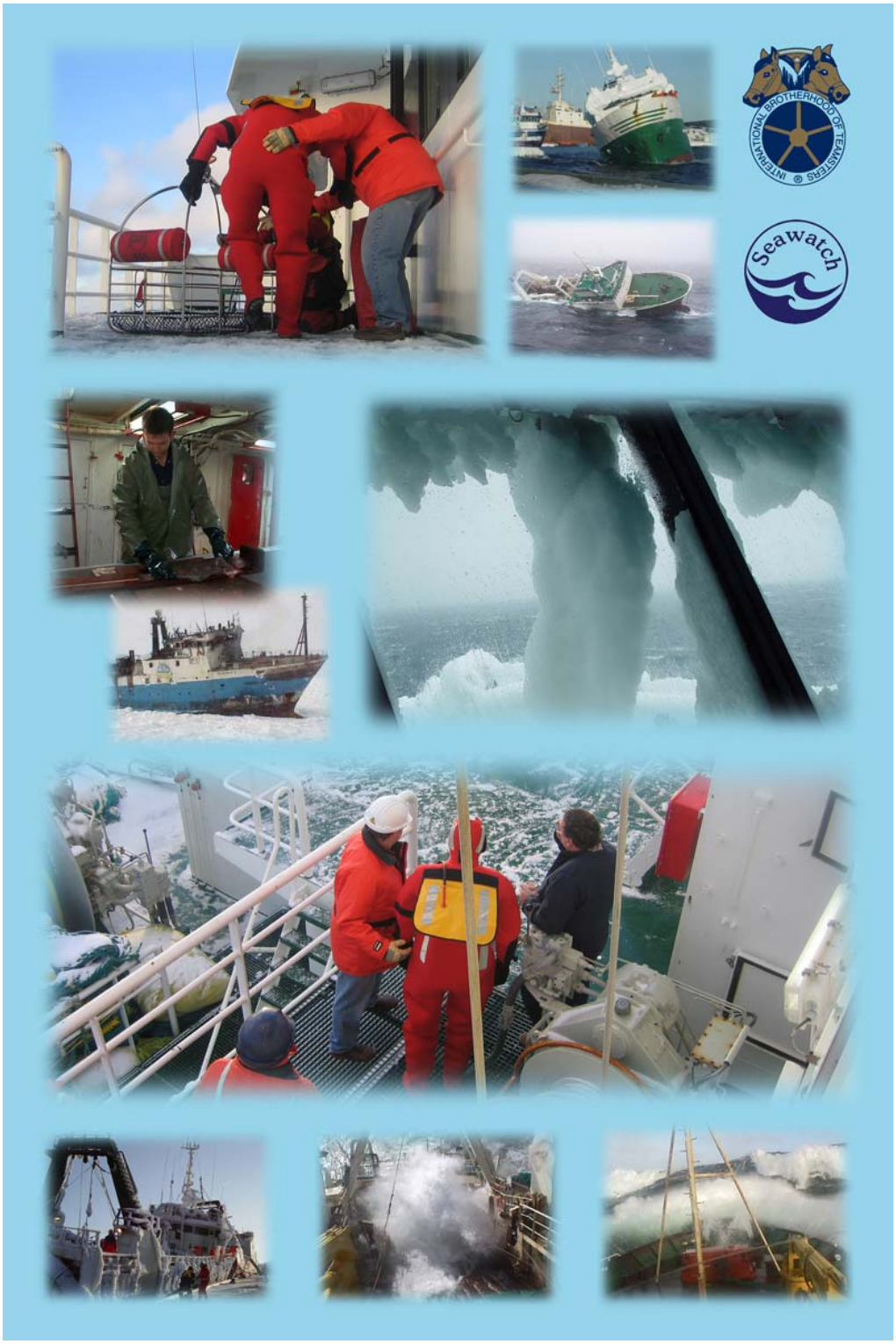
Outlined on the following pages are the posters that were presented at the conference. Presenters were asked to provide a copy of their poster for the proceedings or, if the poster became illegible or lost its meaning when printed in black and white on an A4 page, then presenters were asked to submit a two page extended abstract instead. Thus, all the two-page submissions appear first followed by the longer submissions and then lastly, when the presenter did not provide an extended abstract or a copy of their poster, the short abstract that appeared in the conference handbook is given.

**** First Prize "Winner" of the Best Poster Award ****

Safety at sea

Wayne DeGruchy* and Reuben Beazley

Seawatch inc. – Canada


INTERNATIONAL BROTHERHOOD OF TEAMSTERS
Seawatch

Using observer data in CCAMLR management decisions for Antarctic fisheries

Eric Appleyard* and Eugene Sabourenkov

CCAMLR Secretariat – Australia

Extended Abstract

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was founded under the 1982 Convention of the same name. The Convention is unique in that it is based on an ecosystem and precautionary approach to the conservation of marine living resources in the CCAMLR Area. CCAMLR thus aims to conserve targeted species so as to minimise the risk(s) of detrimental changes and to account for possible effects of fishing on other dependent or related, species.

Observer Scheme

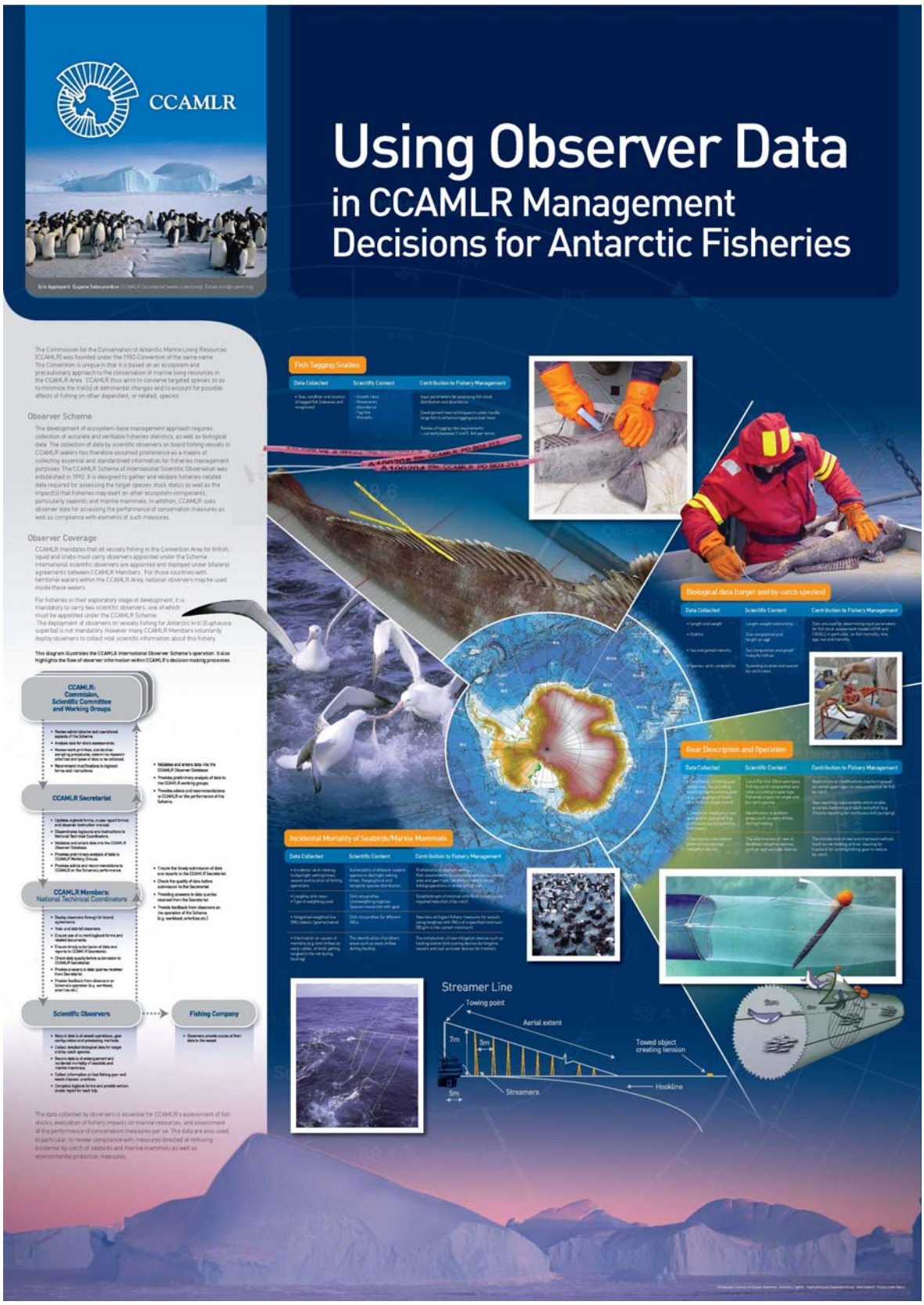
The development of ecosystem-based management approach requires collection of accurate and verifiable fisheries statistics, as well as biological data. The collection of data by scientific observers on board fishing vessels in CCAMLR waters has therefore assumed prominence as a means of collecting essential and standardised information for fisheries management purposes. The CCAMLR Scheme of International Scientific Observation was established in 1992. It is designed to gather and validate fisheries-related data required for assessing the target species stock status as well as the impact(s) that fisheries may exert on other ecosystem components, particularly seabirds and marine mammals. In addition, CCAMLR uses observer data for assessing the performance of conservation measures as well as compliance with elements of such measures.

Observer Coverage

CCAMLR mandates that all vessels fishing in the Convention Area for finfish, squid and crabs must carry observers appointed under the Scheme. International scientific observers are appointed and deployed under bilateral agreements between CCAMLR Members. For those countries with territorial waters within the CCAMLR Area, national observers may be used inside these waters.

For fisheries in their exploratory stage of development, it is mandatory to carry two scientific observers, one of which must be appointed under the CCAMLR Scheme. The deployment of observers on vessels fishing for Antarctic krill (*Euphausia superba*) is not mandatory. However many CCAMLR Members voluntarily deploy observers to collect vital scientific information about this fishery.

The data collected by observers is essential for CCAMLR's assessment of fish stocks, evaluation of fishery impacts on marine resources, and assessment of the performance of conservation measures *per se*. The data are also used, in particular, to review compliance with measures directed at reducing incidental by-catch of seabirds and marine mammals as well as environmental protection measures.


CCAMLR
Using Observer Data
in CCAMLR Management
Decisions for Antarctic Fisheries
Observer Scheme
Observer Coverage
Fish Tagging Studies
Biological data (target and by-catch species)
Gear Description and Operation
Incidental Mortality of Seabirds/Marine Mammals
CCAMLR: Commission, Scientific Committee and Working Groups
CCAMLR Secretariat
CCAMLR Members: National Technical Coordinators
Scientific Observers
Fishing Company
Streamer Line
Towing point
Aerial extent
Towed object creating tension
Hookline
Streamers

El Salvador Observer Programs

Diana E. Barahona*, Sonia M. Salaverria and Salvador C. Siu

Centro de Desarrollo de la Pesca y la Aculcultura (CENDEPESCA) – El Salvador

Abstract

In El Salvador, observer programs are done on board the tuna purse seine fleet with 100% coverage of all trips, in the trawl net fishery with monthly observations on different boats, and in the longline fishery were the program is just starting. The longline observer program is a joint effort of the Inter-American Tropical Tuna Commission – IATTC, World Wildlife Fund – WWF and the fishery authority of the countries who participate in it; for example, CENDEPESCA in El Salvador. As part of the program, workshops are made to show fishermen that there is a problem regarding marine turtle hookings in the longline fishery. The main objective of this program is to exchange their J-hooks to circle hooks. Observations are made in order to demonstrate to them that circle hooks will not decrease their fishing effort or capacity while protecting and conserving the marine turtle populations. For El Salvador promoting responsible and sustainable fisheries is important; and one way this can be achieved is through observer programs.

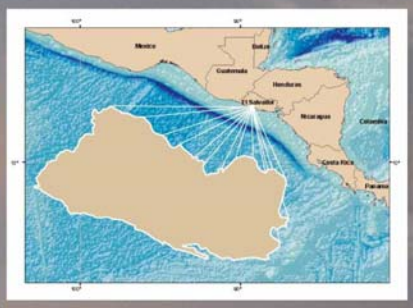
El Salvador Observer Programs

El Salvador is located in Central America, with approximately 300 Km of coastline bordering the North Pacific Ocean, between Guatemala and Honduras, among 13° 10' y 13° 40'N Latitude. It is the only Central American country with one Ocean.

On board observer programs are an important tool in the monitoring and control systems of fisheries administrations. Together with other tools such as vessel monitoring systems – VMS it helps fisheries to be manager responsibly. In addition to observing fishing activities, observer programs help capture important information such as specie size, gender, and quantities of bycatch that would otherwise be lost.

El Salvador has on board observer programs in three fisheries:

1. Tuna Purse Seine 2. Trawl net for shrimps and squat lobster ("langostino")
3. Longline for both migratory species and coastal species



Tuna purse seine

The first on board observers program in El Salvador started in 2001 with the tuna purse seine fishery. El Salvador has four vessels which are greater than 363 metric tons and are required by the IATTC (Inter American Tropical Tuna Commission) to have an observer coverage of all trips (100%). Even though El Salvador's participation iniciated in 2001, this program was established since 1992, in the La Jolla Agreement for all countries fishing in the Eastern Pacific Ocean and now is an integral part of the AIDCP (Agreement on the Internacional Dolphin Conservation Program). The main objective tuna species captured are "yellowfin tuna" (Thunnus albacares), "bigeye tuna" (Thunnus obesus) and "skipjack tuna" (Katsuwonus pelamis). Important bycatch information captured by the program are actual dolphin mortalities caused by the fishery, small tuna discards, shark and billfish captures, among others

Trawlnet for shrimps and "langostino"

In the Trawlnet fishery, El Salvador's industry has two objective species: Shrimp which are captured near the coast and are divided into: "white shrimp (Litopenaeus vannamei, L. stylirostris, L. occidentalis); "brown shrimp" (Farfantepenaeus californiensis) and "red shrimp" (F. brevirrostris) and "langostino" (Pleuroncodes planipes) which are captured at around 40 miles offshore. In these fisheries, on board observations are done once a month for shrimp and bimonthly for squat lobster. In addition, special investigation trips are made by CENDEPESCA (Fisheries and Aquaculture authority of El Salvador) to monitor these resourses. In the shrimp trawlnet, sea turtle bycatch is avoided through the use of TEDs (Turtle Excluder Device) which are required by Law to be used on the nets. Other bycath information obtained are lobster, crab and conch

Longline for both migratory species and coastal species

The other observer program is the long line fishery. The main objective of this program is to observe sea turtle interactions with different types of fishhooks, especially circle hooks as these are believed to reduce sea turtle bycatches. This program is also carried out throughout the region in Guatemala, Costa Rica, Panama, Colombia, Peru and Ecuador with the help of World Wildlife Fund (WWF) and IATTC.
Important information on specie captures are being obtained, especially the different kind of shark species for the pelagic longline fishery and catfish, snapper in the bottom longline.
Fishermen are being stimulated to use circle hooks by observing the increased efficiency in their captures. An exchange program is made with the J hooks that they used to work with, and they are then required to participate in the program by allowing observers on board their boats. While on board, observers help them use the sea turtle dehookers on case of incidental captures. In El Salvador the experiment consists of alternating J hooks with size 13 and 14 circle hooks in the bottom longline and circle hook 15 and 16 in the pelagic longline.
Although many observer programs do not incorporate female participation, in El Salvador both genders are allowed to go on fishing trips

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100% observer coverage in the directed shark drift-gillnet fishery: Spending the winter in sunny southeast Florida

Dana M. Bethea* and Ivy E. Baremore

NOAA – Southeast Fisheries Science Center, Florida – USA

Abstract

In compliance with the Atlantic Large Whale Take Reduction Plan and the Endangered Species Act incidental take statement for Highly Migratory Species, NOAA Fisheries Southeast Regional Office requires 100% observer coverage of the directed shark driftgillnet fishery during the Right Whale calving season, November 15 – March 31. The shark drift-gillnet fishery was developed off the east coast of Florida and Georgia in the late 1980s. Vessels operating in the fishery are small (~20 – 40 ft in length) and fish multi-mesh gillnets up to 1 mile long for < 24 hours during the night. Due to safety concerns, the observer is typically 3 – 8m forward of where the net is hauled aboard. Because trips are largely weather dependent and daily, the 100% coverage mandate introduces a unique suite of responsibilities for both observer and observer coordinator that are not encountered in many observer programs. Issues related to deployment, coordination, and safety will be discussed.

100% Observer Coverage in the Directed Shark Gillnet Fishery: Spending the Winter in Sunny Southeast Florida

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Southeast Fisheries Gillnet Observer Program

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Shark Population Assessment Group

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BACKGROUND

In 1998, the Atlantic Large Whale Take Reduction Plan and the Biological Opinion issued under Section 7 of the Endangered Species Act mandated 100% observer coverage of the southeast shark gillnet fishery during the right whale calving season (15 Nov-30 Mar) for all vessels (1) operating from West Palm Beach to Sebastian Inlet, Florida, using either drift- or strike-gillnet gear and/or (2) operating above 27°51' N using strike-gillnet gear.

In 2002, all shark gillnet vessels fishing during right whale calving season were required to carry a vessel monitoring system (VMS) that allowed NOAA Fisheries Office of Law Enforcement to determine to location of the vessel at all times.

In 2005, the Southeast Fisheries Gillnet Observer Program universe was expanded to include all vessels that have an active directed shark permit and fish with gillnet gear. Some of these vessels were not previously subject to observer coverage because they either were targeting non-highly migratory species or were not fishing gillnets in a drift or strike fashion within the zone. Because of the need to cover all vessels fishing gillnet gear and the implementation of VMS, 100% observer coverage was revoked after the 2005 commercial shark season.

FISHING TECHNIQUES

When a vessel fishes drift-gillnet gear, the vessel sets the net in a straight line off the stern. The net soaks at the surface for a period of time (usually overnight), is inspected at various occasions during the soak, and is hauled back when the captain or crew feels the catch is adequate. Drift-gillnet vessels use nets 1,372-1,646 m (4,500-5,400 ft) long, 20 m (60 ft) deep, and with stretched mesh of 12.7 cm (5 in).

When a vessel fishes strike-gillnet gear, the vessel encircles a school of sharks with the net (sometimes using a "kicker boat"). The net generally fishes from the surface to the bottom to prevent sharks from escaping either under or over the net. Fishing usually occurs during daylight hours, using visual sighting of shark schools from the vessel and/or spotter plane. The gear is hauled back without much soak time. Strike-gillnet vessels use nets 274-1,372 m (900-4,500 ft) long with stretched mesh sizes 22.7-30.5 cm (9-12 in).

Vessels are relatively small (7-13 m, 20-40 ft). Gillnets are banned in state waters of Florida, forcing vessels to operate >3 miles from shore. Because of these two factors, this fishery is highly dependent on favorable weather conditions.

More information on the boats, gear, and fishing methods of this fishery can be found in Trent et al. (1997) [Trent, L., E. Parshley, and J.K. Carlson (1997) Catch and Bycatch in the Shark Drift Gillnet Fishery off Georgia and East Florida. Mar. Fish. Rev. 59: 19-28.].

OBSERVER PROTOCOL

Selection letters requiring observer coverage were issued seasonally by the SEFSC observer coordinator.

During the 100% observer requirement period (15 Nov-30 Mar, 1998-2005), observers were deployed in ports where the gillnet fleet was currently active. Unless the vessel was in safety violation, observers were required to board all drift- or strike-vessels for all trips during this time period. Observers would then remain in that port and in close contact with the fleet, moving with the fleet as they moved.

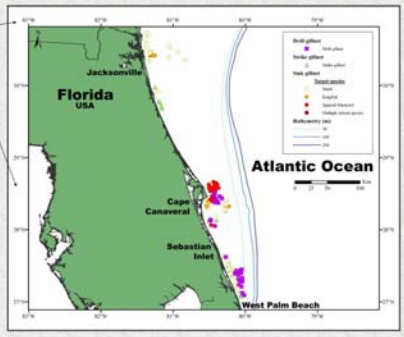
Observations were made as the net was hauled aboard. The observer remained about 1-5 m forward of the stern of the vessel in a position with an unobstructed view and recorded species, numbers, and estimated lengths of sharks and bycatch as they were suspended in the net just after passing over the power roller. Weights (in kg) were estimated from these estimated lengths using published and unpublished length-weight relationships. When species identification was questionable, the crew stopped the reel so that the observer could examine the animal for positive identification. Photographs would also be taken and sent to the SEFSC observer coordinator for additional identification.

Disposition of each shark and bycatch species brought onboard was recorded as kept, discarded alive, or discarded dead. As time permitted, the observer would randomly measure sharks and take biological samples while the vessel was returning to port. Fork length in cm (measured as a straight line from the tip of the snout to the fork in the tail) and sex were determined for each shark. Biological samples (e.g., vertebrae, reproductive organs, stomach) were removed, placed on ice, and frozen upon returning to port.

Because of the intensity of 100% coverage, observers would debrief with and submit data to the SEFSC observer coordinator on a weekly basis.

ACKNOWLEDGEMENTS

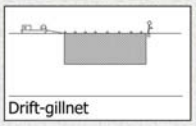
We thank our observers, especially A. de Ron Santiago. J. Carlson is SEFSC lead observer coordinator. K. Brewster-Geisz, M. Clark, L. Hale, and C. Rilling helped to determine the universe of gillnet vessels. M. Ribera provided assistance with mapping set locations. All photos courtesy of S. Gulak.

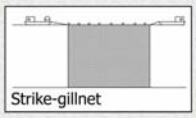


Left: Area of operations for 100% observer coverage, 1998-2005.

Below: Distribution of all observed gillnet sets in the U.S. south Atlantic, 2005-2006.

Below: Schematic of drift- and strike-gillnet gear in the water.





Above: Example of (a) main vessel and (b) "kicker boat" in shark gillnet fishery fleet.

Left: Examples of catch from shark gillnet gear.

Below: Examples of vessels and gear in shark gillnet fleet.

Seabird mortality in the Argentine trawl fleet: A joined initiative between NGOs, academia and the government

Gabriel Blanco[1]*, M. Favero[2] and F. Rabufetti[3]

[1] *Programa Observadores INIDEP – Argentina*
[2] *UNMdP / CONICET – Argentina*
[3] *Aves Argentinas / BirdLife – Argentina*

Extended Abstract

Introduction

A large number of threatened albatross and petrel species use the waters of the Patagonian Shelf as foraging area, both during the breeding and non breeding season. While research carried out during the last years provided a good picture of the levels of mortality of albatrosses and petrels associated to longliners, the information is very scarce regarding trawlers. Information coming from other areas in the South Atlantic suggests that the mortality of seabirds attending trawlers can be even higher than reported for longliners.

As part of a collaborative project we developed standardised sampling protocols and educational programmes aimed to train observers and to improve data quality.

Objectives

- To obtain the first estimate of trawler related seabird mortality across the Argentine EEZ.
- To quantify the level of seabird-trawler interaction over the area.
- To analyse the changes in seabird attendance and mortality as a function of the operational and environmental variability.
- To generate information to raise awarenes in the fishing industry and the general public.

Methods

Seabirds associated to trawlers and mortality rates were determined by at sea observer coverage dedicated to measure the seabird-trawl interaction and mortality. Observer coverage of over 400 settings and 130 sea days is expected by the end of the current year. Data collection was taken by trained observers following protocols adopted previously in the South West Atlantic (Sullivan & Reid, 2002) to ensure data and database compatibility throughout the South American shelf (see Appendix I). In all cases, an interview with observers was agreed previous to all trips in order to emphasise particular points in sampling procedures. Another interview with the observer was agreed at the end of every trip in order to discuss particular characteristics of the trips and potential improvements to the sampling procedures.

All the sampling protocol was developed after the discussion with a panel of specialists collaborating in the project. Datasets taken during the fishing trips included:

- Periodical estimations of seabird abundance associated to the vessel, by species and age classes.
- Counts of bird contacts with fishing gear scored by location and severity during trawling and onboard processing.
- Environmental (relative wind intensity and direction, sea roughness, time of the day and season) and operational (discharge level, fishing target) variability.
- Confirmed mortalities counted on every haul.
- Collection and storage of dead birds for further studies.

Sampling Protocol

With the objective of putting together opinions concerning to the elaboration and adaptation of sampling protocols, a workshop with all project collaborators was held in Buenos Aires. After two days we decided the basics of sampling data and procedures to be requested from observers. Protocols included general recommendations, safety rules, operational definitions, censuses procedures, environmental variables and forms.

Educational program

An educatiional program aimed to observers from the National Orbservers program constituted a very interesting experience developed between INIDEP, NGOs and the Academia. Information obtained from observers after the educational program has clearly improved in quality during the last years.

Awareness material, leaflets and ID charts aimed to fishermen, observers and the general public were developed mainly by NGOs.

Results

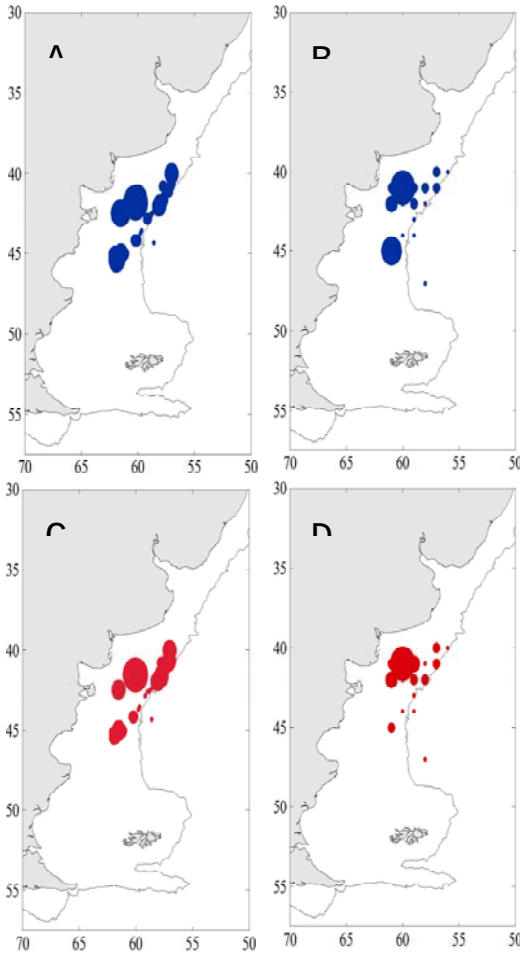


Figure 1: *Distribution of Black-browed Albatross abundances (A, C) and interactions (B, D) observed during the first stage of the project (241 settings). Adult birds are represented by blue circles, juvenile individuals represented by red circles.*

The large and complex Argentinean trawl fishery (with diverse fishing methods, targets and seabird species affected) presents a challenging landscape for researchers and conservationists. In small and medium-sized offshore trawlers Black-browed albatrosses (*Thalassarche melanophris*, EN), White-chinned petrels (*Procellaria aequinoctialis*, VU), Southern Giant Petrel (*Macronectes giganteus*, VU) and Southern Royal albatrosses (*Diomedea epomophora*, VU) interact and die getting entangled or colliding with the warp cables. During coastal operations, other seabirds like Great shearwaters (*Puffinus gravis*), Imperial cormorants (*Phalacrocorax atriceps*), Magellanic penguins (*Spheniscus magellanicus*, NT), and Kelp gulls (*Larus dominicanus*) have been reported interacting with vessels.

NT = nearly threatened; VU = vulnerable; EN = endangered

Contact rates (mainly with warp cables) range between 50 to 150 per hour. Mortality rates between 0.06 to 0.18 birds per hour. This information is in line with other data from Malvinas.

Considerations

In Argentina (among other countries in the region) the interest of researchers, conservationists (NGOs) and the government towards the search of solutions and the development of responsible fisheries is clear. The most visible signal of this interest is the sign and ratification of the ACAP and the recent elaboration or publication of the National Plans of Action for reducing the incidental mortality of seabirds.

The outputs of the project will provide the first figures of mortality in the area and facilitate the development and adoption of mitigation methods.

Special thanks to:

Save the Albatross – IAATO Campaign;
WORLD FISHERIES TRUST
Guillermo Cañete and Alejandro Arias (FVSA), Patricia Gandini (UNPA, CONICET, WCS), Pablo Yorio and F Quintana (CENPAT-CONICET, WCS), Esteban Frere (BirdLife International), Adrian Schiavini (CADIC-CONICET, WCS).

NGOs and Observer Programs in Argentina: A starting point to improve the interjurisdictional communication

Gabriel Blanco[1]*, G. Caille[2], R. González[3], F. Rabuffetti[4] and G. Cañete[5]

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[2] *Fundación Patagonia Natural (FPN), Proyecto PMIZCP GEF – PNUD ARG/02/G31*
[3] *Proyecto PMIZCP GEF – PNUD ARG/02/G31, Instituto de Biología Marina y Pesquera Almirante Storni (IBMyP)*
[4] *Aves Argentinas / BirdLife (AA)*
[5] *Programa Marino. Fundación Vida Silvestre Argentina*

Extended Abstract

Introduction and Objectives

There are 5 Programs of Fishing Observers (POPs) converge in the Argentine Economic Exclusive Zone: 4 provincials (up to 12 miles) and one national (12 to 200 miles). Usually they worked independently within their jurisdictions.

Two local NGOs (FPN and AA) and the Fishing Research Institute 'Alte Storni' invited these five POP´s Coordinators to a First Workshop.

The objectives of this Workshop were:

- To initiate a process of dialogue and exchange of information on the problematic topics of the Programs.
- To propose mechanisms of cooperation and technical assistance that make possible the resolution of common problems.
- To establish a common agenda about key issues by all participants.

All POP managers and other NGOs (FVSA) attended to the workshop and detected the following problems:

- *Appreciation* – Low appreciation of the POP as an on-board tool and low observer appreciation by the vessel crews.
- *Normative* – Asymmetry among current Normative Frames, some POPs without formal consolidation.
- *Funding* – Diversity of source Funding, maladjustment of budget to operatives needs of each POP.

POP of Río Negro Province

- Manager: Ocampo Reinaldo & Fernando Paúl Osovnikar.
- 15 observers.
- More than 100 sea days / year.
- Coastal Longliner fleet.
- Offshore trawler fleet.
- Jiggers.
- Other Artisanal fleet.
- Created by Ministerial Resolution.
- On 1994 the Fundación Patagonia Natural and the Marine and Fishing Biology Institute Almirante Storni, developed the first Program of Biologists Observers onboard sponsored by the 'Plan de Manejo Integrado de la Zona Costera Patagónica (GEF/PNUD-FPN/WCS)'.
- Since 2004 started to monitor the activity of the trawlers and artisanal shellfish fleets (crabs, vieira and clam experimental fishery).

POP of Chubut Province

- Manager: María Eva Góngora & Luis Mendia.
- 18 active observers.
- Artisanal and Factory shrimp, Offshore trawler and other Artisanal fleets.
- Created by Provincial Law without regulation.
- Starting 2001 implemented a Dynamic Monitoring System on provincial fleet.
- Obtain in Real Time fishing and biological information to advice the Provincial Authority Acts and Regulations.
- Obtain ecosystem information on the basis for research and management.
- Intensive Training Modules supported by the Academia.
- Semester observers' evaluations.
- Specifics Protocols.

POP of Santa Cruz Province

- Manager: Susana Pittaluga, Maria Eugenia Riveros & Alberto Dolcemáscolo.
- 37 active observers.
- Artisanal and industrial tangoneros.
- Offshore trawler fleet.

- Other Artisanal fleet.
- Created by SubSecretary Disposition.
- Before 2000 there was a Provincial Fishing Policy Corp. whose observers were trained by the INIDEP.
- During 2003 Fundación Patagonia Natural, the Provincial Authority of Acts and Regulations and the Puerto Deseado Research Center has implemented a specific observers training plan.
- Estimate actual catch and effort data.
- Biological sampling of the catch.

POP of Tierra del Fuego Province

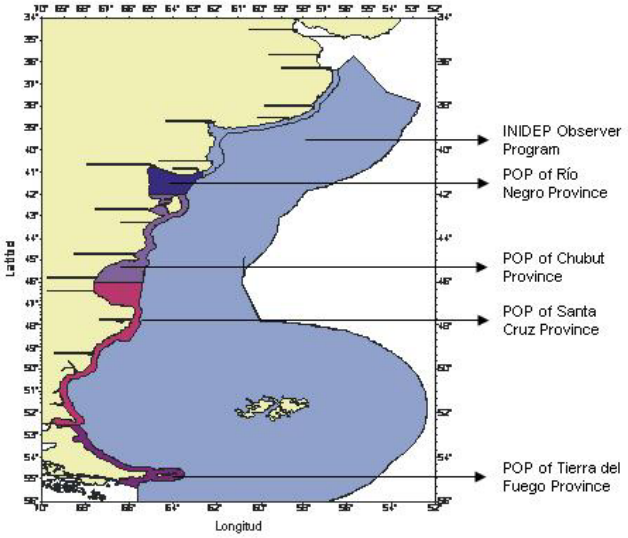
- Manager: Marcelo Magrans & Eduardo Bauduco.
- 8 active observers.
- Offshore and industrial trawler fleet.
- Other Artisanal fleet.
- Created by Provincial Decree.
- On 2003 the First observer training course was implemented.
- Ending 2004 the regulation for the Observer Program Activity was provided.
- On February 2005 the first embarkation was established.

INIDEP Observer Program

- Manager: Lic. Gabriel Blanco.
- 45 active observers.
- More than 6,000 sea days/year.
- Longliners fleet; Freezer trawlers fleet; Factory trawlers fleet.
- Jiggers fleet; Traps fleet; Offshore trawlers fleet.
- Created by Secretary Resolution, without regulation.
- Since 1984 started to estimate total catch, effort data and discards of fishery resources (including the unprocessed by-catch).
- Biological sampling of the catch.
- Fish proccesing onboard, daily production and conversion factors.
- Gear performance and characteristics.
- Monitoring the effectiveness of selective fishing gear and changes of mesh sizes.
- Estimating by-catch of marine mammals and seabirds.
- Contact with fishermen.
- Foreing fishery monitoring.
- Bianual observer training and a strict permanent evaluation system.
- Observer retension rates up to 2 – 10 years.

Main accords and advances

- Advances in the communication among all POPs according usual tips and looking forward to the II Workshop.
- Collaborative ongoing in technical POPs training. (i.e., Technical teams from Río Negro and Chubut provided assistance to POP of Tierra del Fuego Province).
- First steps in the standardisation of specific on-board protocols (i.e., Chubut and Santa Cruz Provinces POPs are working on San Jorge Gulf´s shrimp fishery on board protocol).
- The Federal Fishing Council (CFP) support the POPs workshops and others initiatives. (i.e., Technical assistance to POP of Tierra del Fuego Province).
- Second POPs Workshop, possibly second semester of 2007.



Fisheries observer program on board of associated foreign vessels in Ecuador

Iván Cedeño* and F. Solano

National Institute of Fisheries, Guayaquil – Ecuador

Extended Abstract

The National Fisheries Institute of Ecuador (INP) has a monitoring program for small pelagic fisheries through commercial catches and hydro-acoustic surveys, with information from 1981 up to present.

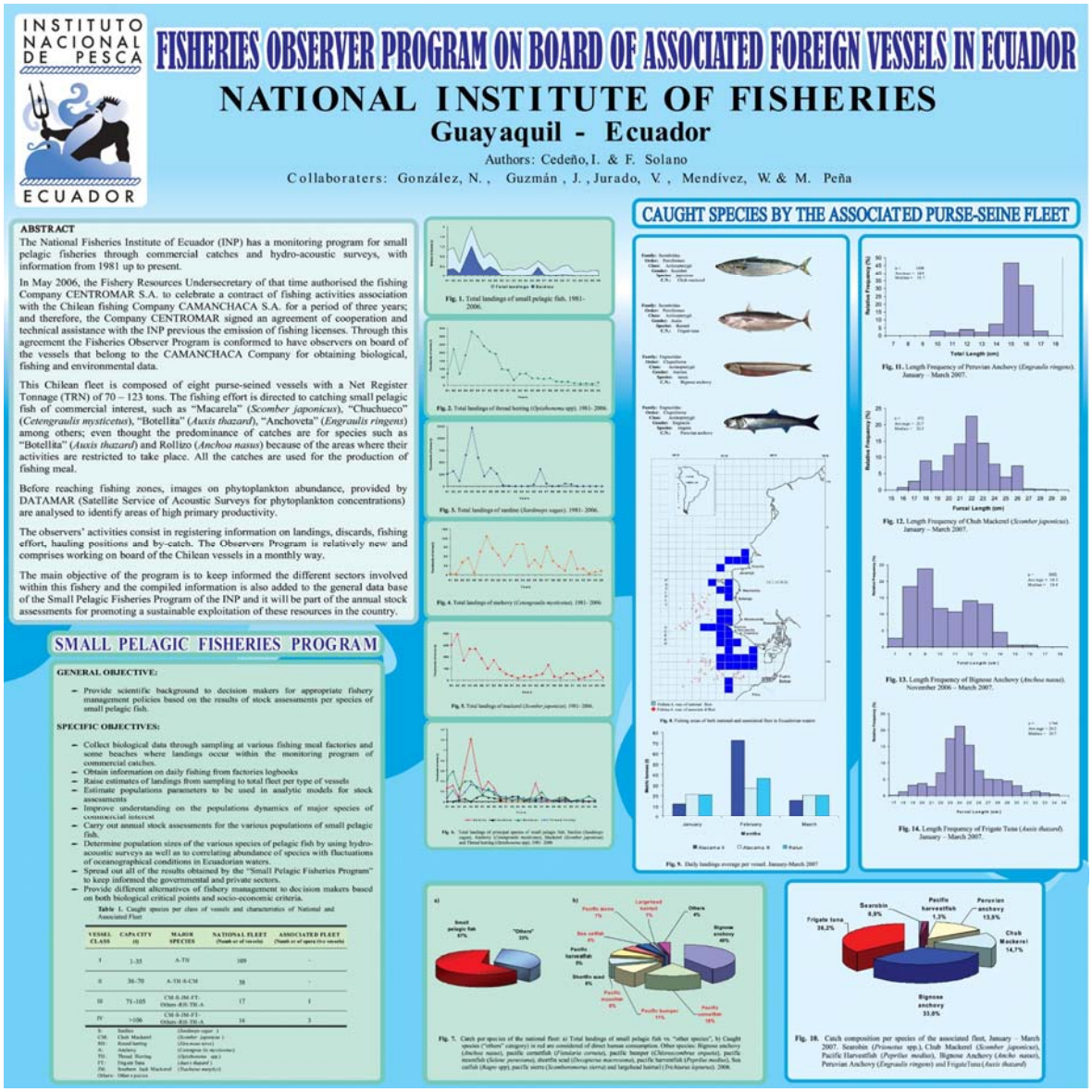
In May 2006, the Fishery Resources Undersecretary at the time authorised the fishing Company CENTROMAR S.A. to sign a contract of fishing activities in association with the Chilean fishing Company CAMANCHACA S.A. for a period of three years; and therefore, the Company CENTROMAR signed an agreement of cooperation and technical assistance with the INP previous to issuance of fishing licenses. Through this agreement the Fisheries Observer Program is designed to have observers on board of the vessels that belong to the CAMANCHACA Company to obtain biological, fishing and environmental data.

This Chilean fleet is composed of eight purse-seined vessels with a Net Register Tonnage (TRN) of 70 – 123 tons. The fishing effort is directed to catching small pelagic fish of commercial interest, such as 'Macarela' (*Scomber japonicus*), 'Chuchueco' (*Cetengraulis mysticetus*), 'Botellita' (*Auxis thazard*), 'Anchoveta' (*Engraulis ringens*) among others; even thought the predominance of catches are for species such as 'Botellita' (*Auxis thazard*) and Rollizo (*Anchoa nasus*) because of the areas where their activities are restricted to take place. All the catches are used for the production of fishing meal.

Before reaching fishing zones, images on phytoplankton abundance, provided by DATAMAR (Satellite Service of Acoustic Surveys for phytoplankton concentrations), are analysed to identify areas of high primary productivity.

The observers' activities consist of recording information on landings, discards, fishing effort, hauling positions and by-catch. The Observers Program is relatively new and consists of working onboard of the Chilean vessels on a monthly basis.

The main objective of the program is to keep informed the different sectors involved within this fishery. The compiled information is also added to the general data base of the Small Pelagic Fisheries Program of the INP and it will be part of the annual stock assessments for promoting a sustainable exploitation of these resources in the country.


INSTITUTO NACIONAL DE PESCA
ECUADOR
FISHERIES OBSERVER PROGRAM ON BOARD OF ASSOCIATED FOREIGN VESSELS IN ECUADOR
NATIONAL INSTITUTE OF FISHERIES
Guayaquil - Ecuador
Authors: Cedeño, I. & F. Solano
Collaboraters: González, N., Guzmán, J., Jurado, V., Mendívez, W. & M. Peña
ABSTRACT
The National Fisheries Institute of Ecuador (INP) has a monitoring program for small pelagic fisheries through commercial catches and hydro-acoustic surveys, with information from 1981 up to present.
In May 2006, the Fishery Resources Undersecretary of that time authorised the fishing Company CENTROMAR S.A. to celebrate a contract of fishing activities association with the Chilean fishing Company CAMANCHACA S.A. for a period of three years; and therefore, the Company CENTROMAR signed an agreement of cooperation and technical assistance with the INP previous the emission of fishing licenses. Through this agreement the Fisheries Observer Program is conformed to have observers on board of the vessels that belong to the CAMANCHACA Company for obtaining biological, fishing and environmental data.
This Chilean fleet is composed of eight purse-seined vessels with a Net Register Tonnage (TRN) of 70 – 123 tons. The fishing effort is directed to catching small pelagic fish of commercial interest, such as "Macarela" (Scomber japonicus), "Chuchusco" (Cetengraulis mysticetus), "Botellita" (Auxis thazard), "Anchoveta" (Engraulis ringens) among others; even thought the predominance of catches are for species such as "Botellita" (Auxis thazard) and Rollizo (Anchoa nasus) because of the areas where their activities are restricted to take place. All the catches are used for the production of fishing meal.
Before reaching fishing zones, images on phytoplankton abundance, provided by DATAMAR (Satellite Service of Acoustic Surveys for phytoplankton concentrations) are analysed to identify areas of high primary productivity.
The observers' activities consist in registering information on landings, discards, fishing effort, hauling positions and by-catch. The Observers Program is relatively new and comprises working on board of the Chilean vessels in a monthly way.
The main objective of the program is to keep informed the different sectors involved within this fishery and the compiled information is also added to the general data base of the Small Pelagic Fisheries Program of the INP and it will be part of the annual stock assessments for promoting a sustainable exploitation of these resources in the country.
SMALL PELAGIC FISHERIES PROGRAM
GENERAL OBJECTIVE:
- Provide scientific background to decision makers for appropriate fishery management policies based on the results of stock assessments per species of small pelagic fish.
SPECIFIC OBJECTIVES:
- Collect biological data through sampling at various fishing meal factories and some beaches where landings occur within the monitoring program of commercial catches.
- Obtain information on daily fishing from factories logbooks
- Raise estimates of landings from sampling to total fleet per type of vessels
- Estimate populations parameters to be used in analytic models for stock assessments
- Improve understanding on the populations dynamics of major species of commercial interest
- Carry out annual stock assessments for the various populations of small pelagic fish.
- Determine population sizes of the various species of pelagic fish by using hydro-acoustic surveys as well as to correlating abundance of species with fluctuations of oceanographical conditions in Ecuadorian waters.
- Spread out all of the results obtained by the "Small Pelagic Fisheries Program" to keep informed the governmental and private sectors.
- Provide different alternatives of fishery management to decision makers based on both biological critical points and socio-economic criteria.
Table 1. Caught species per class of vessels and characteristics of National and Associated Fleet
VESSEL CLASS | CAPACITY (t) | MAJOR SPECIES | NATIONAL FLEET (Number of vessels) | ASSOCIATED FLEET (Number of vessels)
I | 1-35 | A-TH | 109 | -
II | 36-70 | A-TH-S-CM | 38 | -
III | 71-105 | CM-S-JM-FT-Others-RH-TH-A | 17 | 1
IV | >106 | CM-S-JM-FT-Others-RH-TH-A | 16 | 3
S: Sardine (Sardinops sagax)
CM: Chub Mackerel (Scomber Japonicus)
RH: Round herring (Etrumeus teres)
A: Anchovy (Cetengraus Ec mysticetus)
TH: Thread Herring (Opisthonema spp.)
FT: Frigate Tuna (Auxis thazard)
JM: Southern Jack Mackerel (Trachurus murphyi)
Others: Other species
Fig. 1. Total landings of small pelagic fish. 1981-2006.
Fig. 2. Total landings of thread herring (Opisthonema spp). 1981- 2006.
Fig. 3. Total landings of sardine (Sardinops sagax). 1981- 2006.
Fig. 4. Total landings of anchovy (Cetengraulis mysticetus). 1981- 2006.
Fig. 5. Total landings of mackerel (Scomber japonicus). 1981- 2006.
Fig. 6. Total landings of principal species of small pelagic fish. Sardine (Sardinops sagax), Anchovy (Cetengraulis mysticetus), Mackerel (Scomber japonicus) and Thread herring (Opisthonema spp). 1981- 2006
CAUGHT SPECIES BY THE ASSOCIATED PURSE-SEINE FLEET
Fig. 8. Fishing areas of both national and associated fleet in Ecuadorian waters
Fig. 9. Daily landings average per vessel. January-March 2007
Fig. 11. Length Frequency of Peruvian Anchovy (Engraulis ringens). January – March 2007.
Fig. 12. Length Frequency of Chub Mackerel (Scomber japonicus). January – March 2007.
Fig. 13. Length Frequency of Bigmose Anchovy (Anchoa nasus). November 2006 – March 2007.
Fig. 14. Length Frequency of Frigate Tuna (Auxis thazard). January – March 2007.
Fig. 7. Catch per species of the national fleet: a) Total landings of small pelagic fish vs. "other species", b) Caught species ("others" category) in red are considered of direct human consumption. Other species: Bigmose anchovy (Anchoa nasus), pacific cornetfish (Fistularia corneta), pacific bumper (Chloroscombrus orqueta), pacific moonfish (Selene peruviana), shortfin scad (Decapterus macrosoma), pacific barracudafish (Paprilus medius), San catfish (Ragno spp), pacific sierra (Scomberomorus sierra) and largehead hairtail (Trichiurus lepturus). 2006.
Fig. 10. Catch composition per species of the associated fleet, January – March 2007. Searobin (Prionotus spp.), Chub Mackerel (Scomber japonicus), Pacific Harvestfish (Paprilus medius), Bigmose Anchovy (Anchoa nasus), Peruvian Anchovy (Engraulis ringens) and FrigateTuna (Auxis thazard)

The Uruguayan pelagic longline fishery: How is it monitored?

Marcos Cornes[1]*, Philip Miller[1], Sebastian Jimenez[1], Martin Abreu[1] and Andres Domingo[1,2]

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Abstract

The Programa Nacional de Observadores a Bordo de la Flota Atunera Uruguaya (PNOFA) was created in 1998 by the Área de Recursos Pelágicos of the Dirección Nacional de Recursos Acuáticos (DINARA), with the aim of collecting information on the Uruguayan pelagic drift longline fishery. Between 1998 and 2007 the scientific observers of PNOFA monitored 70 fishing trips (approx. 4,000,000 hooks), in the Atlantic, Indian and Pacific Oceans, ranging from 4 to 109 days, including departures and arrivals on foreign ports. The PNOFA annual coverage has ranged between 9% – 45% of the total fleet effort. Currently, the basic duties of the observer include the collection of data on the fishing operative, environmental parameters and catch (identification, quantification, length sampling, sex determination, etc.). Biological samples are collected for species identification, genetic studies, age and growth, reproduction and diet of different zoological groups. Other tasks developed by the observers include the traditional tagging of fish and turtles, deployment of satellite tags on sea turtles, testing different measures for reducing the incidental seabird and sea turtle mortalities, and censuses and sightings of seabirds and marine mammals. Recently, pioneer activities of scientific observers acting as onboard environmental educators have been conducted, promoting environmental friendly practices within the fishermen. The creation of PNOFA has offered many biologists the opportunity to develop a professional career as scientific onboard observers. Besides, a consolidated work team has emerged, allowing the development of research activities on different taxa and fishery issues.

The Uruguayan pelagic longline fishery: how is it monitored?

Marcos Cornes[1], Philip Miller[1], Sebastián Jiménez[1], Martin Abreu[1] & Andrés Domingo[1, 2]

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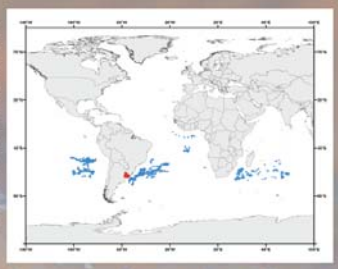
What is PNOFA?

The Programa Nacional de Observadores a Bordo de la Flota Atunera Uruguaya (PNOFA) was created in 1998 by the Área de Recursos Pelágicos of the Dirección Nacional de Recursos Acuáticos (DINARA), which is the governmental agency in charge of managing the Uruguayan aquatic resources. The main objective of PNOFA is to collect information about the Uruguayan pelagic drift longline fishery, in order to assist in the decision making and regulations inherent to this fishery. Since 1998, the scientific observers of PNOFA have monitored 70 fishing trips (approx. 4.000.000 hooks) in the Atlantic, Indian and Pacific Oceans, with lengths ranging from 4 to 109 days, including departures and arrivals on foreign ports. The PNOFA annual coverage has ranged between 9%-45% of the total fleet effort. Currently, the PNOFA team is composed by 5 people, and all of them have a Biology Degree or are studying to obtain their degrees.



Activities developed by the PNOFA Observers

Currently, the basic duties of the observer include the collection of data on the fishing operative, environmental parameters and catch (identification, quantification, length sampling, sex determination, and digestive tract contents). Biological samples are collected for species identification, genetic studies, age and growth, reproduction and diet of different zoological groups. Other tasks developed by the observers include the traditional tagging of fishes. Recently, pioneer activities of scientific observers acting as onboard environmental educators have been conducted, promoting environmental friendly practices within the fishermen.

Bycatch Research

In the last three years, PNOFA has increased the efforts directed to investigate the impact of the pelagic longline fishery on non-target species. As part of this initiative, some observers have specialized on different taxa, developing research projects directly related with bycatch. The main activities are the following:

Testing bycatch mitigation measures (Bird scaring lines, blue dyed baits).
Censuses of seabirds attending the longline vessels.
Collection of biological samples (whole specimens and parts).
Photographic records.

Testing bycatch mitigation measures (circle hooks, blue dyed baits).
Deployment of satellite transmitters on leatherback turtles.
Tagging with traditional flipper tags.

Censuses of marine mammals attending the longline vessels.
Bycatch registration.
Assesment of marine mammal-inflicted damage on the capture and baits.

Difficulties and Problems

Logistic planning of the monitoring program is limited by the lack of fluid communication between PNOFA and the boat owners.

Transport of observer and the required equipment from office to fishing boats, as well as back from the boat to the office, is complicated by the lack of vehicles.

Difficulties to get into the ports; observers do not have credentials to get into the ports, which are restricted areas.

Skippers, crews and boat owners perceive that observers are getting paid too high for the job they do, so the relationship is sometimes complicated and harsh.

Onboard accommodations are not adequate; not enough room available to store the equipment and materials, neither to do the primary processing of the collected data and samples.

The observers have to face administrative problems and lots of bureaucracy in the processes of getting paid and the subsequent payment of taxes. The observers are not prepared to deal with these problems, and there is no technical support to help them.

What has PNOFA produced?

- Enhanced understanding of the fleet operational characteristics
- Technical reports subbmited to ICCAT
- Analysis of distribution patterns using across-basins approach
- Technical support in the creation of NPOAs (Seabirds and Sharks)
- Joint work with international organizations: NOAA, WWF, Birdlife, IUCN, ICCAT.
- Scientific papers and book chapters
- Internships for students of the Facultad de Ciencias de la Universidad de la República have allowed the development of Bachelor's thesis
- Collaboration with local and regional NGOs: Karumbé, Proyecto Albatros y Petreles, TAMAR, NEMA
- The creation of PNOFA has offered many biologists the opportunity to develop a professional career as scientific onboard observers.
- A consolidated work team has emerged, allowing the development of research activities on different taxa and fishery issues.

Acknowledgments

To our mates in the Departamento de Recursos Pelágicos, and all the fishermen that have helped us.

Interactions between cetaceans and the pole-and-line tuna fishery in the Azores

Carla Dâmaso, J.M. Goncalves, M. Machete and R.S. Santos

Department of Oceanagraphy and Fisheries / Institute of Marine Research, University of Azores – Portugal

Abstract

This work aimed to characterise the association between the cetaceans that inhabit the Azorean waters and the tuna fishery with pole-and-line, from 1998 to 2005, by using collated information from the POPA (Program for the Fisheries Observation in Azores) database. The results showed that the fishing events with cetaceans associated represent less than 10% of the total, assuming values around 5% in the last few years, and in only about a half of these perturbation of the fishing operations was registered. A total of 13 species were recorded in association with the fishery, belonging to Misticets and Odontocets, being only 3 species responsible for more than 90% of all associations – Common dolphin (*Delphinus delphis*), Atlantic spotted dolphin (*Stenella frontalis*) and Botlenose dolphin (*Tursiops truncatus*). Common dolphin was the species most frequently associated with the fishing events, the bigeye tuna fishing events were the ones that registered the greater value of association with cetaceans, being the interspecific association between them the most frequent (73% of the reported associations). The medium catches, the medium size of the tunas and the fishing time per fishing event showed high values in the presence of cetaceans. The spatial distribution of the fishing events associated with cetaceans overlaps the spatial distribution of the fishing effort, with high concentrations in the fishing banks and near the islands. This study clearly shows the importance of the POPA program in the collection of information to understand and study the association between the tuna fishery and cetaceans in the Azores.

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106

Interactions between Cetaceans and the Pole-and-Line Tuna Fishery in the Azores

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[1] Department of Oceanography and Fisheries/Institute of Marine Research – University of Azores. 9901-862 Horta. Portugal.
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1 Introduction

- Nowadays, in the Azores, tuna and tuna like species are the most important fishery resources[1].
- Five species of tunas occur in the Azores, being the Bigeye and Skipjack tunas the most important in terms of catches, followed by Albacore, Yellowfin and Bluefin tunas[2].
- Cetaceans are the only marine mammals that inhabit the Azorean waters – 24 species confirmed.
- The association between different species of tuna is frequent as well as the association between tunas and cetaceans[2,3], being these associations very common all over the world [4,5,6,7,8].
- In the Azores the tuna fishing boats use exclusively the pole-and-line fishing method[9] that is known to do not affect negatively the cetaceans associated[9].

Objectives

- This work aims to characterize the association between the cetaceans that inhabit the Azorean waters and the tuna fishery with pole-and-line, from 1998 to 2005, by using collated information from POPA database.

2 Azorean Tuna Fishery

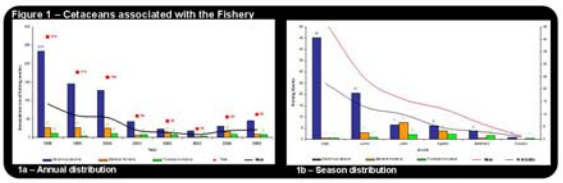
- The Azores Archipelago is located in the Atlantic ocean, over the Mid-Atlantic Ridge, and constituted by nine volcanic islands and some islets.
- The Azorean Tuna fishing fleet, composed by vessels smaller than 30 m, operates seasonally, between April and October, using exclusively pole-and-line with live bait fishing method.
- From April to end of June Bigeye Tuna is the most captured, being replaced by Skipjack afterwards, when the water temperature increases.

3 Methods

- POPA (**O**bservation **P**rogram for the **F**isheries of the **A**zores) was funded in 1998, ensuring the absence of dolphin mortality or injury in tuna fishery.
- Data used in this work was collected by observers on board the tuna fishing boats, in the period between 1998 and 2005.
- Data collection is made between sunrise and sunset, including:
  - Weather conditions and physical information
  - Vessel positions and travels
  - Activity of the vessel
  - Information about cetaceans, marine birds, marine turtles and fishing events, including associations.
- All the information collected by the observers is available in POPA database.

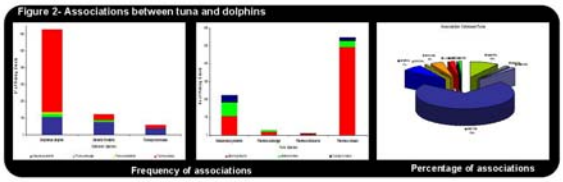
4 Results

Figure 1 – Cetaceans associated with the Fishery



1a – Annual distribution | 1b – Season distribution

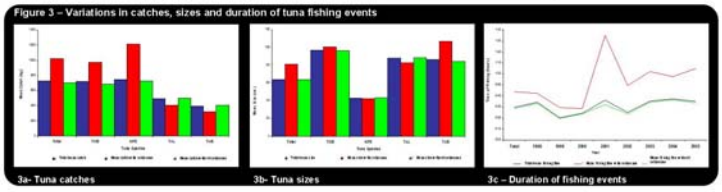
Figure 2- Associations between tuna and dolphins



Frequency of associations | Percentage of associations

- Number of fishing events with cetaceans associated decreases over the years (except in 2004 and 2005) and also over the fishing season, corresponding to less than 10% of the totality of fishing events.
- Common dolphins are the species associated in the majority of the fishing events, followed by Spotted dolphins and Botlenose dolphins. These 3 species represent about 93,5% of the associations.
- The Bigeye Tuna fishing events have the higher number of associations with dolphins, followed by Skipjack Tuna.
- The most common association is registered between Bigeye Tuna and Common Dolphin, corresponding to more than 70% of the total associations.
- No associations were registered between Albacore and Botlenose dolphin neither between Yellowfin Tuna and Common dolphins.

Figure 3 – Variations in catches, sizes and duration of tuna fishing events



3a- Tuna catches | 3b- Tuna sizes | 3c – Duration of fishing events

- The catches of tuna per fishing event is larger in the presence of cetaceans associated with the fishery, in the total and in the fishing events for Bigeye and Skipjack tunas, reaching a difference of about 290 kg for the first and 480 kg for the second.
- The size of the individuals captured in fishing events with cetaceans present is larger for Bigeye and Yellowfin tunas. The opposite situation was registered for the other tunas.
- The fishing events last longer in the presence than in the absence of dolphins. Fluctuations were recorded over the years, with variations between 1 hour (in 2001) and 5 minutes (in 2000).

Table I – Dolphins hooked and released during fishing events covered by POPA Observers

Year	Number of Dolphins
1998	16
1999	24
2000	9
2001	1
2002	1
2003	0
2004	0
2005	5
Total	56

- The number of dolphins hooked during fishing operations decreased over the studied period, being zero in 2003 and 2004.
- A total of 56 dolphins were hooked, being all released alive and with no apparent injuries.

5 Conclusions

- The existence of POPA is crucial for continuous monitoring of fisheries and associated species.
- The Azorean Pole-and-Line Tuna Fishery has a minimum impact on local populations of cetaceans, with no mortality associated with the fishery.
- Like in the ETP the association between tuna and dolphins is frequent, but is avoided by fisherman, that believe the dolphins have a negative effect on fishing operations.
- In the presence of dolphins the fishing events last longer, the catches are higher and also the size of the tunas are larger.
- As the fishing method used by Azorean fishermen has negligible impact on cetaceans populations, fishing behaviour can be changed, taking advantage of the associations between tuna and cetaceans.

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Crab identification verification in the North Pacific Groundfish observer program

Sharon Davis and Duane Stevenson

NOAA – North Pacific Groundfish Observer Program – USA

Abstract

Alaska groundfish observers are required to perform many duties aboard commercial fishing vessels, with most of their time spent on determining the species composition of catches. The correct identification of species at sea is fundamental to this task. The Alaska Fisheries Science Center's Fisheries Monitoring and Analysis Division has taken great strides in the development of species training presentations, accompanied by hands-on laboratories, to ensure that observers are thoroughly familiar with the species identification keys and guides issued. Since 2005, the Division has been focusing on specifically improving the laboratory specimens used to train crab identification. Crab carapaces are notoriously fragile, and entire specimens are often not available for examination. The Division worked to design a new dichotomous key for crab species encountered by groundfish observers and created a new collection of preserved crab carapaces and whole specimens used to train and test observers. To allow for verification of at-sea species identifications, each observer completes an identification form for each species encountered. These forms are used by Division staff during data quality control checks to assess the reliability of identifications. A record of verified identifications for each observer is maintained in the Division's database.

Crab Identification Verification in the North Pacific Groundfish Observer Program

Sharon Davis & Duane Stevenson
North Pacific Groundfish Observer Program • Fisheries Monitoring & Analysis Division • Alaska Fisheries Science Center • Seattle, WA

Introduction

Observers in the groundfish fisheries of the North Pacific Ocean and Bering Sea encounter several species of crabs. King, Tanner, and snow crabs support major fisheries in Alaskan waters, and have a significant economic impact on the region. Commercial crab stocks in the Bering Sea and Aleutian Islands (BSAI) region and Gulf of Alaska (GOA) are managed by the State of Alaska, with Federal oversight in the BSAI. Crab stocks are surveyed each year by NMFS in the BSAI and by the Alaska Department of Fish and Game in the GOA.

North Pacific Groundfish Observer Program (NPGOP) observers have been collecting biological data on crab since the early 1990's. Commercially important crab species are classified as "prohibited" and bycatch caps are established in groundfish fisheries to protect the directed crab fisheries. As part of their training, North Pacific groundfish observers receive instruction, identification tools, and hands-on practice to prepare them to collect biological data on the crabs they encounter as bycatch.

Training Presentation

Crab identification training consists of a classroom session and a laboratory session. A training lecture accompanied by a PowerPoint slide show introduces trainees to relevant parts of crab anatomy and terminology, as well as sexing and measurement protocols. Identification of all king crabs (*Lithodes* and *Paralithodes* spp.) and Tanner crabs (*Chionoecetes* spp.) is covered in detail, and the 12 non-prohibited crab species and species groups are covered more briefly. The hands-on laboratory session introduces observers to the identification key and specimen collection.

Crab Taxa Identified by NPGOP Observers	
Prohibited	Non-Prohibited
Hybrid Tanner	*Paralithodes* spp.
Opilio Tanner	Korean hornyhead crab
Hybrid Tanner	Helmet crab
Tanner/ Tanner	Scaled crab
Angulatus Tanner	Box crab
Red king	Fuzzy crab
Blue king	Hieroglyphic crab
Brown king	Decorator crab
Golden king	Lyre crabs
	Decorator crabs
	Hermit crabs

Identification Key

A dichotomous identification key provided to observers includes all "Prohibited" species (king crabs and Tanner crabs), which are targeted by fisheries, and several non-prohibited species commonly encountered as bycatch. It relies heavily on characteristics of the rostrum, carapace, and legs. Hermit crabs, lyre crabs, and decorator crabs are identified only to the group level.

Species Description Form

This form, designed to be completed with the specimen in hand, is an important means of verifying observer identifications. It prompts the observer to count the number of walking legs on the specimen and to describe distinguishing characteristics of the carapace, legs, and rostrum. The form also includes a space for specimen illustration. Observers are required to complete one of these forms each time a new species of crab is encountered.

Specimen Collection

The specimen collection includes crab carapaces, partial specimens, and whole monsters. Specimen preparation consists of drying, viscera removal, and reinforcement of the carapace and legs with silicone. Most specimens are robust enough to be handled, but small and delicate specimens are mounted inside clear plastic cases. Trainees use this collection in a laboratory training session to familiarize observers with the use of identification materials.

Debriefing and Quality Control

Following the completion of a cruise, observers submit their data sets to NMFS debriefing personnel for review. Debriefers use species description forms, verbal descriptions, photos, and collected specimens to verify the accuracy of crab identifications. Questionable identifications are edited and calculation and transcription errors are corrected. The edited crab bycatch data are then used in the management of Alaska's crab fisheries.

The missing value: Who cares about razor clams?

Donatella Del Piero

University of Trieste – Italy

Extended Abstract

Razor clams live buried in sandy sediments and are widely diffused along the italian coasts and the target species *Ensis minor* (Chenu, 1843) and *Solen marginatus* (Pulteney, 1799). The scientic names adopted are derived from the indication published in Bedulli *et al.* (1995). Other names and authors are found in the scientific literature (e.g., Turgeon *et al.*, 1998).

The clams are harvested mainly with hydraulic dredges, but there are professional scuba divers licensed too.

The clam fishery has been organised on regional basis since 1997 and managed by fishermen organisations named Consortia. In 1987 Poutiers reported several hundreds of metric tons landed only in the Adriatic, but the survey data since 1979 revealed strong oscillations from year to year with a negative trend (Del Piero and Dacaprile, 1998). There are no so long coverage for the Thyrrenian Sea, the hydraulic dredges were replaced by scuba divers and the fishery season longer than the Adriatic one that covers fall and winter months. From 1993 onwards along the Adriatic coast the more appreciated *Ensis minor* declined markedly, with no appreciable recruitment and *Solen marginatus*, once marginal in commercial landings, became the principal target.

The reported catches for the 2004 and 2005 for the hydraulic dredges obtained thank to the courtesy of IREPA (Dr Labanchi) show an increase in landings from 356.499 kg to 453.060 kg and the global value rose from about 2,3 to 3,2 million euros but the average raw price is 50 eurocent lower.

It's not possible to have information about the species effectively catched and the there is no scientific literature on the topic. The data from professional divers are not properly censused and Maritime officers estimate for the Tuscany region i.e., where no dredges are licensed for razor clams, an amount of 50 kg/day for each fisherman. The same officers report that *Solen marginatus* is the target species.

The term 'substitution' was invoked to explain the diminution of *E. minor* and the prevalence of *S. marginatus* but the term may be unprecise because survey data show a rather slow but continuous population structure build-up and gain in space. Information collected among officers and colleagues confirms that it's a general feature along the italian coasts. As a result of the different rules applied, the dredge owners of the Adriatic claim for extending the fishery season on the Adriatic districts. Due to the lack of survey data on stocks, the fishery policy seems to be replaced by the market policy.

Integrated weight longlines with paired streamer lines – best management practice for demersal longline fisheries

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Extended Abstract

To evaluate a new technology – integrated weight longlines (IW) – as a viable seabird mitigation technology for demersal longline fisheries, we compared three experimental mitigation treatments, IW line alone, IW with paired streamer lines (IWPS) and unweighted longlines (UW) with PS (UWPS), to a control of no deterrent (UW alone).

Trials took place on two vessels targeting Pacific cod (*Gadus macrocephalus*) over a five-month period in the Bering Sea, Alaska, USA. We used multiple criteria for evaluations – catch rates of all taxa, seabird behavior, and gear sink rate and performance – making this study the largest and most comprehensive experiment of its kind.

All mitigation technologies dramatically decreased seabird by-catch rates while having little to no effect on fish catch rates (Figure 1). Mitigation was more effective for surface foraging seabirds than for diving seabirds (shearwaters), reducing mortality rates by 91% to 100% and 79% to 97%, respectively. IWPS performed best, reducing surface forager catch by 100% and shearwater catch by 97%, relative to controls. IW alone and UWPS performed similarly reducing surface forager catch by 91% and 98%, respectively, and shearwaters catch by 88% and 79%, respectively.

Seabird behavior was a poor proxy of seabird mortality, especially for IW gear (Figure 2).

Abundance and attack rates of surface foraging seabirds were significantly reduced relative to controls for both mitigation methods that included streamer lines (UWPS and IWPS); shearwater abundance was also reduced in streamer line treatments, but only UWPS reduced shearwater attacks. IW alone had no effect on the abundance or attack rate of either foraging guild – both mirrored the controls – and neither measure of behavior reflected the pattern or magnitude of catch rate reductions across mitigation methods.

IW lines reduced the distance astern that birds have access to sinking baits by near half and its handling qualities were superior to UW. We conclude that IW longlines deployed with paired streamer lines constitute best practice for seabird conservation in demersal longline fisheries using auto-line systems.

Keywords: Seabird-fishery interaction; By-catch reduction; Integrated weight longline; Sink rate; Cooperative research.

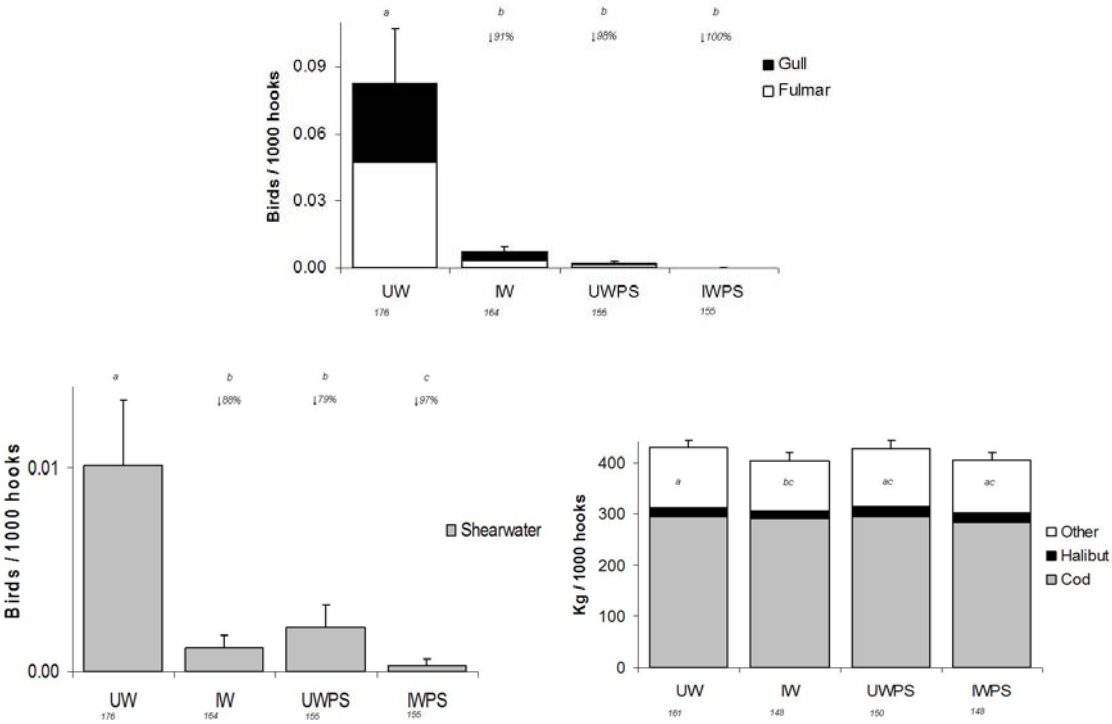

Figure 1: *Mean catch rates (±SE) of surface foragers (a) shearwaters (b) and fish (c) by mitigation treatment and control (UW: control of unweighted longline; IW: integrated weight longline; UWPS: unweighted longline plus paired streamers; IWPS: integrated weight longline plus paired streamers). Letters above bars (a, b) and within bars (c) indicate significant differences in Bonferroni post-hoc comparisons (p<.05; the same letter is equivalent to not significant). Sample sizes (number of sets) for each treatment indicated below x-axis and are different for birds and fish due to different sampling strategies. Scale of y-axis for surface foragers (a) is eight times greater than for shearwaters (b).*

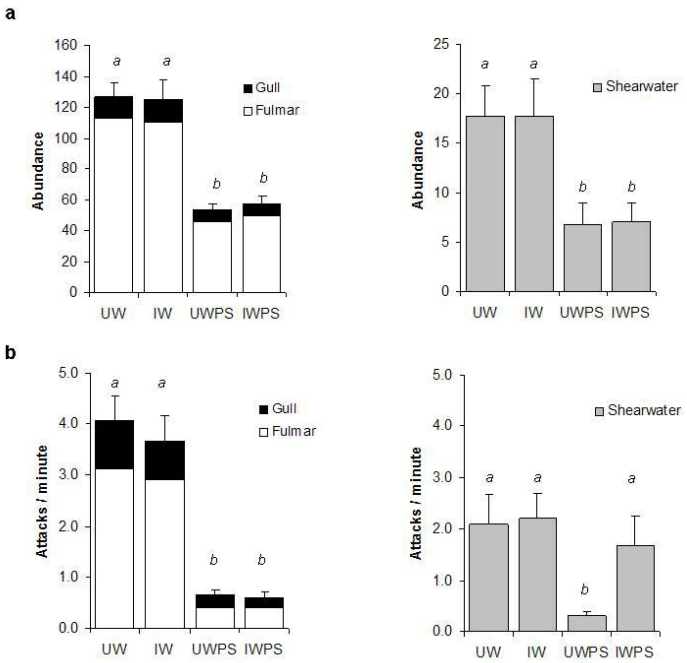

Figure 2: *Mean surface foraging seabird and shearwater abundance (±SE; a) and attack rate (b) by mitigation treatment and control (UW: control of unweighted longline; IW: integrated weight longline; UWPS: unweighted longline plus paired streamers; IWPS: integrated weight longline plus paired streamers). Letters above bars indicate significant differences in Bonferroni post-hoc comparisons (p<.05; the same letter is equivalent to not significant). Sample sizes (number of sets) were 89, 66, 96 and 89 (abundance) and 72, 56, 94 and 85 (attacks / minute) for UW, IW, UWPS and IWPS, respectively. Abundance scale differs between surface foragers (a) and shearwater (b).*

IPHC stock assessment surveys: Platforms of opportunity for cooperative research

D.L. Dykstra* and T.O. Geernaert

International Pacific Halibut Commission – USA

Extended Abstract

Introduction

The International Pacific Halibut Commission (IPHC) was established in 1923 by a Convention between the governments of Canada and the United States of America. Its mandate is research on and management of the stocks of Pacific halibut (*Hippoglossus stenolepis*) within the Convention waters of both nations.

Each year the IPHC conducts a coast wide stock assessment survey using 12 – 15 commercial longline vessels. Over 1,200 stations are fished with longline gear from the California border to the Aleutian Islands and Bering Sea. As part of the survey, the commission hires 30 biologists to staff the cruises. These sea samplers work closely with the fishing crews to collect the data and process the fish. Biological data collected includes length, sex, otoliths and maturity estimates of Pacific halibut. These vessels are also used as a platform of opportunity for other types of data collection. Seabird abundance, marine mammal encounters, shark population studies, rockfish assessments and video monitoring feasibility studies are examples of special projects conducted on IPHC survey vessels in support of other outside agencies.

Seabird Abundance Estimates

The IPHC has been collecting seabird abundance estimates since 2002 and has compiled this data along with data from ADFG and NMFS field cruises. Sea samplers record the number of seabirds by species or species group both on the water and in the air within a 50-meter radius of the vessel's stern, immediately after the gear is hauled. Because of its systematic grid layout and broad coverage, this snapshot methodology provides data on the presence and absence of species and their relative abundance. The IPHC coauthored a report with Washington Sea Grant for the North Pacific Fisheries Management Council on seabird distribution in the longline fisheries with accompanying avoidance recommendations.

By-catch Monitoring and Sampling

IPHC chartered survey vessels are excellent platforms for collecting non-halibut data. Since 2003 by-catch data has been collected for the Department of Fisheries & Oceans (DFO) in Canadian waters. Data recorded while the longline is retrieved include species identity, order, and spacing of all hooked organisms while at the end of every haul, lengths, sex, maturities, and otoliths are collected from retained rockfish. Catch and effort data collected provide DFO with coast-wide relative abundance indices for many commonly caught species.

Shark interactions on longline gear

Sleeper sharks (*Somniosus pacificus*) occur as incidental catches on IPHC surveys and their interaction with the commercial fleet is problematic. Little of their life history is known and given the increasing worldwide attention to elasmobranches and their interaction with fisheries, the IPHC is conducting a cooperative research project on this species with the University of Victoria and the Institute of Zoology in London, England. In 2004 biopsy darts were used to obtain genetic samples for stock identification. The genetic study will use polymerase chain reaction (PCR) amplification of the DNA target chain. It is hoped that this will yield sufficient information to differentiate among nurseries of this species. In addition to the genetic work the University of Washington has used our survey vessels as platforms to tag sleeper sharks in Prince William Sound.

Marine mammal interactions and sightings

Since 1998 the IPHC has collected marine mammal encounter information on the stock assessment surveys for the National Marine Mammal Laboratory in Seattle, WA and the Pacific Biological Station in Nanaimo, B.C. In recent years depredation on halibut gear by sperm and killer whales has become a problem in Alaska and around the world. The IPHC is

working with the several agencies to report sightings and collect more detailed encounter information. We are also participating in industry workshops in an effort to understand the cause and find effective solutions.

Using digital video monitoring systems in fisheries

In 2002, the National Marine Fisheries Service (NMFS) contracted with the IPHC to examine the feasibility of electronic monitoring in the halibut longline fleet operating off Alaska. An Electronic Monitoring System (EMS) was installed on two IPHC chartered halibut longline vessels. Cameras were placed on the stern and recorded images of setting gear and the performance of seabird avoidance devices (streamer lines). The video observations found that when two cameras were used, the EMS was successful in detecting streamer line deployment and relative position on 100% of the daytime sets. EMS was also used to determine if video imaging can detect and identify incidentally-caught seabirds. It was found that an EMS program would be able to detect a high proportion of incidentally caught seabirds. However, additional work is needed on seabird image identification methods as well as testing the effects of soak time on the physical characteristics of seabirds.

Recommendations for reducing vessel selection bias in U.S. observer programs

Michael Fogarty[1], Dennis C. Hansford[2]* and Jon H. Volstad[3]

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[3] *Versar Inc, Columbia, MD – USA*

Abstract

In May 2005, the National Observer Program convened a workshop of regional observer program managers and analysts to evaluate bias in 24 regional observer programs. Because the fisheries addressed were diverse, the issues associated with potential vessel selection bias were similarly diverse and thus formed a strong basis for the workshop to draw a number of generally applicable conclusions on how to diagnose and reduce vessel selection bias when it occurs. Based on information from a questionnaire developed by observer program managers and workshop discussions, the causes of biases were broadly classified into three categories: (i) errors in the sampling frame; (ii) bias caused by how vessels within the sampling frame are sampled (i.e., observed vessels are not representative of the general fleet); and (iii) bias caused by changes in fishing behavior when observers are deployed. The last category of bias is not directly related to the vessel selection method but was considered during the workshop because it applies to a sample of vessels. Recommendations were developed for regional observer programs to routinely monitor if vessel selection bias is occurring, and for actions to reduce or eliminate bias.

Recommendations for Reducing Vessel Selection Bias in U.S. Observer Programs

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National Oceanic and Atmospheric Administration
National Marine Fisheries Service
Northeast Fisheries Science Center

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Columbia, MD, USA

Problem statement: Observer programs with less than 100% coverage cannot accurately sample the fleet if the vessel selection procedure for deploying observers is biased.

NOAA's National Marine Fisheries Service (NMFS) is developing a framework for statistically valid, unbiased vessel selection procedures for deploying observers

- ✓ **Observer programs are in all six NMFS regions**
- ✓ **42 fisheries are observed**
- ✓ **A variety of data are collected, including catch and bycatch**

Methods of Vessel Selection

- Census
- Random sampling with replacement
- Stratified random sampling with replacement
- Stratified random sampling without replacement
- Systematic random sampling
- Ad hoc selection

Sources of Bias in Estimating Catch and Bycatch

- In the sampling frame (vessel list)
- How vessels within the sampling frame are sampled
- Changes in fishing behavior when observers are deployed

Methods and Tools to Assess Potential Biases

Assessment of Biases in Vessel Selection and Observer Deployment

- Evaluate average trip length for observed vessels versus general fleet
- Evaluate average harvest (catch retained) per trip for observed vessels versus the general fleet
- Evaluate average depth of observed sets versus reported sets by vessel class
- Evaluate extent of spatial overlap of observed tows/sets with reported fishing locations by the general fleet

Assessment of Biases in Sampling Frame

- Evaluate vessel characteristics within the sampling frame compared to vessels that require observer coverage, but that are not covered for various reasons
- Evaluate proportion of sampled trips versus trips made by the general fleet

Recommendations for Minimizing Vessel Selection Bias

Bias in Vessel Selection and Observer Deployment

- Utilize random selection schemes
- Determine stratification criteria per fishery/program and select vessels with equal probability within strata
- Apply adaptive sampling designs to account for dynamic fishery and vessel participation patterns
- Increase the portion of vessels that agree to take observers through outreach programs and other means

Bias in the Sampling Frame

- Develop sampling frames based on lists of actively participating vessels in each fishery.
- Increase the coverage of the fleet by reducing the number of vessels that are unsafe

Reference: Volstad, Dr. Jon H. and Fogarty Dr. Michael, *Report on the Observer Program Vessel Selection Bias Workshop*, Woods Hole, May 17-19, 2006

http://www.st.nmfs.noaa.gov/st4/nop/index.html

Rapid availability of commercial salmon catch reports from fishing grounds, via web-based data-entry by call-center staff

Robert Houtman

Department of Fisheries & Oceans, Pacific Biological Station, Nanaimo, B.C. – Canada

Extended Abstract

Rapid availability of catch data allows fishery managers more precise control of harvest impacts, both on retained catch and on released by-catch. For commercial salmon fisheries in British Columbia, a system has been developed to allow catch reports to be entered into a secure fishery database from remote locations on any schedule required. The system relies on fishers or observers to be able to contact a 'Call Centre' via a phone call. Since phone calls can be made via land-line, cellular, satellite or radio phone, fishers can make catch reports from even the most remote locations.

When a catch reporting phone call is made, call center staff connect to a fishery database via a web-based data entry interface. By reference to the database, the interface validates various aspects of the information provided, including fisher, vessel, and licence identification, and licence eligibility to fish at the reported time and area. The call center operates at all hours, and thus supports any required reporting deadline.

To minimise call times, the data entry screens of the web-based interface are configured according to fishery opening parameters entered in the database. Thus, only information appropriate to the fishery is expected on the call. For example, once the fishery is identified on the call, subsequent screens only require specifics of gear characteristics or catch storage as required for that fishery.

Once a complete report is entered in the database, a system-generated 'confirmation number' is provided to the caller. This number represents proof of compliance with catch reporting requirements. Completed catch report data are immediately available to all authorised users of the database via the same interface.

In the British Columbia commercial salmon fishery, this reporting mechanism is currently used for fisher catch reports from fishing grounds, on-board observer catch reports, fisher 'off-load' reports of landed weight, and fisher Start and End Fishing 'activity reports'. Other reports that could be made using this mechanism include dockside validation catch reports, on-water 'interview' data, and vessel sighting reports.

In 2006, 27,800 fisher catch reports were completed using this reporting mechanism, and there were no indications that the system was challenged by this call volume. Further, for days with catch reporting, the 50th and 95th percentiles of reports completed per day were 48 and 311, respectively. These statistics demonstrate that this reporting mechanism has the capacity to handle large numbers of calls annually, and sufficient flexibility to deal with the large day-to-day variation in report volume that will be typical for fisheries. Finally, the 50th and 95th percentiles of call length for fisher catch reports were 78 and 167 seconds respectively, a reasonable duration considering the amount of information that is communicated and validated during the calls.

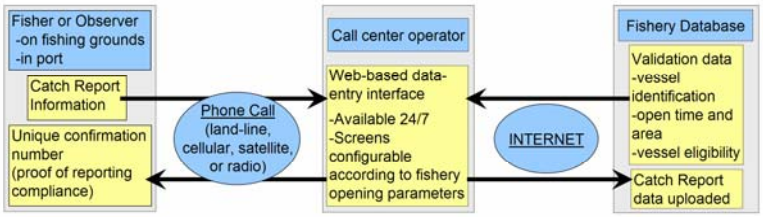
Rapid availability of commercial salmon catch reports from fishing grounds, via web-based data-entry by call-center staff.

Robert Houtman, Pacific Biological Station, Nanaimo, B.C.

Fisheries and Oceans Canada Pêches et Océans Canada

Abstract

Commercial salmon fishery management benefits from rapid availability of catch reports from fishers and fishery observers. To achieve this, Fisheries and Oceans Canada relies on a call-center to receive catch reports from fishers and fishery observers on the fishing grounds, and to enter the data immediately into the salmon catch database using a web-based interface. Catch reports are made by phone (land-line, cellular, satellite or radio). The call center can receive calls 24/7, allowing fishery managers to require catch reports be made within a few hours of fishing. By reference to the database, the data entry software is able to validate certain aspects of the reports, including gear type, licence/vessel/fisher identification, and eligibility to fish at the reported time and area. After a completed catch report, the system generates a report identification number which is provided to the person making the report; this number is critical for fishers to be able to provide as evidence of reporting compliance. Completed catch report data are immediately available to all authorized users of the database via the same interface. Details of the system operation, as well as catch reporting statistics, are provided.



Introduction

Rapid availability of catch data allows fishery managers more precise control of harvest impacts, both on retained catch and on released by-catch. For commercial salmon fisheries in British Columbia, a system has been developed to allow catch reports to be entered into a secure fishery database from remote locations on any schedule required.

The system relies on fishers (or observers) to be able to contact a "Call Center" via a phone call. Since phone calls can be made via land-line, cellular, satellite or radio phone, fishers can make catch reports from even the most remote locations. When a catch reporting phone call is made, call center staff connect to a fishery database via a web-based data entry interface.

This approach allows for validation of certain reported data against the database, increasing data quality, and allows the data entry screens to be configured according to fishery-specific data requirements, minimizing call duration. Further, this approach provides the large and extremely flexible report handling capacity essential to fishery reporting requirements.

Catch Reporting Sequence

1. Fisher phones call center.
2. Operator connects to fishery database using web-based data entry system.
3. Fisher provides their logbook number and unique page number, allowing the system to validate the logbook number against the page number. Associations in the database allow the reporting vessel and gear type to be identified based on the logbook number.
4. Fisher provides information on fishing area and date.
5. The database determines the fishery opening which the reporting vessel was eligible for, based on fishery opening details entered previously in the database by system administrators.
6. Fisher provides kept and released catch for all species.
7. Complete catch report is recorded in the database, associated with the correct opening and licence.
8. A system-generated Confirmation Number is provided to the fisher. This number represents proof of compliance with reporting requirements if demanded by enforcement personnel.

Current and Potential Uses

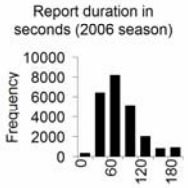
Current uses in commercial salmon fisheries:

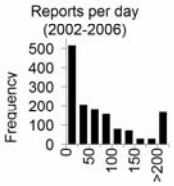
- Fisher catch reports from fishing grounds
- On-board observer catch reports
- Fisher 'off-load' reports of landed weight
- Start and End Fishing 'activity reports'

Potential uses:

- Dockside validation catch reports
- On-water 'interview' data
- Vessel sighting reports

Fisher Catch Report Statistics





Reports per year

Year	Total calls
2002	22507
2003	23743
2004	23395
2005	20992
2006	27824

Data Entry Interface Screens

How can observer programs contribute to ecosystem-based management?

Brad Justin

North Pacific Groundfish Observer – USA

Extended Abstract

Abstract

Ecosystem-based management (EBM) is an integrated approach to management that considers the entire ecosystem, including humans. The goal of ecosystem-based management is to maintain an ecosystem in a healthy, productive and resilient condition so that it can provide the services humans want and need. Ecosystem-based management differs from current approaches that usually focus on a single species, sector, activity or concern; it considers the cumulative impacts of different sectors.[3]

Scientific investigations demonstrate that EBM promotes sustainable fisheries which in the long run result in more secure fishing investments, robust exploited populations, and stability for industry. Observer programs (OP's) should be designed in ways to work toward this growing approach, which would help expand various OP outputs. The ideas presented in this abstract pertain to the North Pacific Observer Program in particular, but can be applied to other OP's as well. Presently in Alaska observers collect data that help us understand ecosystems, but the collection efforts need to be broader both temporally and spatially. To accomplish this, OP's must find ways of redistributing observer duties to spend more time gathering ecosystem information while still accomplishing the necessary catch monitoring duties. Because this redistribution would create ripple effects across established programs, it must be done with some forethought, to minimise disturbances of the sectors, (industry, OP, etc.) Therefore, a formal study conducted by the OP (or by a consultant) would help to determine which EBM initiatives are most feasible and also help prioritise data needs. The OP could then make the necessary broader ecosystem observations. In time, these efforts would enhance ecosystem understanding and assist conservationists and managers in achieving more sustainable harvests of economically important species.

There are other ways OP's can contribute more to EBM. By incorporating ecosystem education during training, observers would develop an understanding of how observer data are used to assess the condition of an ecosystem and the impacts fishing has on an ecosystem. New designs in observer programs or augmentation of existing projects, such as year-round stomach collections in the North Pacific Program, for predatory/prey dynamics, would also enhance our understanding of ecosystems. The redistribution and expansion of observer duties to focus more on collecting detailed data for species associated with target fisheries would increase understanding of by-catch species and their role within the ecosystem (e.g., corals, sponges). Finally, reinterpreting existing data using new analytical methods or paradigms which specifically address / explore ecosystem dynamics, or which more clearly pinpointthe sources of perturbations, could also enhance ecosystem understanding and could be achieved without having to change existing observer sampling duties.

Introduction

- What is ecosystem-based management (EBM)?
- What are data needs of EBM?
- Can observer programs (OP's) collect these data? If so, how should they go about it?
- What else can OP's do to enhance EBM?

Methods

This study was conducted as a survey of the scientific literature. I also interviewed one scientist and contacted several fisheries managers, conservation group staff, and North Pacific Groundfish Observer training staff with specific questions.

3 From 'Consensus Statement'

Results

How can OP support EBM?	How do these support EBM?
Incorporate ecosystem education into training module.	Observers develop a better understanding of how observer data is used to assess the condition of an ecosystem and the impacts fishing has on an ecosystem.
Revisit existing data using new analytical methods or paradigms which specifically address/explore ecosystem dynamics.	Enhance ecosystem understanding; more clearly pinpoint the sources of ecosystem perturbations.
Redistribution and expansion of observer duties	
Year-round stomach collections.	Improve understanding of predator-prey dynamics.
Finer scale collection/identification of species already sampled such as coral or other non-target species.	More detailed data of by-catch and indicator species.
New designs in observer programs	
Formal study conducted by OP of ways to redistribute observer duties to spend more time gathering ecosystem information while still accomplishing necessary catch monitoring duties.	Study would help OP determine which EBM initiatives are most feasible and prioritise data needs. OP then makes 'smarter' ecosystem observations leading to enhanced ecosystem understanding.

Conclusions

- Whichever approaches are used, OP's will be crucial toward advancing EBM.
- OP should find ways to make both broader and more detailed ecosystem observations.
- OP must prioritise and find which approaches are the most feasible/effective in advancing EBM.

Acknowledgements

I'd like to acknowledge Dave Fluharty and Kim Dietrich of the University of Washington who were of great help in assisting with my research. Keith Davis also provided research leads and scientific literature.

Building an efficient working relationship between fishermen and observers

Amanda Kardas

NMFS Certified Observer, Northeast Fisheries Observer Program, A.I.S. Inc – USA

Abstract

Daily interactions with commercial fishermen are a major component of a fisheries observer's job. Observers are exposed to many different opinions and field a variety of questions. Often times observers are unable to answer questions because they are regulatory based, while other topics such as observer job duties are easily answered. But, the overall majority of questions address the interpretation of laws and regulations. For example, a fishing vessel was boarded by the United States Coast Guard and the Captain asked the boarding officer about Summer Flounder regulations. In this instance, not one of the Coast Guard personnel knew the answer. They proceeded to look it up and even then the interpretation was vague and there was uncertainty whether the law had come into effect. In this instance the guidelines of how the law was written was not concise and rather confusing. If they were written in more of a clear-cut and to the point fashion this confusion and interpretation could have been eliminated. Lack of communication and outreach is another circumstance that industry encounters. Some of the fishermen in the small ports claim that they do not receive information on law changes or closed areas. For example, on May 1, 2006 the Northeast Fisheries Observer Program (NEFOP) implemented the USCG decal requirement for all vessels carrying a fisheries observer. Several captains in various ports did not know about the current USCG decal requirement even months after the requirement had started to be enforced. Another example is a situation that occurred when a fishing vessel was fishing in Nantucket Lightship and was not aware of the Closed Area Scallop delineations. They were ultimately boarded by the Coast Guard and lost their entire trip for one tow over the line. Besides losing their trip they were also sent back to their homeport, miles away from the port they were fishing from. Shortly thereafter an observer was assigned to their boat which lead to the perception that observers are placed on fishing vessels to act as undercover fish police to catch and document fishermen's illegal fishing activities. In order to answers these questions the observer could be required to know the regulations or the regulations and laws could be written in a more user friendly manner. More outreach is needed to enable the fishermen to be aware of updates and changes that often occur. This information will allow the fishermen and observer to work much more efficiently with one another.

Building An Efficient Working Relationship Between Fishermen And Observers

Amanda Kardas, NMFS Certified Fisheries Observer, Northeast Fisheries Observer Program, A.I.S., Inc.

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Another example is a situation that occurred when a fishing vessel was fishing in Nantucket Lightship and was not aware of the **Closed Area Scallop delineations**. They were ultimately boarded by the Coast Guard and lost their entire trip for one tow over the line. Besides losing their trip they were also sent back to their homeport, miles away from the port they were fishing from. Shortly thereafter an observer was assigned to their boat which lead to the perception that observers are placed on fishing vessels to act as undercover fish police to catch and document **fishermen's illegal fishing activities**.

In order to answers these questions the observer could be required to **know the regulations** or the regulations and laws could be written in a more user friendly manner. More outreach is needed to enable the fishermen to be aware of updates and changes that often occur. This information will allow the fishermen and observer to work much more efficiently with one another.

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Observer data and marine mammal take reduction planning

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Abstract

The incidental mortality and serious injury (or by-catch) of marine mammals in fishing gear has been a central concern of resource managers, the commercial and recreational fishing industries, conservationists, scientists, lawmakers, and the public both nationally and globally for the past several decades. The U.S. *Marine Mammal Protection Act* (MMPA), specifically section 118, explicitly addresses by-catch of marine mammals incidental to commercial fishing operations. Section 118 mandates both shortand long-term goals for reducing marine mammal by-catch as well as requirements necessary to attain these goals. One program under section 118 requires convening teams of stakeholders to develop take reduction plans. This poster will provide an overview of the process for developing marine mammal take reduction plans, as required by the MMPA. Data collected through observer programs form the basis of this process as well as provide an essential tool for monitoring the effectiveness of a take reduction plan once implemented. Observer data are used to determine the by-catch rate of a particular marine mammal stock in a particular fishery. These by-catch rates are then used to set target levels for reducing by-catch in a fishery. Once take reduction measures have been implemented, observer data are then necessary for determining whether marine mammal by-catch has declined as a result of these management actions.

OBSERVER DATA AND MARINE MAMMAL TAKE REDUCTION PLANNING

Kristy J. Long
NOAA Fisheries Service, Office of Protected Resources
Silver Spring, Maryland, USA

THE ISSUE

The incidental mortality and serious injury (or bycatch) of marine mammals in fishing gear has been a central concern of resource managers, the commercial and recreational fishing industries, conservation organizations, scientists, lawmakers, and the public both nationally and globally for the past several decades. The U.S. Commission on Ocean Policy declared bycatch the largest threat currently facing marine mammals in the United States.

Marine Mammal Protection Act – Bycatch Reduction Mandate

The Marine Mammal Protection Act (MMPA), as amended in 1994, provides that NOAA Fisheries, the agency responsible for conservation and management of cetaceans, seals, and sea lions, shall develop and implement take reduction plans (TRPs) for each "strategic"* stock that interacts with a commercial fishery that has frequent (i.e., Category I) or occasional (i.e., Category II) bycatch of marine mammals.

*A strategic stock is any marine mammal stock: (1) for which the level of direct human-caused mortality exceeds the potential biological removal level[1]; (2) which is declining and likely to be listed as threatened under the Endangered Species Act; or (3) which is listed as threatened or endangered under the Endangered Species Act or as depleted under the MMPA.

North Atlantic right whales (*Eubalaena glacialis*)
Photo: NOAA

Goals of a Take Reduction Plan

The immediate goal of a TRP is to:

- Within 6 months, reduce bycatch of marine mammals below the potential biological removal (PBR)* level for those stocks covered by the plan.

The long-term goal of a TRP is to:

- Within 5 years, reduce bycatch of marine mammals to insignificant levels approaching a zero mortality and serious injury rate, taking into account the economics of the fishery, the availability of existing technology, and existing state and regional fishery management plans.

*Potential Biological Removal (PBR) is the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population.

Humpback whale (*Megaptera novaeangliae*)
Photo: NOAA

Components of a TRP

TRPs must include:

- A review of the information in the relevant marine mammal Stock Assessment Reports;
- Estimates of the total number of animals being seriously injured or killed from the stock each year during the course of commercial fishing operations by fishery;
- Recommended or voluntary measures for reducing bycatch; and
- Recommended dates for achieving the specific objectives of the plan.

Specific management measures may include:

- Time / area closures
- Gear / fishing practice modifications
- Effort reduction requirements
- Outreach and education recommendations

Steps Involved in Take Reduction Planning

Phase 1: Data Collection and Analysis → Phase 2: Convene Take Reduction Team (TRT) → Phase 3: TRT develops consensus recommendations and submits to NOAA Fisheries → Phase 4: Publish draft and final regulations in *Federal Register* with opportunity for public comment → Phase 5: Implementation, monitoring, and evaluation of TRP measures.

Observer Data and the TRP Process

Phase 1: Data collection and analysis

Observer data allow NOAA Fisheries to:

- Characterize the interaction between marine mammals and fishing gear using the Marine Mammal Incidental Take Form
- Estimate annual human-caused serious injury and mortality in each fishery
- Discern and evaluate patterns and correlations among locations of interactions to focus management measures in areas or times of highest bycatch

Phase 5: Implementation, monitoring, and evaluation of TRP measures

Observing whether bycatch has been reduced as the result of TRP measures is a crucial step in evaluating the success of a particular TRP. If bycatch ratesIf bycatch rates remain the same or increase after a TRP has been implemented, the TRT must reconvene and develop additional measures to achieve the short- or long-term goal of a TRP.

MARINE MAMMAL INCIDENTAL TAKE FORM

OBSERVER/TRIP ID _____ HAUL # _____
YEAR (MM/DD/YYYY) _____ TIME (24 hr) _____
LOCATION OF TAKE
LATITUDE ____ deg ____ min N / S LONGITUDE ____ deg ____ min W
SPECIMEN NUMBER (BY TRIP) ____ SPECIMEN FIELD NUMBER _____
SPECIES IDENTIFICATION
___ Short-finned pilot whale ___ Long-finned pilot whale ___ Unid. pilot whale
___ Risso's dolphin ___ Atlantic spotted dolphin ___ Pantropical spotted dolphin
___ Bottlenose dolphin ___ Common dolphin ___ Unid. dolphin
___ Cuvier's beaked whale ___ Unid. beaked whale ___ Pygmy sperm whale
___ Unid. marine mammal Other _____
Diagnostic features _____
Confidence Level of Species ID ___ Good ___ Fair ___ Poor
Photos Taken? Y / N Number of photos taken _____
HOOKING OF MARINE MAMMAL
Was animal hooked? Y / N / Unknown (If No, skip to next section) No. of gangions to next float ____
Location Internal: Hook visible? Y / N ___ Visible to insertion point ___ Partial hook ___ Not visible
Location in Mouth: ___ Upper ___ Lower ___ Side ___ Swallowed ___ Unknown
External: ___ Front Flipper ___ Dorsal fin ___ Body ___ Head / Neck ___ Tail
___ Other/Unknown (explain) _____
Was hook removed from animal? Y / N / Unknown
If No, was line intentionally cut? Y / N Amount of line left trailing (in ft) _____
ENTANGLEMENT OF MARINE MAMMAL
Was animal entangled? Y / N / Unknown
Entanglement Location (check all that apply): ___ Front Flipper ___ Head / Neck ___ Tail/Flukes
___ Body ___ Mouth ___ Other _____
Gear involved: ___ Hook ___ Mainline ___ Gangion/Leader ___ Dropline/Floatline ___ Float
Was gear removed from animal? Y / N / Partial / Unknown
If No, amount of line left on animal (in ft)? _____ Were wraps cut? Y / N / Partial / Unknown
DESCRIPTION OF GEAR REMOVAL PROCEDURE / GEAR REMAINING (Use addtl. sheet as necessary)

Short-finned pilot whale (*Globicephala macrorhynchus*)
Photo: NOAA

SKETCH OF ANIMAL SHOWING WHERE GEAR WAS HOOKED OR ENTANGLED ON BODY
(Include other identifying or unusual marks as appropriate)

CONDITION OF MARINE MAMMAL UPON RELEASE
___ Alive, swam away normally ___ Alive, swam abnormally ___ Dead
Description of animal's behavior/condition upon release (use addtl. sheets as necessary) _____
WAS ANIMAL BOARDED? Y / N If No, approx. length of animal (ft) _____
If yes, complete the following. If full necropsy performed, use separate necropsy data sheet.
Total length (tip of rostrum to fluke notch, in cm) _____ Straight / Curved / Estimated
Sex: M / F / Unknown Disposition of Carcass: _____
Additional comments: _____
BIOPSY SAMPLES TAKEN? Y / N / Attempted (unsuccessful)
If yes, remize samples: _____
PRESENCE OF OTHER MARINE MAMMALS AT TIME OF CAPTURE
Were other marine mammals present at time of capture? Y / Did not look / Looked but did not see
Number of other marine mammals present (record all those) ____ MIN ____ MAX ____ BEST GUESS
Same species as animal captured? Y / N / Unknown Species ID if different: _____
Approximate distance from vessel (in ft) _____
DETERRENCE/AVOIDANCE
Were actions taken to deter or avoid animals? Y / N / Unknown
Describe (use addtl. sheets as necessary; indicate whether actions taken before, during, or after interaction)
Debriefed: Y / N Debriefed by: _____ Date: _____

Pelagic Longline Take Reduction Team – An Example

By working with the PLTRT, NOAA Fisheries developed an improved marine mammal take form (above) to increase the amount of data collected by observers. This new information will help the PLTRT and NOAA Fisheries monitor marine mammal bycatch rates and help in determining exactly how animals are interacting with longline gear. Analysis of previous observer data revealed that interactions between the fishery and pilot whales predominately occur in one particular area, the Mid-Atlantic Bight, of the Northwest Atlantic Ocean. Therefore, the PLTRT recommended several gear and fishing practice modifications (e.g., prohibiting mainline lengths > 20 nm in the Mid-Atlantic Bight) to NOAA Fisheries.

For more information on marine mammal Take Reduction Planning at NOAA Fisheries, please contact the Office of Protected Resources, Marine Mammal Division at 301-713-2322.

www.nmfs.noaa.gov/pr/interactions/

Observer program developed by Projeto Albatroz, Brazil

Patricia Mancini*, Fabiano V. Peppes and Tatiana Neves

Projeto Albatroz – Brazil

Extended Abstract

The Projeto Albatroz goal is seabird conservation, mainly albatross and petrel by-catch avoidance in longline fleets that operate in Brazilian and adjacent waters. This objective is addressed through scientific research and environmental education with fishermen to test and implement mitigation measures to reduce seabird by-catch using observers on board the vessels. The observers are responsible for data collection at sea, carrying out a seabird census, deployment of satellite transmitters for tracking seabirds, and collection of fishery production and by-catch data. Observers carry out an education program with fishermen during the fishing trips, exchanging experiences, talking about conservation issues (seabirds, turtles, sharks, bone fishes, marine pollution, fishery stocks, etc.) and showing them how they can help the conservation of marine ecosystem. With respect to mitigation measures, the fishermen are first informed of the main techniques to reduce by-catch, such as torilines, blue bait and night setting. After this, they are invited to test and improve these measures, adjusting them to their specific fishing requirements. It is an interactive process where observers and fishermen work together to solve the seabird by-catch issue. The last step is the adoption of mitigation measures by the fishermen, and onboard monitoring by the observers to check that the gear is functioning correctly or whether it needs further adjustment.

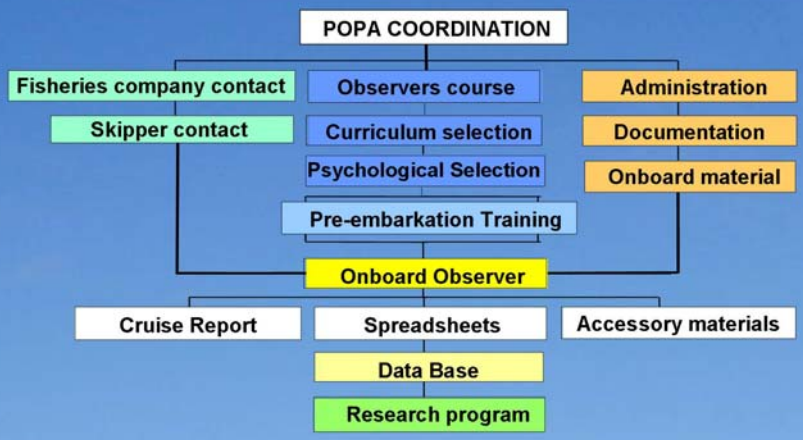
Observer Program developed by Projeto Albatroz, Brazil

Patricia L. Mancini, Fabiano V. Peppes & Tatiana Neves

Projeto Albatroz, Av. dos Bancários sala 22, Ponta da Praia, Santos- SP, Brazil. E-mail: pmancini@projetoalbatroz.org.br

Program goals are to reduce seabird bycatch using onboard observers to research, test and implement mitigation measures, and to educate fishermen in environmental awareness. Since 2000 the Observer Program accomplished 50 cruises in southern Brazil.

OBSERVER PROGRAM OF PROJETO ALBATROZ - POPA



OBSERVER RESPONSIBILITIES:



1. To contact the fishermen to make them aware of the albatross situation around the world and to introduce mitigation-measure issues explaining their benefits to the longline fishery.



2. To collect data on seabird numbers, bycatch and fishery production, and to deploy satellite transmitters for tracking seabirds.






3. To introduce and test mitigation measures to reduce seabird bycatch on longline vessels based in ports of southern Brazil.

On-Board Advisory Psychology Program in Brazil

Maria Cristina Fernandes, Claudete Romão, Patrícia L. Mancini* and Tatiana Neves

Projeto Albatroz, Brazil

Extended Abstract

The On-Board Advisory Psychology Program of Projeto Albatroz, a Brazilian NGO that addresses the conservation of seabirds by working with on-board observers on longline fleets in Brazil, was implemented in January 2003. This program was created to minimise the possible occurrence of behavioural problems which may cause prejudice in the observer's activities on-board. The main objectives of the program are: (i) to define the ideal observer profile to meet the needs of Projeto Albatroz; (ii) to carry out a psychology assessment to select candidates to become observers; (iii) to add to observers training orientation with respect to interpersonal relationships and the adaptation process related to physical and emotional stresses during cruises; and (iv) to measure the stress level and the possible psychological and behavioural alteration of observers during the confined period on the vessels. The program methodology was adapted from the Marine Personal Service Selection that includes the Antarctic Brazilian Program which chooses and monitors researchers that work in the isolated Brazilian Antarctic Base, officials on-board vessels and submarine workers. The pre-embarkation selection is accomplished by means of projective tests (QI, Social Acceptable Level, EFN e HTTP, ISSL) and individual interviews before each cruise. This activity aims to evaluate the observer's psychological condition just before embarkation. Observers have to fill out a logbook while at sea that details their routine and emotional state. There are subsequent interviews to evaluate how the observer felt about the cruise and any difficulties encountered. The intention of this procedure is to improve the observers ability to cope with conditions at sea on these cruises. After the program was implemented there was a reduction in behavioural problems on-board. The results were so positive that this program was adopted by other organisations that use observer services. Currently, this psychological evaluation process is a requirement of the National Onboard Observer Program (PROBORDO) developed by the Special Secretariat of Aquaculture and Fisheries of the Presidency of the Republic of Brazil according to IN no1 of September 2006.

On-Board Advisory Psychology Program in Brazil

Maria Cristina Fernandes, Claudete Romão†, Patrícia L. Mancini and Tatiana Neves

† In memoriam, Projeto Albatroz, Av. dos Bancários sala 22, Ponta da Praia, Santos- SP, Brazil. mail: pmancini@projetoalbatroz.org.br

The Projeto Albatroz, a Brazilian NGO that addresses the conservation of seabirds by working with on-board observers on longline fleets in Brazil, created the On-board Advisory Psychology Program in January 2003.

OBJECTIVES OF THE PROGRAM

- To define the ideal observer profile to meet the needs of Projeto Albatroz
- To train the observer in interpersonal relationships and the adaptive process related to physical and emotional stresses during cruises
- To carry out a psychological assessment to select candidates to become observers
- To measure the stress level and the possible psychological and behavioural alteration of observers during the confined period on the vessels

RESULTS

1. After the program was implemented there was a reduction in behavioral problems on-board.

2. The results were so positive that this program was adopted by other organizations that use observer services.

3. Currently, this psychological evaluation process is a requirement of the National Onboard Observer Program (PROBORDO).

Leonardo Sales
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Coordinator of POPA

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PROBORDO

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Data quality: Ways to improve observer data

Katherine McArdle

NOAA Fisheries, Northeast Fisheries Observer Program (NEFOP), Woods Hole, Massachusetts – USA

Extended Abstract

Reliable, unbiased observer data are required for stock assessments, establishment of management measures, and quota monitoring. The Northeast Fisheries Observer Program (NEFOP) insures data quality through several processes: training, debriefing, audits and tests, captain's interviews and research on fisheries.

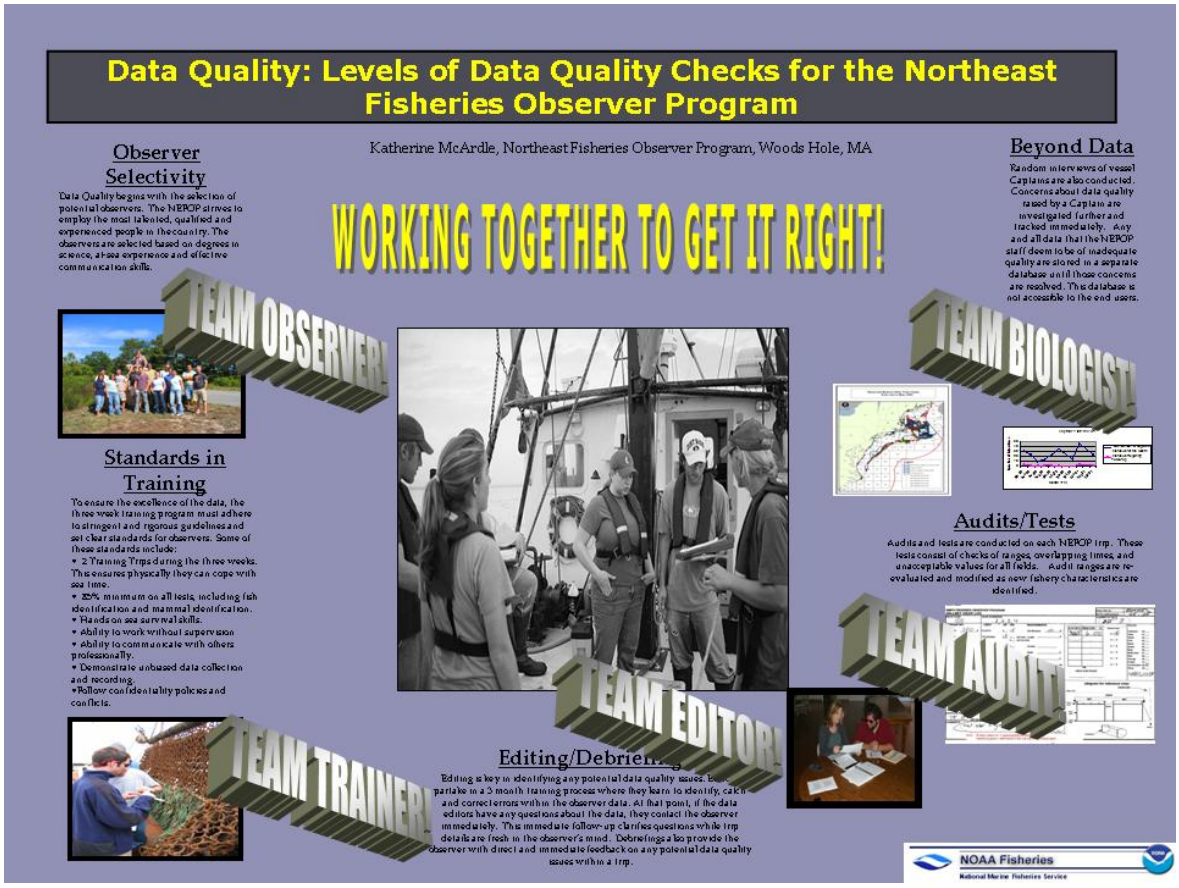
A sound observer training curriculum is the first step in obtaining quality data. The primary goal of the training process is to provide instruction on the most accurate way to collect data. Fishery regulations affect the type of data being collected; therefore, the training curriculum must be routinely updated to ensure appropriate protocols are being practiced. To ensure the excellence of the data, training programs must adhere to stringent and rigorous guidelines and set clear standards for data quality.

Debriefing may occur as soon as data from an observer's trip is received by NMFS personnel. Data are reviewed by NEFOP data editors. At that point, if the data editors have any questions about the data collected on the trip, they contact the observer immediately. This immediate follow-up clarifies questions while trip details are fresh in the observer's mind. Debriefings also provide the observer with direct and immediate feedback on data quality.

Audits and tests are conducted as data from each trip are entered into Oracle tables via on computer screens. These audits and tests consist of checks of ranges, overlapping times, and unacceptable values for all fields. Audit ranges are re-evaluated and modified as new fishery characteristics are identified (e.g., if the mesh size regulations changed for a certain fishery).

Random interviews of vessel captains are also conducted. Concerns about data quality raised by a captain are investigated further and tracked immediately. Any and all data that the NEFOP staff deem to be of inadequate quality are stored in a separate database until those concerns are resolved. This database is not accessible to the end users.

The Program has found that at each process thorough examination of every trip results in higher quality data. Proper training will result in less confusion among observers. Prompt debriefings will increase the probability of an observer remembering the details for their trip. Ensuring that the ranges within audits and tests consist of proper values will not allow unrealistic values to get in the database. Finally, performing Captain's Interviews allows NEFOP to receive direct feedback from the industry about an Observer's performance and may indicate any problems with data quality.


Data Quality: Levels of Data Quality Checks for the Northeast Fisheries Observer Program
Katherine McArdle, Northeast Fisheries Observer Program, Woods Hole, MA
WORKING TOGETHER TO GET IT RIGHT!
Observer Selectivity
Data Quality begins with the selection of potential observers. The NEFOP strives to employ the most talented, qualified and experienced people in the country. The observers are selected based on degrees in science, at-sea experience and effective communication skills.
TEAM OBSERVER!
Standards in Training
To ensure the excellence of the data, the three week training program must adhere to stringent and rigorous guidelines and set clear standards for observers. Some of these standards include:
• 2 Training Trips during the three weeks. This ensures physically they can cope with sea time.
• 100% minimum on all tests, including fish identification and mammal identification.
• Hands on sea survival skills.
• Ability to work without supervision
• Ability to communicate with others professionally.
• Demonstrate unbiased data collection and recording.
•Follow confidentiality policies and conflicts.
TEAM TRAINER!
TEAM EDITOR!
Editing/Debriefing
Editing is key in identifying any potential data quality issues. Each partake in a 3 month training process where they learn to identify, catch and correct errors within the observer data. At that point, if the data editors have any questions about the data, they contact the observer immediately. This immediate follow-up clarifies questions while trip details are fresh in the observer's mind. Debriefings also provide the observer with direct and immediate feedback on any potential data quality issues within a trip.
Beyond Data
Random interviews of vessel Captains are also conducted. Concerns about data quality raised by a Captain are investigated further and tracked immediately. Any and all data that the NEFOP staff deem to be of inadequate quality are stored in a separate database until those concerns are resolved. This database is not accessible to the end users.
TEAM BIOLOGIST!
Audits/Tests
Audits and tests are conducted on each NEFOP trip. These tests consist of checks of ranges, overlapping times, and unacceptable values for all fields. Audit ranges are re-evaluated and modified as new fishery characteristics are identified.
TEAM AUDIT!
NOAA Fisheries
National Marine Fisheries Service

Educational observer onboard fishing vessels in Brazil

S. Monteiro[1]*, T. Neves[2] and A. Luis[1]

[1] *Universidade de Aveiro – Portugal*
[2] *Projeto Albatroz – Brazil*

Abstract

We inquired several social aspects of two Brazilian crews working in pelagic longline fisheries. Settings were made in southeast Brazilian waters between May and August 2004. Daily working schedules, habits, as well as leisure habits while onboard were observed and registered. A query was made in order to investigate the social and professional character of each crew member. Overall, our results show a low level of studies among these professionals. We suggest the implementation of a new concept of fisheries and biology observer. The Educational Observer, that could be used as informal teacher using as working tool long distance education, as well as informal education focusing environment issues, allowing improvement of educational level and awareness towards the surrounding environment among crews while on board. We believe seabird mortality rate due to incidental capture by fishing vessels can be greatly reduced if leve of awareness is increased through environmental education for it increases the chances of having mitigation measures applied instinctively onboard in areas where no legislation/obligation on the usage of these measures is in force.

Educational observers onboard fishing vessels

S. Monteiro[1]; T. Neves[2] and A. Luis[1]
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This poster is part of a Masters Degree thesis entitled "Awareness directed to fishermen for the reduction incidental capture of seabirds in longline fisheries in Brazil", with the collaboration of the University of Aveiro and Projeto Albatroz, a Brazilian NGO that works directly with fishermen and respective fishing companies in order to promote sustainable fisheries, protecting the albatross and other seabirds in Brazilian waters.

METHODOLOGY

Two deployments were made between May and August 2005 in Brazilian longliners. A full report was made of all the vessel's fishing activities, materials used , working and leisure schedules, crew leisure activities during deployment period, reports on the present seabird populations, their interaction with vessel's and the mitigation measures used. During both deployments informal educational conversations were kept with fishermen on several subjects, focusing albatross conservation and correct use for the vessels waste during the deployment periods and their impact on marine wildlife.

DISCUSSION

The implementation of laws is not enough. It is believed that this group of professionals needs first to understand the reason why a law was implemented so they can respect that law. Both crews showed a desire to collaborate with the project and a few crewmen would like to improve their educational level and would sign up to it if possible.

CONCLUSIONS

Changes in crew behaviour were observed in later trips, mainly related with waste disposal at sea. Fisheries observers create strong links, professional and social with the crews. It is the authors belief that this concept of Fisheries observer, the **educational observer**, is capable of being implemented in other programmes around the world. Local adaptations would have to be done, as well as, provide the observer with a good pre-boarding preparation and a good educational material.

Educational Observer

- Informal teacher
- Instigator of environment friendly practices at sea (discard, waste, etc)
- Environmental and species conservation awareness onboard
- Backup to long distance studies

Increase level of education/awareness of fishermen

Goal in long term:

Mitigation measures applied instinctively onboard in areas where no legislation/ obligation on the usage of this measures is in force.

Acknowledgements
We would like to thank both crews and companies for all their help and cooperation during this work, as well as to all Projeto Albatroz staff and the University of Aveiro.
Photos: *Thalassarche melanophrys* by Luciano Candisani, Projeto Albatroz/ Background picture, longliner "Taihei Maru" by Fabiano Peppes, Projeto Albatroz/ Fishing gear and gear hauling by Sara Monteiro.

Monitoring and managing incidental catch: A case study in the Atlantic Sea Scallop (*Plactopecten magellanicus*) fishery

Carrie Nordeen, Peter Christopher, Dan Caless and Kurt Wilhelm

Northeast Regional Office, National Marine Fisheries Service, MA – USA

Abstract

Establishing a cap on incidental catch is a management tool to allow fishery access to healthy stocks while minimising incidental catch of depleted stocks. The management of the Atlantic sea scallop (scallop) fishery within the Nantucket Lightship Management Area (NLMA) uses such a catch cap. In 2006, even with low catch rates, the catch cap for yellowtail flounder (*Limanda ferruginea*) in the NLMA was rapidly harvested and exceeded. Examining the NLMA scallop fishery demonstrates that effective monitoring and management of a catch cap requires sound data and fishery closure policies.

Monitoring and Managing Incidental Catch: A Case Study in the Atlantic Sea Scallop (*Plactopecten magellanicus*) Fishery

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Abstract
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Introduction

Depleted fish stocks co-occur with fish stocks that are healthy and are frequently caught incidentally. One management tool to allow access to healthy stocks, while controlling incidental catch, is an incidental catch cap. Because such catch caps are often low, high-effort/high-volume fisheries can be difficult to effectively monitor and manage within these caps.

Yellowtail flounder (yellowtail) is an overfished groundfish species that co-occurs with scallops in the NLMA and is caught incidentally in the scallop fishery. If the annual yellowtail catch cap for the NLMA is caught, then the area is closed to scallop fishing for the remainder of the year.

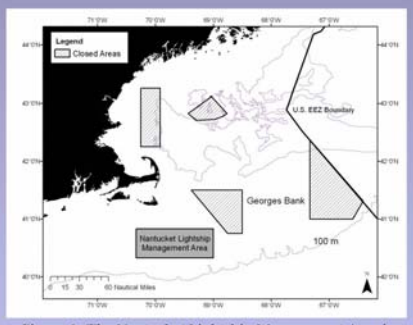

Figure 1. The Nantucket Lightship Management Area is located in the waters off Cape Cod, Massachusetts.

The NLMA opened on June 15, 2006. Catch data were monitored by the National Marine Fisheries Service (NMFS) and based on those data, NMFS closed the fishery on July 20, 2006.

The monitoring and management of the 2006 scallop fishery in the NLMA demonstrates the challenges of monitoring and managing a small, incidental catch cap in a fishery that can have periods of intense fishing effort.

Methods

Scallop and yellowtail catch (kept and discarded) from the NLMA are monitored using observer data from the Northeast Fisheries Observer Program and catch data provided by the scallop fleet via a Vessel Monitoring System (VMS).

Yellowtail catch is determined by calculating the ratio of yellowtail discard to scallop catch for observed trips, then applying the yellowtail discard rate to all scallop catch (from observed and unobserved trips). Vessel reported scallop catch is verified by dealer landings reports; there is no mechanism to verify vessel reported yellowtail discard.

Results

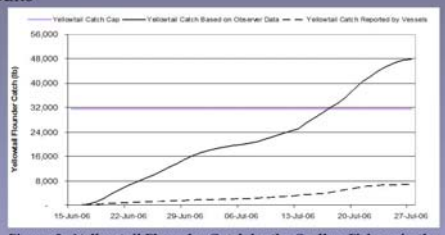

Figure 2. Yellowtail Flounder Catch by the Scallop Fishery in the Nantucket Lightship Management Area in 2006.

- Yellowtail catch reported by the scallop fleet was 88 percent less than the yellowtail catch based on observer data.
- As of the date of the closure (July 20, 2006), the yellowtail catch based on observer data exceeded the yellowtail catch cap by 37 percent.
- As of July 27, 2006, the yellowtail catch based on observer data exceeded the yellowtail catch cap by an additional 39 percent.

Discussion

Even with relatively low catch rates, yellowtail was rapidly harvested, in conjunction with high scallop catch, and the NLMA yellowtail catch cap was exceeded. Because vessels were allowed to complete trips in progress at the time of the closure, the yellowtail catch cap was further exceeded.

Observers do not estimate incidental catch; they record actual catch through rigorous standardized sampling methods. NMFS believes that observer sampling methods and resulting incidental catch estimates are the best available information for monitoring incidental catch in the scallop fishery.

Fleet reporting of species subject to a catch cap may be influenced by the substantial economic incentives to avoid a fishery closure. Vessel operators may have no incentive to avoid yellowtail on their last trip and high incidental catch on these trips can result in earlier-than-expected closures.

Examining the 2006 scallop fishery in the NLMA demonstrates that effective monitoring and management of a fishery within an incidental catch cap requires:

- Timely monitoring that is scientifically based;
- The ability to track and forecast fluctuating catch rates in response to effort changes; and
- Sound closure policy decisions that minimize additional effort.

The role of veterinarians to reduce long-line related mortality of sea turtles

Maria L. Parga* and F. Alegre

Foundation for the Conservation and Rehabilitation of Marine Animals, Barcelona – Spain

Abstract

Longline by-catch is a major conservation issue for the world sea turtle populations. Much research has been done in the past years to reduce incidental capture of marine turtles, but so far little has been done to fully address and reduce post-capture mortality. At this point, the collaboration of veterinarians specialised in sea turtles, and their anatomy and physiology, with observer programs on board long-line vessels is essential to address and eventually reduce post-capture mortality. There are two main areas where veterinarians' specific skills could be useful, either having veterinarians on board fishing vessels, or through complete training courses: improvement of data collection regarding the exact location of hooks lodged in the gastrointestinal tract of captured turtles and the physical state of the animal on release; improvement of hook removal causing minimal damage to the animals, thus increasing the chances of post-release survival The experience carried out on board a long-line vessel in Ecuador by a veterinarian during three weeks, will serve as example of this effective and productive collaboration.

THE ROLE OF VETERINARIANS TO REDUCE LONG-LINE RELATED MORTALITY OF SEA TURTLES

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Foundation for the Conservation and Rehabilitation of Marine Animals, Barcelona, Spain

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INTRODUCTION

Long-line bycatch is a major conservation issue for the world sea turtle populations. Much research has been done in the past years to reduce incidental capture of marine turtles, but so far little has been achieved to fully assess and reduce post-capture mortality. At this point, the collaboration of veterinarians specialised in sea turtles, and their anatomy and physiology, with observer programs on board long-line vessels is essential to address and eventually reduce post-capture mortality.

HOW CAN VETERINARIANS HELP OBSERVER PROGRAMS

Improvement of data collection

The information regarding the exact location of hooks lodged in the gastrointestinal tract of captured turtles and the physical state of the animals on release is essential. It is needed to draw strong conclusions on the lesions caused to incidentally captured animals and, therefore, the real effect of a specific type of hook on sea turtles health.

Fig. 1 (left): Black turtle with a hook coming out by the eyeball. **Fig. 2 (right):** lesion of an old hook in the mandible of a black turtle, which has caused infection of the bone. The lesion on the right figure has a much worse prognosis than that of the left one, which is not affecting any vital organs.

Fig. 3: The glotis is one of the most sensitive anatomic structures of sea turtles. Damage to this area can easily result in the death of the animal.

To remove or not to remove

It is generally accepted by fishermen and observer programs that a hook is always best removed; and if it is deep in the oesophagus and has to be left, this tends to be associated to bad injuries. However, some clinical studies carried out with smaller J hooks suggest that turtles do survive with a hook lodged in the oesophagus, as long as the handling of the animal has been adequate. With these hooks, for example, teaching good handling manoeuvres to fishermen could be a simple and cheap way to reduce sea turtle mortality.

Development of hook-removing techniques

It is imperative that observers are trained to remove a lodged hook causing minimal damage to the animal, increasing its chances of post-release survival. This can only be achieved through a full understanding of the animal's anatomy and physiology.

Fig. 4 (left): Removing a hook from the mouth of an Olive Ridley turtle using a de-hooker in a particular way that observers from Ecuador have developed.

Fig. 5 (right): Veterinarian carrying out a necropsy on a sea turtle with observers on board a long-line vessel.

Figs. 6 and 7: Two diagnostic imaging techniques widely used by veterinarians. Radiographs (left) and endoscopy (right) can give much information on hooks lodged inside sea turtles and the associated lesions.

Assessing post-release mortality

Research needs to be carried out to finally evaluate post-capture mortality in sea turtles depending on the type of hook and place of lodging. For this kind of research, the knowledge of an experienced veterinarian, and the tools he (or she) could take advantage of, could be essential to fully reach this objective.

FINAL CONSIDERATIONS

Much work is currently being carried out towards minimising sea turtle by-catch and associated mortality. Here we propose a new tool, adding veterinarians to the equation. There are several areas where veterinarians' specific skills can be essential, thus complementing the invaluable observers' task. This can be achieved through complete observer training courses, or having the veterinarian on board long-line vessels. Working together, new possibilities for sea turtle conservation become apparent, coming closer to a solution for sea turtle by-catch

Photograph by Dr. Hall

The French tropical tuna purse seine fisheries observer program

Renaud Pianet[1]*, Pierre Chavance, Justin Monin Amande, Emily Walker and Nicolas Bez

IRD – France

Abstract

One of the main characteristics of the purse seine fishery is the fishing mode, i.e., setting on a log or a free school, which gives very different catches in term of set success, tuna species and size composition as well as discards and by-catch composition and quantities. The fishing mode also has important consequences on the 'searching' strategy, with a classical 'random' searching in the case of free swimming schools, opposite to an 'oriented' searching in the case of log or associated sets, made on natural or artificial drifting objects, frequently equipped with radio or satellite beacons. These different behaviours have important consequences on the definition of a reliable effort and makes difficult any estimate of abundance indices. Consequently, since several years, most tuna organisations as ICCAT (International Commission for the Conservation of Atlantic Tuna), IOTC (Indian Ocean Tuna Commission), IATTC (Inter-American Tropical Tuna Commission) and WCPFC (Western and Central Pacific Fisheries Commission) strongly recommend that observer programs be run on the main fisheries such as purse-seine and longline. These programs aim to estimate discards of the main species as well as the quantities of by-catch, in order to evaluate the impact of the fisheries on the ecosystem and to have e better knowledge of effort. On board observers are the only way to obtain a reliable information on these topics. Since several years, a program is run through EU funding at the European level, essentially on French and Spanish tropical purse-seiners. Detailed forms have been defined in order to collect information on the fishing behaviour, environmental parameters, size and species composition of tunas and their associated species (kept on board and discarded), characteristic, use and biotic environment of the floating objects. All this information is computerised and checked on-board, and then transferred in an 'observer database' for analysis. Information from other previous observer programmes will be added in the database and documented for further analysis. The first trips with observers started in 2003 on the Spanish fleet and 2005 on the French fleet. Preliminary results for the French fleet will be presented. The final objective of this study is to evaluate the quantities of discards and by-catches by species using descriptive and spatial analysis of the detailed data collected, and to get a better estimate(and if possible sharing) of fishing activities according to the fishing mode.

The french tropical tuna purse seine fisheries observer program

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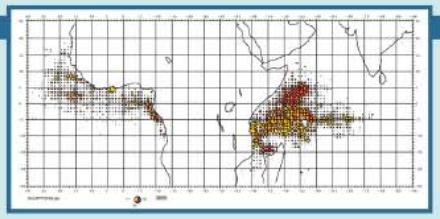
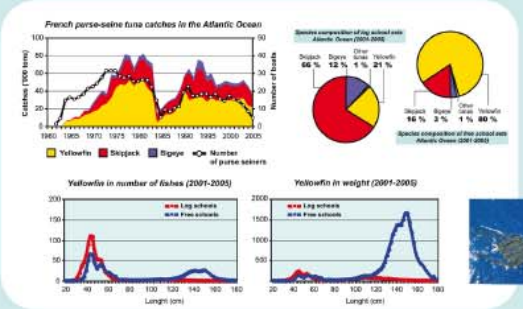
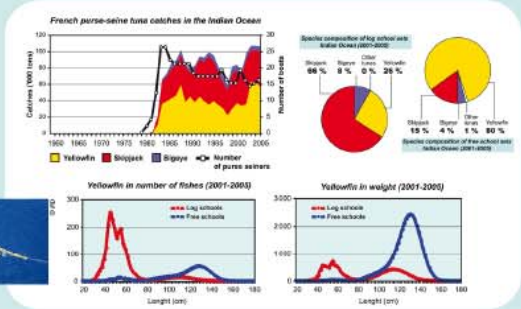
THE FRENCH TROPICAL TUNA FISHERY

The French tropical tuna fishery started in 1952 from albacore baitboats trying to develop a winter counter-season activity in the north of the tropical Atlantic, exceeding forty boats based in Dakar [1] after 1958. This fishery developed regularly in the 60s (expanding down to Pointe-Noire and converting progressively baitboats into purse seiners), and then in the 70s with the building of the modern oceanic tuna purse-seiners fishery.

French tuna exploratory fishing in the Indian Ocean started in 1979 with a baitboat, rapidly followed by a purse-seiner in 1980; in 1982-83, the very strong ENSO observed in the Pacific expanded to Atlantic ocean, resulting in very poor catch rates (mainly due to the strong deepening of the thermocline) and initiating the massive move of most purse-seiners in the Indian Ocean. The situation came back to normal at the end of the 80s, the French fleet sharing since then its activities between both ocean, the Indian Ocean remaining nevertheless largely dominant.







THE STATISTICAL MONITORING SYSTEM

Since the beginning of the fishery – in the tropical Atlantic ocean in the early 60s, then in the early 80s in the Indian ocean – IRD scientists in collaboration with national research centres set in place a statistical data collection system. Presently this system is financially supported by the European Data Collection Regulation (CE 1639/2001). In this framework, the "French National Program" (as well as the Spanish one) for tropical tuna is compounded of four complementary modules:

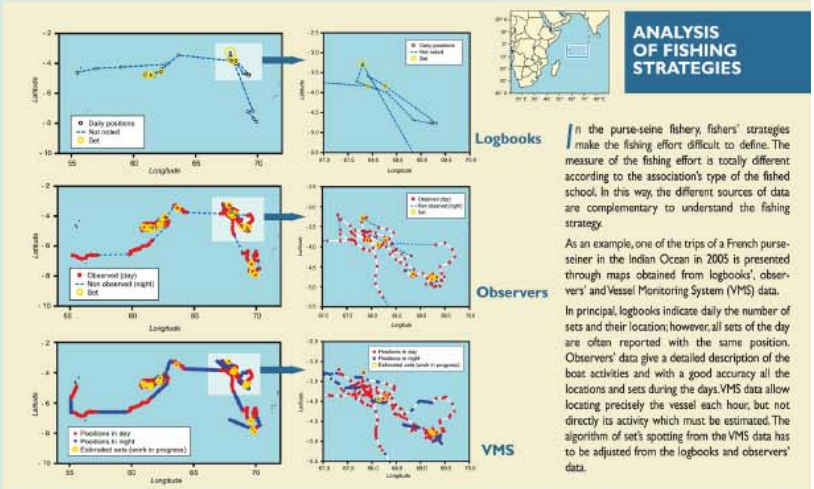
Logbooks (100 % coverage) for general information on trips, effort and catches by commercial categories;

Port sampling of the unloaded catches to estimate sizes and effective species composition (Dakar, Senegal; Abidjan, Ivory Coast; Victoria, Seychelles; Antsiranana, Madagascar);

Observer program (10 % coverage) for precise data on effort strategy, and estimation of the quantities and species composition of by-catches and discards;

Vessel Monitoring System (100 % coverage) to follow more precisely vessels movements and fishing strategies.

As the tropical tuna fishery is multispecific, the composition of catches (species, length, discard behaviour) is highly dependant on fishermen strategies and fishing mode (i.e. log or free schools). The statistical system therefore seeks a good coverage of real catch composition (by heavy sampling on port and observer program), its spatio-temporal distribution and on fishing strategy.



ANALYSIS OF FISHING STRATEGIES

In the purse-seine fishery, fishers' strategies make the fishing effort difficult to define. The measure of the fishing effort is totally different according to the association's type of the fished school. In this way, the different sources of data are complementary to understand the fishing strategy.

As an example, one of the trips of a French purse-seiner in the Indian Ocean in 2005 is presented through maps obtained from logbooks', observers' and Vessel Monitoring System (VMS) data.

In principal, logbooks indicate daily the number of sets and their location; however, all sets of the day are often reported with the same position. Observers' data give a detailed description of the boat activities and with a good accuracy all the locations and sets during the days. VMS data allow locating precisely the vessel each hour, but not directly its activity which must be estimated. The algorithm of set's spotting from the VMS data has to be adjusted from the logbooks and observers' data.

PRELIMINARY RESULTS ON NON-TARGETED SPECIES AND DISCARDS (INDIAN OCEAN)

> Trip and sets characteristics

– 8 trips from December 2005 to February 2007

– 271 fishing days

– 365 sets (65 % positive), 5759 tons of tuna catch

236 sets (65 %) on free or whale associated schools, 51% positive, 3636 tons of tuna catch,

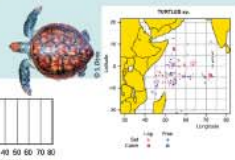
129 sets (35 %) on log or shark-whale associated school, 90 % positive, 2123 tons of tuna catch.

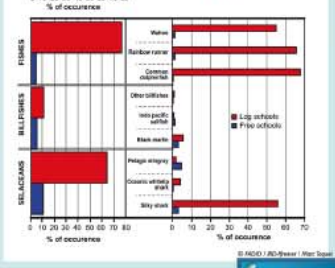
> Raising methodology

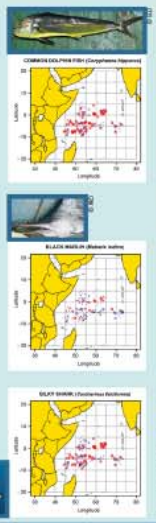
To assess the amount of by-catch and discards of these fleets, the catch per set will be predicted using a model parameterized with observer data [2] from all european purse-seiners (French and Spanish). The model will be applied to logbook data from both fleets to estimate total by-catches, while discards will be estimated separately because of the different behaviour of their fleets.

We will first consider large spatio-temporal strata. Then the model will be optimized by using finer spatio-temporal resolution.

> Preliminary results on by-catch







CONCLUSION

The French fleet is in constant evolution with a change towards oceanic boats having increasing transport capacities. It generates invaluable data through several systems of data collection of which observers' data.

This type of data is the only current opportunity to assess the amount of by-catch and discards, considering the weakness of their recording by other ways. It should also be underlined that there is no direct monitoring of tuna resources abundances by fisheries independent means like scientific surveys. Observations of fishing activities and their results are therefore the only way to estimate and monitor tuna resources and appreciate high seas ecosystem health.

In the Indian Ocean, preliminary results indicates that more than 80 % of log schools sets and less than 20 % of free schools sets contain untargeted species – mainly fishes (including billfishes), sharks and rays – and that the majority of discards is made of minor and small tuna.

Globally, the tropical tuna purse-seine fisheries generate few by-catch and discards compared with others fisheries.

[1] FONTENEAU, A. et MARCILLE, J. (eds). 1988. Ressources, pêche et biologie des thonidés tropicaux de l'Atlantique centre-est. *FAO Doc. Tech. Pêches*, (292):391p.

[2] KLEIBER, P. Estimating annual takes and kills of sea turtles by the hawaiian longline fishery, 1991-97, from observer program and logbook data, *Southwest Fisheries Science Center, Administrative Report* H-98-08.

Important elements and considerations in the design of fishery monitoring programs

Heather Reid

Observer, North Pacific Groundfish – Canada

Abstract

The state and composition of the Alaskan fishery has changed in the decades since the implementation of the observer monitoring system. It is pertinent that current fisheries monitoring models evolve to reflect these changes. Such changes include the development of cooperative systems and a shifting balance from smaller independent vessels toward larger and fleet owned vessels and quota. Further, observer data has furnished managers with a wealth of information that needs to be reflected in any future monitoring effort. The characterisation of vessel size in terms of capacity verses tonnage; the consideration of gear type based on optional impact; and the influence of partial coverage on differential fishing activities are significant modifiers which need to be reassessed and evaluated in terms of cost efficiency and data output. Such an evaluation needs to consider the relative need for additional information in some arenas, while in other cases there is a backlog of information to be processed. An optimal coverage model will have the flexibility to operate on a real time basis, and give greater coverage to the areas identified by managers as priorities, while maintaining a consistent and fair industry standard, so that all parties can reasonably predict their monitoring needs while contiguous records and models can be maintained. It is best that the current system is gradually modified to avoid bureaucratic confusion. While the objectives of such a shift are lofty, the most cost effective results can be obtained by identifying where person hours are best spent and the value of particular duties rated; it is important this is done in consultation with observers and fisher's in the field. Finally, current and future program will benefit from clear processes by which to communicate the effectiveness and feasibility of changes as they are assigned and implemented.

Important Elements and Considerations in the Design of Fishery Monitoring Programs

Heather Reid
National Marine Fisheries Service Certified North Pacific Groundfish Observer

INTRODUCTION

The state and composition of the Alaskan groundfish fishery has changed in the decades since the implementation of the observer monitoring system. It is necessary for current fisheries monitoring models evolve to reflect these changes.

The North Pacific Foreign Fisheries Observer program was implemented in 1973 with the goals of determining Pacific halibut bycatch rates in the groundfish catches and catch statistics in the Japanese crab fishery. The passage of the Magnuson Fishery Conservation and Management Act in 1976, and 30 years of effort and cooperation have given rise to the extensive, multidimensional and world renown domestic fisheries monitoring program we now have.

Now operating under the Magnuson-Stevens Fishery Conservation Act, updated in 2006, it is important to consider our current abilities and objectives in light of the state of the fishery and its key stake holders; the structure and composition of the fleet; and the science, new data needs, capabilities, resources, and models.

Whereas:
We know more. Observer data has furnished managers with a wealth of information.
Then:
Monitoring objectives need to evolve to fill data gaps and foster strengths

Whereas:
Cooperative fishing systems have been developed and there has been a shift from smaller, independent vessels toward larger, fleet owned vessels with specific quotas.
Then:
Monitoring efforts need to evolve reflect structure of fishing activity.

Whereas:
The means of communication now includes real time transmission and there are often electronic and satellite capabilities.
Then:
The monitoring efforts mean balancing the use of people hours with the benefits and complications of electronic adjuncts.

OBJECTIVES

As the fishery changes, we must ask ourselves: What are our objectives when determining the future of observer coverage and data collection?

The objectives of science and monitoring:
- Sound and consistent data collection methods
- Comprehensive coverage
- Thorough, purposeful management
- Environmental understanding, planning and accountability

The objectives of a safe, profitable and sustainable fishing industry:
- Coordination with industry initiatives
- Operating within the means of a working fishing operation
- Simplified and equitable observer coverage
- Share responsibility to identify and meet safety standards

The objective of enhanced and amenable working relationships:
- Effective "in field" communication and data transmitting processes
- Clear understanding of the role of all parties and of fishing regulations
- Enhanced education and communication of the results of monitoring efforts to the affected fleet

DISCUSSION

Changes to the fishing industry and the composition and means of data collection open up great opportunities for fisheries monitoring.

Strong cooperative efforts between government and industry have proved successful in advancing both the science and business of fisheries management. Future success and advances beyond current objectives must take into consideration a few cornerstone issues:

Vessel coverage: As a determinant of observer coverage, vessel length is not an accurate reflector of vessel's holding capacity or fishing effort and thus not a equalitarian determination of coverage. Capacity, quota, gear type and fishing location are all important factors in determining observer coverage that will obtain data relevant to the aforementioned objectives.

Fishing patterns: Possible fish migration, habitat alterations, and rising vessel costs (fuel, personnel, vessel aging) are factors influencing changes in the economics and logistics of fishing. As vessel operations reflect the influences of everything from wages to global warming patterns, so too must monitoring efforts evolve to maintain objectives and contiguous coverage.

More information: There is a wealth of information to be reflected in monitoring protocols (gear impacts, habitat, life cycle and population dynamics, etc) and a backlog of data waiting to be interpreted. As the fishery changes and evolves, the program must ensure that the data collection adjusts to the fishing methods and new areas being exploited.

Communication: Feedback and input from the field is essential to good policy. There is value to science in the subjective input of hands-on personnel. It is not possible for fisheries managers to spot check at sea. Non-adversarial accounts of observer deployments should be encouraged and artfully incorporated into management.

Bureaucracy: Expand communication and procedures to allow stakeholders, managers and fishery workers each to recognize and reflect the role they play in successful fisheries operations and planning.

CONCLUSION

An optimal coverage model will have the flexibility to operate on a real time basis, and give greater coverage to the areas identified by managers as priorities, while maintaining a consistent and fair industry standard, so that all parties can reasonably predict their monitoring needs while contiguous records and models can be

Photo credit: AFSC Fisheries Monitoring and Analysis Division, E. McConnell, A. Kitel, T. Batus, and J. Wesemann

Quantifying coral by-catch in New Zealand orange roughy and oreo fishing fleets

Wendy Norden and Stephanie Rowe*

Department of Conservation – New Zealand

Extended Abstract

Introduction

- Bottom trawling can result in a reduction of benthic habitat complexity and biodiversity, including reductions in the biomass of protected corals.
- Black corals (Order Antipitharia) and Red corals (Family Stylasteridae) are fully protected in New Zealand's Exclusive Economic Zone. To date, we have little knowledge of the long-term effects of benthic impacts on protected corals in New Zealand.
- The Conservation Services Programme's (CSP) fisheries observer project seeks to identify, monitor and quantify protected species interactions with New Zealand commercial fisheries.
- The role of fisheries observers
- The CSP observer programme provides an opportunity to collect and identify deep sea invertebrates affected by trawling operations.
- In order to gain a better understanding of the effects of trawl fishing on protected corals, fishery observers record, weigh and sample specimens of corals landed on vessels.
- To date, observer effort has been focussed in the orange roughy (*Hoplostethus atlanticus*) and oreo (*Pseudocyttus* spp., *Allocyttus* spp. and *Neocyttus* spp.) fisheries.

Data collected per haul

- Trip
- Date
- Tow
- Latitude/Longitude
- Seafloor depth (at haul)
- Coral species (if known)
- Percent coral alive
- Estimate of coral volume and weight
- Estimate of orange roughy or oreo catch weight
- Other invertebrates present

Preliminary Results

- Preliminary data collected through the CSP observer programme shows that coral removal is widespread.
- Between October 2004 and September 2005, observers reported approximately 25 tonnes of coral landed on board deep sea fishing vessels (11% of orange roughy and oreo fishing days observed).
- In the orange roughy and oreo fisheries, the average amount of coral by-catch was 1% of the total fish catch between 1 October 2000 and 30 September 2005. This level of coral by-catch on observed vessels indicates that as much as 1,600 tonnes of coral may have been landed on trawl vessels targeting orange roughy and oreo over this period.
- Observers have reported coral as by-catch in eleven other deep-sea fisheries operating in New Zealand.

Conclusions and future directions

- Preliminary results indicate that a substantial amount of coral and associated invertebrates are being removed from the New Zealand Exclusive Economic Zone through bottom trawling.
- The full extent of long-term structural and functional biodiversity damage caused directly by bottom trawls is unknown.
- The percentage of invertebrates returned that are protected corals is unknown due to the difficulties of identifying corals to lower taxa.
- Coral samples returned since 2006 are being identified by a specialist and results of this work will inform future data collection and management decisions.

Quantifying Coral Bycatch in New Zealand Orange Roughy and Oreo Fishing Fleets

Wendy S. Norden and Stephanie J. Rowe
Marine Conservation Unit, Department of Conservation, P.O. Box 10420, Wellington, New Zealand
Email: srowe@doc.govt.nz

Introduction

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- To date, observer effort has been focussed in the orange roughy (ORH, *Hoplostethus atlanticus*) and oreo (OEO, *Pseudocyttus* spp., *Allocyttus* spp. and *Neocyttus* spp.) fisheries

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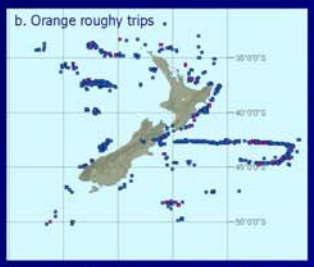

Figure 1 a, b. Observed oreo and orange roughy trips between October 1999 and September 2005 when coral was caught (pink) or was not caught (blue)

Fishing Year	Total ORH and OEO Catch (t)[2]	*Coral Bycatch at a rate of 1% of total fish catch (t)
2000/01	35,066	351
2001/02	33,107	331
2002/03	32,291	323
2003/04	30,520	305
2004/05	32,588	326
Total	**163,572**	**1,636**

Table 2. Total commercial catch for ORH and OEO and possible coral bycatch per fishing year (*These data are estimates and may not reflect actual totals)

Preliminary Results

- Preliminary data collected through the CSP observer programme shows that coral removal is widespread (Figure 1)
- Between October 2004 and September 2005, observers reported approximately 25 tonnes of coral landed on board deep sea fishing vessels (11% of ORH and OEO fishing days observed)
- In the orange roughy and oreo fisheries, the average amount of coral bycatch was 1% of the total fish catch between 1 October 2000 and 30 September 2005 (Table 1)
- This level of coral bycatch on observed vessels indicates that as much as 1,600 tonnes of coral may have been landed on trawl vessels targeting ORH and OEO over this period (Table 2)
- Observers have reported coral as bycatch in eleven other deep-sea fisheries operating in New Zealand

Year	Observed ORH Catch (t)	Observed OEO Catch (t)	Coral Catch (t)	Percent Tows Observed	Coral Percent of Observed Fish Catch
2000	1,928	3,764	118	20	2.07
2001	1,466	3,248	45	13	0.95
2002	3,640	2,725	44	16	0.69
2003	4,290	1,688	26	16	0.43
2004	2,623	3,259	51	17	0.87
2005	3,609	2,265	22	15	0.37
Totals	**17,556**	**16,949**	**306**	**Mean = 16**	**Mean = 1%**

Table 1. Coral bycatch on observed ORH and OEO trips between 1 October 2000 and 30 September 2005

Conclusions and Future Directions

- Preliminary results indicate that a substantial amount of coral and associated invertebrates are being removed from the New Zealand Exclusive Economic Zone through bottom trawling
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- Coral samples returned since 2006 are being identified by a specialist and results of this work will inform future data collection and management decisions

Lit. Cited: [1] Coleman & Williams 2002. TREE, 17 (1): 40-44; Probert et al., 1997. Aquatic Conservation, 7: 27-40; [2] Clement & Associates, 2006. The Atlas of Area Codes and TACCs 2006/07. Nelson, New Zealand.

Acknowledgements

This work was funded by the New Zealand fishing industry and the New Zealand Department of Conservation. We thank the New Zealand Ministry of Fisheries Observer Services team for their support and assistance in undertaking this work. Thanks to Di Tracey, Rick Webber and Mireille Consalvey for their technical advice.

Discards onboard sampling in the Basque Country fleet (North Spain) in the north east Atlantic

Jon Ruiz*, I González Herraiz, E. Mugerza, M. Santurtún, I. Artetxe and G. Oar-Arteta

AZTI, Marine Research Division – Spain

Extended Abstract

Introduction

The importance of discard studies is increasing in Europe day by day since there is the goal of incorporating discards into the fisheries assessments. Sampling with observers onboard is the most used method by EU members to study this subject.

Since 2001, a discard sampling program has been carried out by the AZTI institute in the Basque fleet (North Spain). Only the trawl fleet is considered in this study, since the rest of the segments of the Basque fleet in the North East Atlantic (long line and gillnet, etc.) have negligible levels of discard.

Methodology

The trawl fleet is divided in different fisheries, taking into account the gear, area and the target species. The sampling is based on a stratified random sampling, considering the fishery, as *stratum* and the trip as sampling unit.

To carry out on board sampling, the observer ask to the crew for an estimate of the total catch retained in the cod-end and takes in one basket a random sample of the total catch (catch retained + discards) . The sample is divided into retained catch (species 'expected to be retained') and discard. All the individuals of the sample (retained and discarded) are weighted and measured. As the European regulation requires, (Regulation Nº 1581/2004), otoliths of the discard lengths not presented in landings are collected. Data from the samples are extrapolated to the trip level.

Then, raising procedure is based on WKDSMRP (ICES, 2004) & WKDRP (ICES, 2007): The observed trips averages of weight and number estimates by species are extrapolated to the whole fishery by effort and landings factors, and results from different extrapolation methods are compared. The effort factors used are number of fishing hours, hauls, fishing days and trips; landings factors are total landings, specific landings and target species landings.

Results

Estimates of discard in weight and length distributions by species are obtained by fishery. The quality of the estimates is analysed according to the European Regulation.

Conclusions

AZTI on board sampling program is being favorably carried out, there is a suitable collaboration between the fishery industry and the scientists and no 'observer effect' has been detected on data.

Nevertheless, the variability of discards is high and the sampling is very expensive; a big increase in funding is required to reach quality discard estimates.

Acknowledgments

The Regional Basque Government and the European Union under the Minimum Sampling Program founded the study deployed on discards on board Basque Commercial Vessels. Without the good predisposition of the Basque ship owners, skippers and crews, sampling on board during all the years would have not been ever carried out. Thus, we want to thank to the Basque Fishing Industry for their continuous assistance.

Discards onboard sampling in the Basque Country fleet (North Spain) in the North East Atlantic

Ruiz, J., González Herraiz, I., Mugerza, E., Santurtún, M., Artetxe, I., Oar-Arteta, G.

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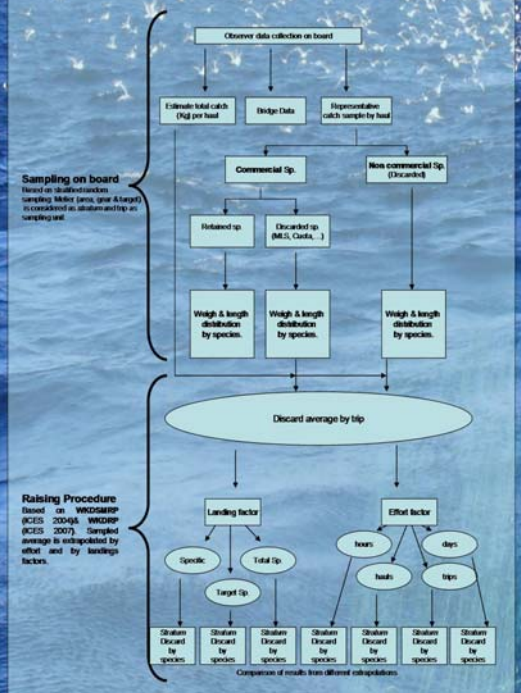
Figure 1.- Discard sampling *strata* (ICES Suareas VI, VII and Divisions VIIIabd and VIIIc).

Methodology



Results

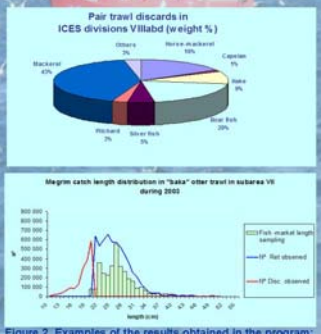


Figure 2. Examples of the results obtained in the program: discard weight estimations (up) and length distributions by *stratum* (*metier*) (down).

Year	Gear	Area	Species	Sampled trips	Present CV	Optimal samplig level
2006	Bottom otter trawl	VI	Hake	4.8%	NA	NA
2006	Bottom otter trawl	VII	Hake	5.7%	67%	25.7%
2006	Bottom otter trawl	VIIIabd	Hake	1.9%	30%	4.4%
2006	Pair bottom trawl	VIIIabd	Hake	2.3%	51%	8.5%

Table 1. Sampling level carried out by AZTI and optimal sampling level that should be carried out to reach the coefficient of variation (CV) required by the European regulation for the discard estimates (CV <= 12.5%) (for hake by gear and area, year 2006).

Conclusions

AZTI on board sampling program is being favorably carried out, there is a suitable collaboration between the fishery industry and the scientists and no "observer effect" has been detected on data.

Nevertheless, the variability of discards is high and the sampling is very expensive; a big increase in funding is required to reach quality discard estimates.

Acknowledgements

The Regional Basque Government and the European Union under the Minimum Sampling Program fund the study on discards deployed on board Basque Commercial Vessels. Without the good predisposition of the Basque ship owners, skippers and crews, sampling on board during all the years of the study would has not been ever carried out. Thus, we want to thank to the Basque Fishing Industry for their continuous assistance.

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- ICES 2004, WDSMRP Report, ICES CM 2004/ACFM:13
- ICES 2007, WKDRP report, ICES CM 2007/ACFM:06, Ref.RMC PGGCBS.

Trial observer program for Indonesia's tuna longline fishery in the Indian Ocean

Lilis Sadiyah[1&2]*, Retno Andamari[3], Budi Iskandar[1], Dyah Retnowati[4] and Craig Proctor[5]*

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[3] *Research Institute for Mariculture, Gondol, Bali – Indonesia*
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Abstract

Indonesia has the largest fleet of commercial longline tuna fishing vessels operating in the Eastern Indian Ocean. It is estimated there are currently 1500 to 1800 vessels in the fleet, although a large rise in national fuel price in 2005 has had a major impact on vessel activity and brought about changes in operating behaviour by some companies. Primary target species are yellowfin, bigeye, albacore, and southern bluefin tunas. To address a lack of CPUE data available from this fishery, a trial observer program was developed – a collaboration between Ministry of Marine Affairs and Fisheries (Indonesia) and CSIRO Marine Research (Australia), with funding from Australian Centre for International Agricultural Research. The observer trials are part of a larger program to further develop Indonesia's capacity to monitor, analyse and report on its tuna fisheries – primary goals being better understanding of catch trends and improved assessments of the tuna stocks and by-catch species. The trials commenced in July 2005 and will run till December 2008, with focus on vessels operating from port of Benoa in Bali. Six observers were recruited and trained in species identification, safety, data management and report writing. At time of writing the team had completed a total of 31 trips to sea, with an average of 18 sets per trip. Observer datasheets and a database, tailored to the Indonesian fishery, were successfully implemented but are still 'evolving'. Development of a logbook/logsheet for the fishery is another key activity being run in parallel with the observer trials.

Trial observer program for Indonesia's tuna longline fishery in the Indian Ocean

Lilis Sadiyah[1&2] • Retno Andamari[3] • Budi Iskandar Prisantoso[1] • Dyah Retnowati[4] • Craig Proctor[5]

Fishery overview and context

Commercial tuna longline fishing commenced in Indonesian waters during the 1930s with Japanese vessels conducting 'test fishing'. Tuna longline fishing by Indonesian commercial vessels did not commence until 1952. Through the 1960s – 1980s there was gradual expansion of the Indonesian longline fleet, but in the late 1980s/early 1990s there was a dramatic, rapid expansion in vessel numbers (Fig. 1) with the development of export markets for fresh and frozen whole tuna to Japan and to other international markets.

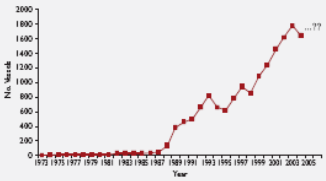

Figure 1: Number of Indonesian commercial tuna longline vessels operating in the Indian Ocean (mod. from Herrera, M. 2002. Catches of artisanal and industrial fleets in Indonesia: An update. WPTT02-02, IOTC Proceedings no. 5). Part of the rapid increase in vessel numbers was the result of Indonesian Government regulations (introduced in 1998) requiring all foreign-owned vessels based in Indonesian ports to be Indonesian flagged.

Indonesia now has the largest fleet of commercial tuna longline vessels in the Eastern Indian Ocean, with an estimated 1500 – 1800 vessels operating from key ports in Java, Sumatera and Bali. Providing a more accurate number of current active vessels is difficult. A major fuel price rise (following a lowering of Indonesian Government subsidies) in early-October 2005 resulted in decreased vessel activity within many fishing companies. Marked changes in fishing behaviours have occurred since this price rise, with many vessels now fishing further from Indonesian shores in search of better catches and staying at sea for up to 3-5 months (compared to 1-2 months previously).

Although the target species of Indonesia's longline fleet are primarily yellowfin (YFT) and bigeye (BET) tunas (Table 1), the catch of many of these vessels includes southern bluefin tuna (SBF). The amount of SBF catch is relatively small compared to that of YFT and BET, but is significant as the majority are caught from the only known spawning area for this species, south of Java and Bali (Fig. 2 and 4). Long term declines in average size and age of SBF caught by this fishery, and also declines in catches of YFT and BET (Fig. 3), are of serious concern. To better understand the reasons behind these trends, and to assist development of effective management strategies for fishery sustainability, obtaining catch and effort data was identified by all the collaborating organisations and stakeholders as an urgent priority.

Figure 2: Southern bluefin tuna landed by Indonesian longline vessels – fish caught on the only known spawning grounds for the species, south of Java and Bali.

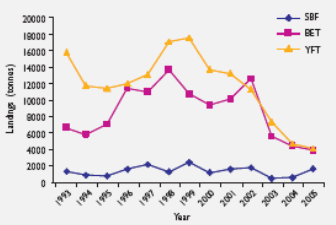

Figure 3: Landings of yellowfin (YFT), bigeye (BET), and southern bluefin (SBF) tunas by Indonesian longline vessels at port of Benoa, Bali. Data for 1993 – 2001 come from port-based monitoring of Research Institute for Marine Fisheries (Indonesia)/CSIRO (Australia), and data for 2002 – 2005 from port-based monitoring program of Indonesia/Indian Ocean Tuna Commission/Japan/Australia.

Overview of the observer program

To address the shortage of CPUE information, a trial scientific observer program for commercial longline vessels based at Port Benoa commenced in July 2005. This program is a collaboration between the Research Centre for Capture Fisheries, within Indonesia's Ministry of Marine Affairs and Fisheries (MMAF), and the Commonwealth Scientific and Industrial Research Organisation (Australia), and is funded by the Australian Centre for International Agricultural Research. Six recruits were provided with observer training. This included fish, cetacean, turtle, and bird identification, data collection and reporting protocols, sea and climate conditions reporting, and guidelines for safety at sea. Data collection sheets and an observer database were developed, based on those of the Secretariat of the Pacific Community and Forum Fisheries Agency observer programs, but modified to suit the Indonesian situation and with Bahasa Indonesia as the working language.

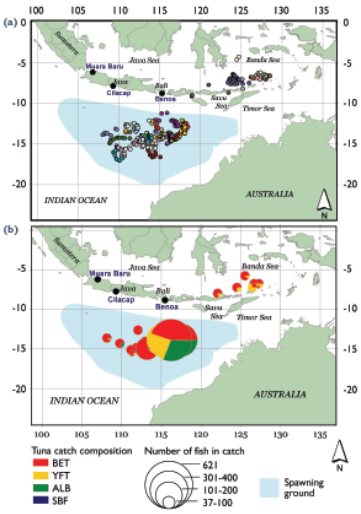

Figure 4: Data from first 23 trips showing (a) set positions and (b) catch composition for the 4 target tuna species.

Summary of observer data to date

To date, Indonesian observers have each completed seven trips to sea (a total of 35 vessel trips). Data presented here are for the first 23 trips (data from more recent trips are still being processed). Average trip length was 27 days, on vessels ranging in size from 61 to 140 gross tonnes. The average number of sets/trip was 18, with averages of 1428 hooks/set, 15 hooks between floats, and 108 floats/set (Table 1). Fishing operation areas included Eastern Indian Ocean between latitude 4°S and 17°S and longitude 107°E and 129°E, but also the Banda Sea (Fig. 4a). Averaged across all trips, catch composition was 34 % tuna (the 4 primary target species), and 66 % bycatch (Fig. 4b).

Number of trips*	23	
	Mean	**Range**
Length of trip (days)	27	16-55
Number of sets/trip	18	8-45
Vessel sizes (GT)	86	61-140
Number of hooks/set	1428	380-2095
Number of hooks between floats	15	5-21
Number of floats/set	108	20-420
Primary target species	Bigeye tuna (*Thunnus obesus*), Yellowfin tuna (*Thunnus albacares*), Albacore (*Thunnus alalunga*), Southern bluefin tuna (*Thunnus maccoyii*)	
Common bycatch species	Lancet fish (*Alepisaurus brevirostris*), Oil fish (*Ruvettus pretiosus*), Black promfret (*Parastromateus niger*), Skipjack tuna (*Katsuwonus pelamis*), Moonfish (*Lampris regius*), Hair tail (*Trichiurus spp.*), Wahoo (*Acanthocybium solandri*), Swordfish (*Xiphias gladius*), Black Marlin (*Makaira indica*), Blue shark (*Prionace glauca*), Crocodile shark (*Pseudocarcharias kamoharai*), Shortnose spurdog (*Squalus megalops*), Pelagic stingray (*Dasyatis violacea*).	
Baits used	Lemuru (*Sardinella spp.*), Swordfish (*Xiphias gladius*), Milkfish (*Chanos chanos*) Skipjack tuna (*Katsuwonus pelamis*), Scad mackerel (*Decapterus spp.*), Blue shark (*Prionace glauca*), Oilfish (*Ruvettus pretiosus*) Squid (*Loligo spp.*).	

Table 1: Summary of trip information from trial observer program for longline vessels based at port of Benoa, Bali.

Further development of the observer program

The trial observer program at Benoa will continue until the end of 2008. As they gain experience at sea, the observers are taking on more tasks. Hook-timers and temperature depth recorders are to be deployed on forthcoming trips, and biological sampling at sea for genetics research projects has commenced. Development is currently underway within MMAF to expand the program (which currently relies entirely on voluntary participation by fishing companies) to become a more formal fisheries observer program, including other ports and other vessel gear types. Also planned is an upgraded log-sheet for vessel skippers. In recognising the importance of sustainability of the tuna stocks and, in turn, sustainability of the tuna industry to Indonesia, the nation's tuna fishing industry associations and the Indonesian Tuna Commission have expressed strong support for these initiatives.

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2 School of Zoology, University of Tasmania, Australia
3 Research Institute for Mariculture, Gondol, Bali, Indonesia
4 Directorate General for Capture Fisheries, Jakarta, Java, Indonesia
5 CSIRO Marine and Atmospheric Research, Hobart, Tasmania, Australia

New Zealand rock lobster stock monitoring

Daryl Sykes

New Zealand Rock Lobster Industry Council – New Zealand

Text from Poster

The New Zealand Rock Lobster Industry Council (NZ RLIC) coordinates and facilitates a CRA Vessel Logbook programme that provides data for use by industry itself and by fisheries scientists and managers.

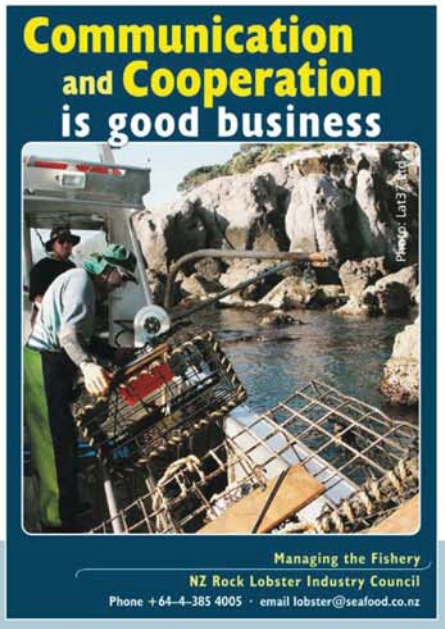
The NZ RLIC encourages all rock lobster fishermen to participate in the Vessel Logbook programme. If participation levels are reasonably high the industry-generated data have numerous advantages over data collected by observers on vessels, including:

- data are more representative of seasonal fishing activities – observer catch sampling coverage is limited;
- data are more cost effective to collect and process thereby reducing government cost recovery levies for research services;
- fishermen can have more confidence in the data that they collect – they know who, when and where data are being collected, and still have an absolute assurance that privacy and confidentiality of individual data sets will be respected;
- by participating in the Vessel Logbook programme fishermen affirm the industry to be a responsible steward of rock lobster fisheries.

Vessel Logbook data continues to be incorporated into the stock assessment process. These programmes are supported by individual lobster fishermen who measure and record all rock lobsters in four designated pots each fishing day. The data, which are designed to be representative of the respective fisheries, are providing reliable and consistent information for stock assessments.

Regional administrative and support staff including those from LAT37 Ltd. are contracted and supervised by the NZ RLIC on behalf of industry. The NZ RLIC contracts Trophia Research to maintain the CRA Vessel Logbook database and to analyse and report logbook data to participants and to the annual stock assessment process.

The NZ RLIC and Trophia Research have implemented a web-based tag and release "track and trace" system that enables more timely reporting of tag recapture data by commercial and non-commercial extractive users. The system can be accessed at http://www.tagtracker. trophia.co.nz/



NEW ZEALAND ROCK LOBSTER STOCK MONITORING

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Sharing training methodologies and resource materials: Benefits and limits

Lisa Thompson* and Brian Mason

AFSC-Fisheries Monitoring and Analysis Division – USA

Abstract

Sharing and exchanging training materials used by observer programs, and other fishery-dependent data collection activities, benefit all involved. Trainer collaboration allows programs in their development stages to adopt existing, time-tested materials and methodologies from existing programs and avoid potential pitfalls already encountered by others. Fully developed monitoring programs seeking a fresh approach to update training methodologies and materials can look to other programs, both new and established, who have adopted different technology, sampling designs, or industry outreach tactics. Similarities and differences among programs must be considered prior to sharing such information, including: Are their fundamental differences in the missions of the programs? Are the methods used by a program scalable, allowing adaptation by programs that are disparate in size or funding level? Are the vessel sizes, gear types, and fisheries monitored similar? The North Pacific Groundfish Observer Program has worked with a variety of other programs, both within the United States and internationally, to foster ongoing trainer partnerships or just provide a head start to new programs. This work has benefited both parties by spreading new ideas and offering us a different approach to some of our established training procedures.

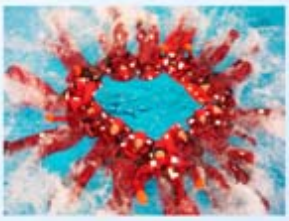
North Pacific Groundfish Observer Program Sharing Training Methodologies & Resource Materials: Benefits & Limits

Lisa M. Thompson
North Pacific Groundfish Observer Program • Fisheries Monitoring & Analysis Division • Alaska Fisheries Science Center • Seattle, WA

The North Pacific Groundfish Observer Program (NPGOP) has worked with a variety of other programs, both within the United States and internationally, to foster ongoing trainer partnerships or just provide a head start to new programs. This work has benefited both parties by spreading new ideas and offering us a different approach to some of our established training procedures. Similarities and differences among the programs must be considered prior to sharing such information. Specific questions must be considered when considering sharing training methods and resources.







Are there fundamental differences in the missions of the programs?

FMA Division's objectives are to provide:

- Catch and bycatch information for quota monitoring and management of groundfish and prohibited species
- Catch and biological data and samples required for stock assessment analyses
- Information to document and reduce fishery/protected species interactions
- Observations and samples to support marine ecosystem research
- Compliance monitoring data
- Detailed catch accounting data to support specialized management programs

Are the methods used by a program scalable, allowing adaptations by programs that are disparate in size or funding level?

FMA Division Funding Structure

- Industry pays contractors directly for observer services ($13-$15M/yr)
- Government pays for training, field support, gear, quality control, data management ($3.5-$4.5M/yr)

FMA Division's Fishery Characteristics

- Trawl Gear = 99% total catch
- Longline Gear = 8 % total catch
- Pot or Trap Gear = 2% total catch
- Jig Gear = <0.1% total Catch
- Vessels requiring coverage range from 60- 125 ft






Are the sizes, gear types, and fisheries monitored similar?

Size of Program and Vessels Needing Coverage

FMA Observer Stats for 2006

- 398 Contracted Observers
- 714 Deployments
- 21,419 vessel days

Sampled

- 41,644 fishing events
- >6,000 mt of catch
- >43 million Hooks
- >19,00 Pots
- 78% Fishing Events Sampled on Observed Trips

FMA Division Stats for 2006

- 38 permanent staff
- Office in Seattle, WA
- Field offices in Anchorage, Kodiak, and Dutch Harbor, AK

Benefits

- Time tested materials and training methodologies that are known to work.
- Ability to avoid potential pitfalls already encountered by other programs
- Pre-tested sampling designs
- Shared industry outreach tactics

Ideas for Sharing Resource Materials

- Trainer swaps between programs
- Annual trainer meetings
- Conferences to create contacts for newer developing programs
- Websites to post materials for sharing
  http://www.afsc.noaa.gov/FMA/training.htm



Integrated tool set – moving to an actionable information environment

Denis Tremblay

Fisheries and Aquaculture Management, Department of Fisheries and Oceans – Canada

Extended Abstract

Abstract

Fisheries & Oceans Canada (DFO) is implementing and/or assessing multi-channel technology innovations under an overall strategy for one-time electronic fishing activity data capture at source (e-collection). Data collected are used to support science, fisheries management and compliance monitoring and observation objectives. Innovative tools already in place or in pilot stage include a GIS-based National Vessel Monitoring System (VMS), electronic fishing logbooks (E-Logs) including Web-based catch reporting, an automated Observer Trip Information System (OTIS), and telephony based voice recognition systems for hailing out and licence renewal. DFO is piloting a Mobile Office and integrated reporting application supporting data capture and remote access by field officers.

Multi-channel electronic data capture at source has led to improvements in the quality and timeliness of monitoring and compliance data. Multiple data tools and integrated databases have increased DFO's capacity to develop exception-reporting applications designed to contrast and compare fishing activity data from multiple sources in order to identify potential occurrences or violations.

Introduction

More and more, it is evident that there is a need for more accurate and timely data on fishing activities, and that collecting electronically at source is the solution to providing fishery managers with actionable information in order to be able to make the right decisions in the course of various fisheries. Data capture at source is the cornerstone of DFO's fishing data collection strategy.

This paper aims to put into context how Canada is implementing new technologies to more effectively monitor fishing activities across the country.

Main concepts

The Department of Fisheries and Oceans (DFO) has 6 regional offices and a Headquarter Office located in the national capital, Ottawa. Expertise on new technological initiatives is present in each of these offices. In order to effectively exploit these resources, DFO created the Innovative Technology and Business Process Program (ITBP) in 2002. This program identified Centers of Expertise for each Region responsible for the national implementation of those new technologies. Examples of these tools are Vessel Monitoring Systems (VMS), electronic logbooks (E-Logs), telephony applications (Interactive Voice Response and Voice Recognition/Speech-to-text), on-line Web-based licensing and mobile technologies for data access and capture in the field by Fisheries Officers.

DFO has adopted an Integrated Suite of Multi-Channel Solutions known as 'The Tool Box'. Different tools are required for different moments in the fishing cycle. Before the season begins, a fisher can retrieve his/her licence conditions, quotas, and areas opened or closed via the Web. Before the trip, the skipper can use telephony (IVR/TTS) or the Web to provide his/her hail-out information, including species sought, area(s) to be fished, sail-out time, vessel ID, etc. During the trip, a series of tools can be used to report back to governmental agencies: VMS for positional data, Electronic logbooks for catch and effort data, Personal Digital Assistants (PDAs) for observers or scientists on board. After the trip, landing reports and scientific port sampling can be recorded with PDAs and sent via the Web or through a secured connection.

Conclusion

Through the combination of a variety of distinct yet complementary data capture tools, DFO is able to acquire timely and current data, often directly from the fisher and/or third-party

service providers, without manual transmissions, re-keying or other interventions, thus providing greater assurances of data quality and integrity.

Through the creative and effective linkage of data captured via VMS, E-Logs and gear sensors and video, major steps can be taken towards achieving a truly integrated data capture and reporting environment to support integrated fisheries management operations and, ultimately, ecosystem-based management. Further, integrating such tools as VMS and E-Logs increases the accuracy of the data captured and thus the value of and confidence in the resultant information.

Application of differential evolution algorithms to optimise welfare in the northern prawn fishery in Australia

Simone Valle de Souza[1]* and C. Gondro[2]

[1] *University of New England – Australia*
[2] *The Institute for Genetics and Bioinformatics*

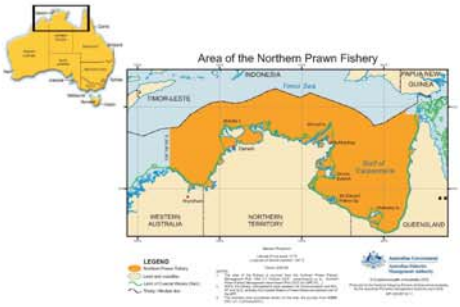
Abstract

Fishing and aquaculture are Australia's fifth most valuable rural industry. Australia's fishing zone is the third largest in the world. Government and fishery authorities are pursuing economic efficiency and effective fishery management for Australia's many high-value fisheries worth $2.2 billion in 2003/04. This paper addresses the issue of optimising welfare in the context of the Northern Prawn Fishery. A single species bioeconomic model that uses quotas as the control variable is specified using a continuous time version of the Schaefer model. A Differential Evolution (DE) algorithm is used to find the optimal solution and the implications of different discount rates for the sustainability of the fishery are explored using the Ramsey assumption of a baseline. The study raises important questions about the role of discounting in conservation of one of Australia's most important fishery resources.

Application of Differential Evolution Algorithms to Optimize Welfare in the Northern Prawn Fishery in Australia

de Souza,S.V.,School of Economics, University of New England, Armidale, NSW
Gondro, C.,TIGB -The Institute for Genetics and Bioinformatics, University of New England, Armidale, NSW

The Northern Prawn Fishery, Australia



- Catches of approximately 5 t per season;
- Annual revenues of approximately US$ 60 mi (2005)
- 80% of commercially harvested prawn species :
  - banana prawns (*Penaeus merguiensis*)
  - brown tiger prawn (*Penaeus esculentus*)
  - grooved tiger prawn (*Penaeus semisulcatus*)
- Current fleet of 52 steel purpose built trawlers
- Seasons of about 150 days/year
- Managed by the Australian Fishery Management Authority
- control mechanisms:
  - limited entry,
  - seasonal closures,
  - permanent area closures,
  - gear restrictions,
  - operational controls and
  - fully transferable Statutory Fishing Rights (SFRs)

Trawls shaped like a cone with a wide opening to catch fish and crustaceans.
(source: AFMA)

The Problem

Complex and distinct stock assessments for different prawn species.

CSIRO scientist, Rob Kenyon compares a teenage prawn or new 'recruit' (left) with an older prawn.
(source: AFMA)

The Objective

To create a user friendly system that identifies the optimal profit in a sustainable fishery using a model that encompasses characteristics of all major species fished.

Current Model

Kompas and Che (2004) model parameterized for characteristics of tiger prawns (*Penaeus esculentus and P.*

Biological Model

$$R_t = \alpha_3 \hat{S}_{t-\tau} e^{-\beta_1 \hat{S}_{t-\tau}} e^{\xi_t} \qquad \hat{S}_t = \alpha_2 R_t e^{-\beta_2 (F_t + m_t)}$$

Fishing Model

$$F_t = q * E_t = q * B_t * N_t * TEC$$

$$h_t = \alpha_3 R_t (1 - e^{-\beta_2 (F_t + m_t)})$$

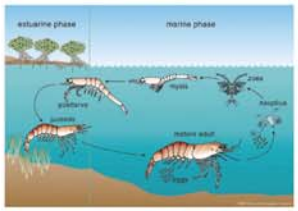
$$CPUE_t = \frac{h_t}{E_t} = \left[\left[\alpha_3 R_t (1 - e^{-\beta_2 (F_t + m_t)}) \right] / E_t \right] * e^{\xi_t}$$

Economic Model

$$p_t = p_0 (h_0 / h_t)^{1/\varepsilon}$$

$$TC_t = c_F + c_L h_t p_b + c_M h_t p_b + c_K E_t + c_O E_t$$

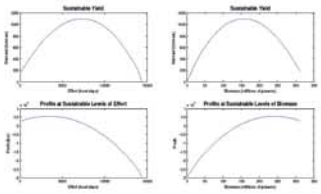
$$TR_t = p_b h_t$$



Life cycle of a penaeid prawn in the Gulf of Carpentaria, Australia, and some of the environmental variables that could affect the stock formation at different life cycle stages
(source: (Vance et al., 2003), diagram by Louise Bell, supplied by the CSIRO Marine and Atmospheric Research)

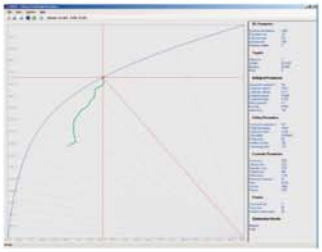
Schaefer Simulation

Current maximum sustainable yields of the fishery and corresponding stocks and profits



The Method

FishDE - Differential Evolution Application



Screenshot of FishDE evolving to a target. The blue curve is the frontier built with sustainable points of biomass with each corresponding to a total net present value profit over 50 years. The red lines indicate the values of a targeted objective. The green lines show the path followed by the optimization algorithm. Model parameters can be set using the pane on the right hand side.

Conclusion

The approach allows easy visualization and exploration of the solution space through the use of a frontier of possible solutions.

The algorithm can easily and consistently converge on near-optimal solutions for each prawn species.

Users can choose alternative profits and levels of biomass to simulate outcomes after a given period of time, and can optimize additional parameters without having to modify

Australian Government Fisheries Research & Development Corporation

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UNE THE UNIVERSITY OF NEW ENGLAND

On board observer program in the largest pelagic fishery in the world: Peruvian experience

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[3] *Logbook-Onboard Observers Program (LOOP) – Peru*

Text from Poster

The Logbook-Onboard Observers Program (LOOP) is an important tool of pelagic fish stock assessment and management in Peru, mainly of anchovy (*Engraulis ringens*), monitoring all activities during trips of the purse seine fishing vessels. The mission is to constitute a multidisciplinary group aiming to improve the knowledge and comprehension of the fishery and its resource in Peru. The vision is to become a basic point of reference for fishery management in the Humboldt Current Ecosystem (HCE).

The program started in the '80 in IMARPE due to the necessity of effective effort units: traveling time length, length of seeking time, number of fishing sets per trip to estimate trends in efficiency of the fishing fleet. The program stopped because of the lack of financial support.

Afterwards, in 1996 the program was restarted and is still working. The program has evolved since its beginning adapting at present to the framework of the Ecosystem Approach in Fishing (EAF), adding to effective effort unit data the issues of: biological data as latitudinal and vertical distribution, size structure and behavior of fish, interaction of birds, mammals and turtles with fish population, taking pictures of acoustic records, discards, drifts, among others.

Currently, due to the need of a real time and effective management a new tool is being used, a java application in a cell phone messaging system, getting fishery and biological data on time to a data base IMARSIS, a server at IMARPE.

Acknowledgements

We appreciate the kindness and collaboration of the Logbook-Onboard Observers Program of IMARPE: G.Espinoza, P.Ramirez, C.Palacios, J.Puchulan, A.Quiroz, C.Ruiz, J.Barrera, J.Liza, S. Silva, C.Rodriguez, A.Barrantes, V.Sipiran, S.Gavidea, M.Mauricio, O.Morales, C.Valladares, J.Alvarez, N.Aliaga, M.Perez, P.Huaman, M.Lopez, V.Duran, R.Pastor y C.Morales.

On board Observer Program in the Largest Pelagic Fishery in the world: Peruvian Experience

M.Bouchon[1], A. Chipollini[1], M.Niquen[1], E.Díaz[1], F.Van Oordt[2], C.Peña[1], C. García[1], M.Ochoa[3], E.Espinoza[3], J. Limache[3]
1Population Dynamic Area, 2 Top Predators Area, 3 Logbook-Onboard Observers Program (LOOP)
e-mail: mbouchon@imarpe.gob.pe Instituto del Mar del Perú, Postal Box 22, Callao - Peru

The Logbook-Onboard Observers Program (LOOP) is an important tool of pelagic fish stock assessment and management in Peru, mainly of anchovy (Engraulis ringens), monitoring all activities during trips of the purse seine fishing vessels. The mission is to constitute a multidisciplinary group aiming to improve the knowledge and comprehension of the fishery and its resource in Peru. The vision is to become a basic point of reference for fishery management in the Humboldt Current Ecosystem (HCE).

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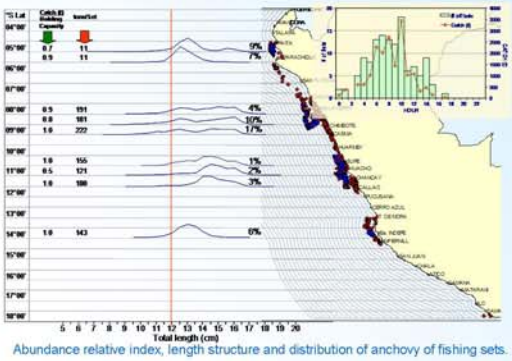
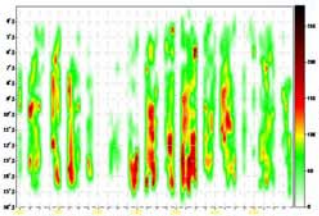
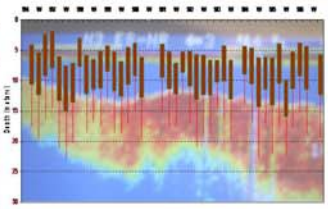


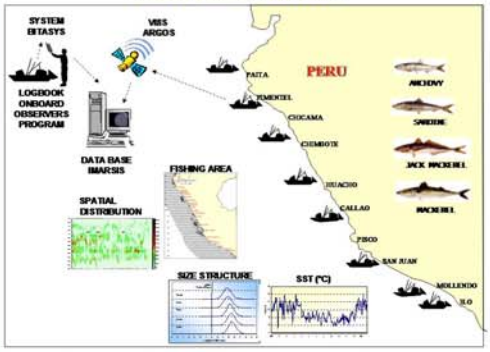
Abundance relative index, length structure and distribution of anchovy of fishing sets.



Spatial and temporal distribution of anchovy (tons/Set)



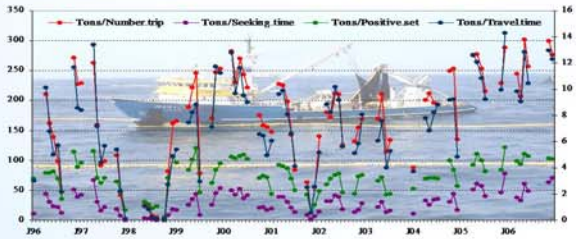
Seasonal vertical distribution of anchovy



Currently, due to the need of a real time and effective management a new tool is being used, a java application in a cell phone messaging system, getting fishery and biological data on time to a data base IMARSIS, a server at IMARPE.

Discards in the purse seine fishery

Interaction with top predators



Relative abundance indices time series in anchovy fishery (1996 – 2006)

ACKNOWLEDGEMENTS

We appreciate the kindness and collaboration of the Logbook-Onboard Observers Program of IMARPE: G.Espinoza, P.Ramirez, C.Palacios, J.Puchulan, A.Quiroz, C.Ruiz, J.Barrera, J.Liza, S. Silva, C.Rodriguez, A.Barrantes, V.Sipiran, S.Gavidea, M.Mauricio, O.Morales, C.Valladares, J.Alvarez, N.Aliaga, M.Perez, P.Huaman, M.Lopez, V.Duran, R.Pastor y C.Morales.

Photos : Logbook-Onboard Observers Program.

Peruvian experience in fisheries observer programs and scientific monitoring

Francis van Oordt

Instituto del Mar del Perú. Gral. Gamarra S/N, Chuquito, Callao – Perú

Abstract

Fisheries observer programs have been implemented in different industrial Peruvian fleets with scientific purposes to better understand fishing activities along the coast. The Purse Seine fishery, which represents aproximately 95% of the total fishing vessels, targeting mostly Peruvian Anchovy Engraulis ringens, was the first to be monitored in 1996, through the Peruvian Marine Research Institute's Lookbook Program. This program operates in 20 ports important where the fleet activites go from 04 º S to 18º S to an average of 150 nm from the coast. Observers are distributed strategically along the coast according to the fishing effort, reaching a total of 32 (biologists and fisheries engineers). This program has provided important information on fishing effort (total catch per trip/set, catch landed, time at sea, etc.) and biology (recruitment, sizes, sexual maturity, etc.) of the anchovy fishery of the last 10 years. IMARPE also monitors the tuna and giant squid foreign fishing fleets, to gather both information in biology and fishing effort. Tuna fisheries observers from IMARPE are mandatory in all foreign vessels below 353 metric tons of carrying capacity. Artisanal fisheries are also monitored by observers from IMARPE on different important Peruvian ports, where landings and other biological data are registered on land. Also, national and international NGO's have started several efforts to reduce incidental catch of different species in artisanal fisheries, for this purpose research is done through monitoring programs in some ports of the coast, working with on-board observers and fishermen to monitor the fishing activities and therefore, assess the by-catch issue.

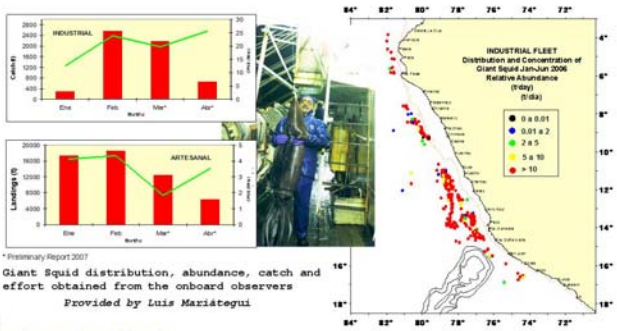
Peruvian Experience in Fisheries Observer Programs and Scientific Monitoring

Francis van Oordt[1]

1 Instituto del Mar del Perú. Gral. Gamarra S/N, Chuquito, Callao, Perú.
[Tel. 420-2000. Ext. 258, email: fvanoordt@imarpe.gob.pe]

1. Introduction

The Peruvian Marine Research Institute – IMARPE has implemented Fisheries Observer Programs with scientific purposes to better understand fishing activities along the coast. This programs have been established in different Peruvian fisheries, including the industrial purse-seine fleet, the most important fleet in Peru, and also artisanal fisheries, monitoring landings along several ports on the coast.



* Preliminary Report 2007

Giant Squid distribution, abundance, catch and effort obtained from the onboard observers

Provided by Luis Mariátegui

Industrial Purse Seine fisheries interactions with predators reported by on board observers.

Provided by Marilu Bouchón

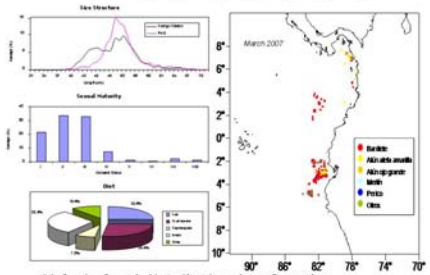
2. Industrial Fisheries Observer Programs

Peruvian Purse Seine Fisheries

The Peruvian Purse Seine Fishery is monitored by the Logbook and Onboard Observer Program since 1996. For further information view Poster "On board Observer Program in the Largest Pelagic Fishery in the world: Peruvian Experience".

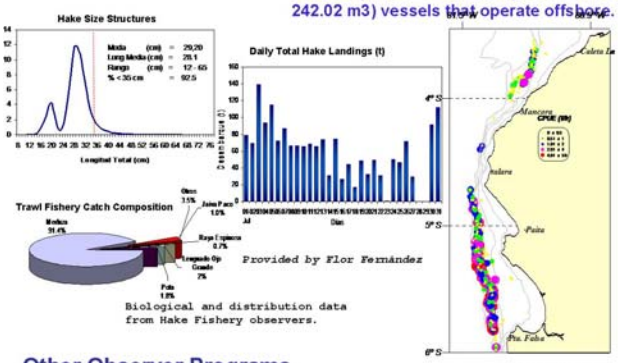
Tuna, Giant Squid and Hake Fisheries

IMARPE's Scientific Technicians (TCI) are positioned on tuna and giant squid foreign vessels operating in Peruvian waters, gathering information in both fishing effort and biology of the species. Tuna fisheries observers from IMARPE are mandatory in all foreign vessels below 353 metric tons of carrying capacity, and giant squid observers in all vessels. Hake fishery is also monitored by TCI, comprising small coastal vessels (41.45 – 140.74 m3), and mid-scale (125.83 – 242.02 m3) vessels that operate offshore.



Biological and distribution data from the Tuna Fishery observers.

Provided by Gladis Cárdenas

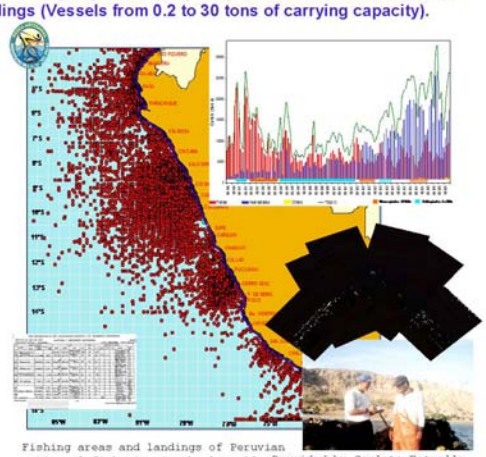


Provided by Flor Fernández

Biological and distribution data from Hake Fishery observers.

3. Artisanal Fisheries Monitoring Program

Around 14 fishing methods are used extensively by artisanal fishermen in Peru such as: gillnet, purse-seine, divers, longline, traps, casting nets, others, targeting 250 marine species. 29 Artisanal Fishing Landing points along the coast are evaluated by observers from IMARPE, compiling information on catches, fishing effort and biology through a Catch Sampling Surveys (ECM) of the artisanal fisheries landings (Vessels from 0.2 to 30 tons of carrying capacity).



Fishing areas and landings of Peruvian artisanal fisheries in the last 10 years

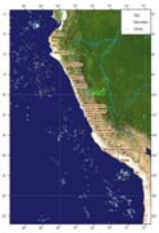
Provided by Carlota Estrella

Other Observer Programs

Since 2005 WWF-OPP in alliance with local Peruvian NGO's (ACOREMA, APECO, PRO –DELPHINUS), established an onboard observer program to assess turtle bycatch in longline fisheries. Designed and coordinated with international agencies (CIAT, NOAA, and WWF) one of its objectives is to test circular hooks in the reduction of sea turtle bycatch. Observers collect data on hooking and entanglement rates, catches, species composition, biometrics and fishing areas, both of sea turtles and target species.

Artisanal Longline Fishery Observers Program

Vessels	Longline 7-20m length
Ports	Paita, Pucusana, Ilo
No. of sampled vessels	28
Observed Trips/Sets	96 / 709
No. Observers	29 (2% of total fleet)
Interactions	59 % of obs sets



Distribution of artisanal Peruvian longline fishery, targeting shark and mahi mahi, monitored by observers.
Provided by Nelly de Paz

5. Acknowledgments

Special thanks to Marilú Bouchon and Andrés Chipollini (*Population Dynamics Research Unit*), Gladys Cárdenas (Neritic *Pelagic Resources Research Unit*), Luis Mariátegui (*Invertebrates Research Unit*), Flor Fernandez (*Demersal Benthic and Coastal Fish Research Unit*) and Carlota Estrella (*Statistics and Artisanal Fisheries Unit*) from IMARPE, and Nelly de Paz (ACOREMA).

Beyond the beach: Addressing accidental marine turtle by-catch in Malaysia

Rahayu Zulkifli[1]*, Yeo Bee Hong[2], Annadel Cabanban[1] and Kenneth Kassem[1]

[1] *WWF – Malaysia*
[2] *WorldFish Center (previous)*

Extended Abstract

Malaysia sits in the heart of the Coral Triangle, the world's pinnacle of marine biodiversity and is an important range state of four species of marine turtles namely, Hawksbill *(Eretmochelys imbricata),* Green *(Chelonia mydas),* Olive Ridley, (*Lepidochelys olivacea*) and Leatherback turtles *(Dermochelys coriacea).* In Malaysia, fisheries range from small-scale inshore fishing boats (< 40 tonnes) deploying drift nets to large-scale (> 70 tonnes) prawn and bottom trawlers. Limited reports and anecdotal evidence however, suggest that interactions between fishers and turtles are not uncommon.

A Socioeconomic Study and Survey of Sea Turtles and Fisheries Interaction in Malaysia: Case Studies in Terengganu and North Pahang conducted by the WorldFish Center in collaboration with the Department of Fisheries Malaysia and WWF-Malaysia between September 2005 and March 2006, gave an insight into the possible magnitude of this marine turtle-fisheries interaction. Among the key findings show that interactions do exist. The interaction is most common and coincides with the peak turtle nesting season of between May and July.

On the east coast of Peninsular Malaysia, in particular in the state of Terengganu, WWF-Malaysia has been engaging local communities to promote marine turtle conservation since 2003. Terengganu hosts the highest number of Green Turtle *(Chelonia mydas)* on the Ma'Daerah beach. Ma'Daerah is a 1.7km stretch of pristine nesting beach with an average number of 350 nests per year. A level of trust has been established with the local community and a study to document the level of sea turtle-fishery interactions through a programme involving trained, onboard observers is possible. Surveys of fishermen in the state of Terengganu, Malaysia have shown that they are aware of the threat of fishing to marine turtles. Such a study would result in a range of proposed mitigating measures to help reduce turtle mortality.

Their involvement will be crucial and will be facilitated by WWF-Malaysia's long history at the Ma'Daerah Turtle Sanctuary, and the creation of a local community group MEKAR. MEKAR is a community-based organisation whose main objective is to increase awareness and knowledge on turtle conservation-related issues among the wider community through awareness activities.

Findings from this study will help conservationists and the relevant authorities address the increasing threat of marine turtle by-catch in Malaysian waters.

In Sabah, Malaysia (Borneo), WWF-Malaysia is implementing activities towards the conservation of ecosystems and endangered species, such as marine turtles, in the Priority Conservation Areas of the Sulu-Suluwesi Marine Ecoregion. Ethnobiological information on the biology and ecology of turtles are being collected for future use in zoning of coastal beaches for conservation. Trawler by-catch data will be collected for the discussions with the fishery sector on reduction of turtle by-catch. A business plan is being prepared for sustainable financing of conservation efforts in the Turtle Islands Park, Malaysia (in Sandakan Priority Conservation Area).

Beyond the Beach: Addressing Marine Turtle Bycatch in Malaysia

Rahayu Zulkifli[1], Yeo Bee Hong[2], Annadel Cabanban[1], Kenneth Kassem[1]
[1]WWF-Malaysia
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Malaysia sits in the heart of the Coral Triangle, the world's pinnacle of marine biodiversity and is an important range state of four species of marine turtles namely Hawksbill (*Eretmochelys imbricata*), Green *(Chelonia mydas)*, Olive Ridley, *(Lepidochelys olivacea)* and Leatherback *(Dermochelys coriacea)* turtles. There is however limited information in Malaysia documenting the level of marine turtle and fisheries interactions. Malaysian fisheries range from small-scale inshore fishing boats (<40 tonnes) deploying drift nets to large-scale (>70 tonnes) prawn and bottom trawlers. Limited reports and anecdotal evidence however, suggest that interactions are not uncommon.

On the east coast of Peninsular Malaysia, WWF-Malaysia has been engaging local communities to promote marine turtle conservation since 2003. A level of trust has been established and a study to document the level of sea turtle-fishery interactions through a programme involving trained, on-boat observers are possible. Such a study would result in a range of proposed mitigating measures to help reduce turtle mortality. Surveys of fishermen in the state of Terengganu, Malaysia have shown that they are aware of the threat of fishing to marine turtles.

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Introduction

Turtles in Malaysia:
- **Leatherback *(Dermochelys coriacea)***
- **Green *(Chelonia mydas)***
- **Hawksbill *(Eretmochelys imbricata)***
- **Olive Ridley *(Lepidochelys olivacea)***

Status:
- **Endangered/Critically Endangered**
  (IUCN Red List)

Remaining important nesting beaches:
- Terengganu: Redang Island, Perhentian Islands, Kerteh, Geliga
- Pahang: Cherating
- Malacca: Padang Kemunting, Terendak Army Camp, Upeh Island
- Sabah: Turtle Islands Park
- Sarawak: Talang-Talang Islands

Fishing in Peninsular Malaysia
- Types of gear: Purse seine, drift nets, trawlers, longlines, hook & lines, traditional
- Types of catch: Small pelagics, prawns, squid, crabs, others

Knowledge of turtle bycatch
- Based on anecdotal evidence obtained from survey carried out by WorldFish Center, interactions exist

Ma' Daerah Turtle Sanctuary, Terengganu, Malaysia

Activities at the sanctuary

- Beach is approximately 1.7km long
- Considered a critical nesting beach because of threats from nearby developments
- Records the second highest nesting of green turtles in Peninsular Malaysia
- Almost all green turtles *(Chelonia mydas)*
- Most eggs are incubated in *ex-situ* nests
- Average nesting of 350 nests per year with approximately 35,000 hatchlings released per year

Turtle remains found near the Ma'Daerah nesting beach. Cause of death unknown but suspected to be incidental bycatch.

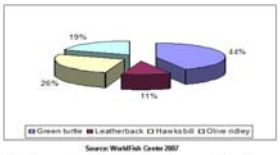
Study done on fisheries-marine turtle interactions:

Socioeconomic study and survey of sea turtles and fisheries interaction in Malaysia: Case studies in Terengganu and North Pahang

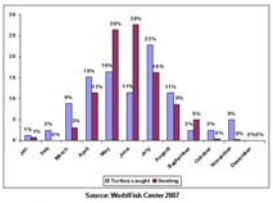
* September 2005 – March 2006

* Conducted by WorldFish Center with Department of Fisheries Malaysia and WWF-Malaysia

* Key findings:



Fisheries-marine turtle interaction according to species



Number of turtles caught vs nesting season

Working with MEKAR/Fishermen

* MEKAR is a local community group comprising community near Kerteh in Terengganu, Malaysia who are interested in conserving turtles from the threats of extinction

* Main objective of MEKAR: To increase awareness and knowledge on turtle conservation-related issues among the wider community through awareness activities

* WWF-Malaysia will seek cooperation from MEKAR members when carrying out field surveys and onboard observations to study fisheries-marine turtle interaction

Potential/plans for observations
-Starting July 07:
* Consultations with authorities and fishermen to design observation protocol
* Pilot test onboard observations in 2 key states (Terengganu & Malacca)
* Compile and analyse data and makes recommendations to relevant authorities

Other bycatch work in Malaysia and the Coral Triangle area:

- WWF-Malaysia is also working towards the conservation of marine turtles and other endangered species in the Sulu-Sulawesi Marine Ecoregion (SSME)
- Enthnobiological information on beaches and bycatch being collected for future use in zoning in East Malaysia
- Business plan being prepared for sustainable financing of conservation efforts in the Turtle Islands Park, Sabah, Malaysia
- WWF-Philippines focusing on marine mammal bycatch
- The Cetacean Research and Conservation project addresses the issue of bycatch through an integrated coastal resources management program
- WWF-Philippines initiated a turtle bycatch project focused on testing of circle hooks for longlines in the Pacific fleets
- For Turtle Islands Heritage Protected Area (considered one of the remaining major rookeries for Green Turtles in South East Asia) WWF-Philippines will work through the Joint Management Committee to advocate for the undertaking of a joint research with Malaysia for onboard monitoring of shrimp trawlers

Does the camera really add 10 pounds? Consequences of implementing an electronic monitoring system on logbook compliance and fishing fleet composition

J.W Cummings, W.K. de la Mare, D.N. Edwards, J.L. Finney, M.H. Grinnell*, C.J.A. MacKenzie, N. Millar, A. Taylor and P. van Dishoeck

School of Resource & Environmental Management, Simon Fraser University

Text from Poster

Introduction

Electronic monitoring (EM) programs have been suggested as replacements for at-sea observer programs and have several advantages including reduced bias (Ames, 2005; McElderry et al. 2003; McElderry et al. 2004) simpler logistics, reduced costs, increased coverage (Ames, 2005), and wider fleet suitability (i.e., even to those fleets composed of small, space-limited vessels). In 2006, Fisheries and Oceans Canada introduced 100% at sea monitoring coverage on long line groundfish vessels with the new Integrated Groundfish Management Plan. One component of this is an EM system. In the current EM system a logbook is recorded by the fishermen and an audit is performed on 10% of the hauls to compare the video record with the logbook data. The logbook is used as the official trip record unless the logbook fails to agree with the video. If the logbook fails, the video is subject to a full audit, with costs paid by the fisherman. The EM data then becomes the official trip record. Stakeholders are currently trying to determine optimal audit rules for the BC long line fishery.

Approach

In this study we are using a simulation modeling approach to evaluate the outcomes of an EM system implementation on a hypothetical fishery. Specifically, we will explore what incentive/disincentive structures best meet the following management objectives:

- Efficiency of the system.
- Facilitation of accurate logbook reporting.
- Maintenance of stable fleet composition.

Assumptions

- Catch does not reduce catch per unit effort.
- Economically rational actors (e.g., profit maximiSation).
- Quota liquidity (i.e., always a willing buyer/seller).
- Perfect information in investment decisions.
- Landed (ex-vessel) price and quota price are constant.
- By-catch limits are a set proportion of target species quota.

Limitations

- Modeling human behaviour, which can be unpredictable.
- Assumes perfect knowledge and decisions based on most profitable outcomes.

Merits

- Closed-loop: managing people and their behaviour, not fish stocks.
- Proactive: evaluate and develop management strategy before implementation.
- Flexible: can add complexity and other variables as needed, and can be adapted to other management plans.

Does the Camera Really Add 10 Pounds?

Consequences of implementing an electronic monitoring system on logbook compliance and fishing fleet composition

Cummings, J.W., W.K. de la Mare, D.N. Edwards, J.L. Finney, M.H. Grinnell, C.J.A. MacKenzie, N. Millar, A. Taylor, and P. van Dishoeck
School of Resource and Environmental Management, Simon Fraser University
Correspondence: mgrinnel@sfu.ca

Introduction

Electronic monitoring (EM) programs have been suggested as replacements for at-sea observer programs and have several advantages including reduced bias[1,2,4] simpler logistics, reduced costs[2], increased coverage[1], and wider fleet suitability (i.e., even to those fleets composed of small, space-limited vessels).

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Figure 1. Example of what is recorded by an EM system. The date, time, vessel name, and GPS coordinates are seen in the upper left hand corner.

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In this study we are using a simulation modeling approach to evaluate the outcomes of an EM system implementation on a hypothetical fishery. Specifically, we will explore what incentive/disincentive structures best meet the following management objectives:

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Figure 2. Examples of fishing vessels in the BC long line fishery.

Conceptual Model

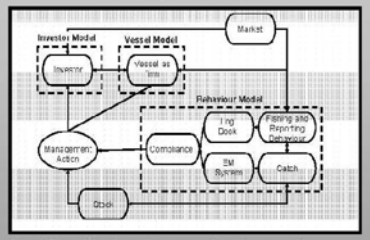

Figure 3. The model has three main components that are interconnected:
•*Investor model:* makes annual investment decisions
•*Vessel model:* makes at season economic decisions
•*Behaviour model:* makes decisions about where to fish and for how long. Also makes decisions about whether or not to comply with regulations, and reveals if non-compliance is caught by the EM system.

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- Catch does not reduce catch per unit effort
- Economically rational actors (e.g., profit maximization)
- Quota liquidity (i.e., always a willing buyer / seller)
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References

(1) Ames, R. T., 2005. The efficacy of electronic monitoring systems: a case study on the applicability of video technology for longline fisheries management. International Pacific Halibut Commission Scientific Report 91, 94 p.
(2) Ames, R. T., G. H. Williams, and S. M. Fitzgerald, 2005. Using digital video monitoring systems in fisheries: applications for monitoring compliance of seabird avoidance devices and seabird mortality in Pacific halibut longline fisheries. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-162, 30p.
(3) McElderry, H., J. Schrader, and J. Illingworth, 2003. The Efficacy Of Video-Based Monitoring For The Halibut Fishery. Fisheries and Oceans Canada, Research Document 2003/042. "not to be cited without the permission of the authors"
(4) McElderry, H., J. Illingworth, D. McCullough, and J. Schrader, 2004. Electronic Monitoring of the Cape Cod Haddock Fishery in the United States – A Pilot Study. Unpublished report prepared for the Cape Cod Commercial Hook Fishermen's Association (CCCHFA) by Archipelago Marine Research Ltd., Victoria BC Canada. 37 p.

Investor model: quota and vessels

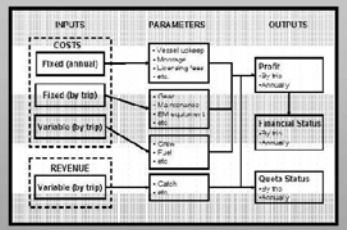

Figure 4. Flow diagram of components of the investor model. This model makes yearly decisions on 1) **quota** (purchase/sell/lease to vessels), 2) **vessels** (purchase/sell/upgrade), and 3) **retirement** (firms without quota and vessels). This component of the model uses a rules-based linear program to maximize predicted annual profit.

Vessel model: trip by trip

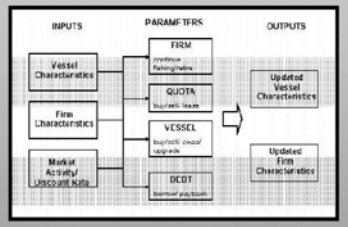

Figure 5. Flow diagram of components of the vessel as firm model. This model makes trip by trip decisions about whether to go fishing. These decisions are based on the cost of fishing versus the expected profit of the trip. This model also updates the vessel parameters at the end of each trip.

Behaviour model: trip plan and compliance

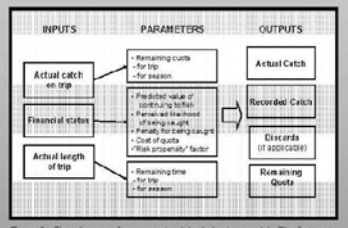

Figure 6. Flow diagram of components of the behaviour model. The first part of the model (not shown here) makes decisions about where a vessel will fish and for how long. When catch exceeds trip limits or held quota for a given species, decisions are made about whether or not to comply with regulations (i.e. purchase/lease quota, discard or not). This component also evaluates whether or not misreporting is caught by the EM system (not shown).

Perspective on design of a collaborative sampling program for the Shoreside Hake Fishery

Lori K. Jesse*, Steven J. Parker and Mark R Saelens

Pacific States Marines Fisheries Commission / Oregan Department of Fish & Wildlife – USA

Text from Poster

Introduction

- The shoreside hake sampling program is an experimental cooperative effort between Washington, Oregon, California, the Pacific States Marine Fisheries Commission (PSMFC) and the National Marine Fisheries Service (NMFS).
- The goals of the shoreside hake sampling program are:
- Bycatch documentation through species composition samples.
- Collection of weight, length, sex and otoliths of landed species.
- The program currently uses a combination of state and industry samplers to collect species composition and biological sampling.
- As a permanent sampling program is designed by managers, the functionality and feasibility of an industry-staffed sampling program should be evaluated.
- The purpose of this project is to examine which aspects of a sampling program are perceived as the most important and whether industry samplers are a viable option for attaining program goals.

Methods and results

- We identified the key elements of a successful sampling program and organised them into categories and subcategories.
- Using a questionnaire, we collected opinions to rank the importance of those categories and whether each task could be completed more effectively by industry or government.
- Eleven survey respondents were analyzed, three from industry and eight from state and federal governments.

We used the Analytic Hierarchy Process (AHP):

- The AHP is a mathematical decision making technique that allows consideration of both qualitative and quantitative aspects of an issue to inform decisions.
- It reduces complex decisions to a series of comparisons, and then synthesizes the results.
- The AHP is based on a scale one through nine; one being slighty important, nine extremely important compared to the alternatives.
- Weighing and ranking the importance of Administrative Ease, Program Flexibility, Accountability and Data Quality, and Industry Involvement provides quantitative structure to individual opinion.
- Characteristics were weighted through survey responses then summarized using the AHP.

Conclusions

- The predominant issue is whether or not industry samplers can achieve data accuracy equal to that of government samplers (Data Quality).
- Additional issues perceived as essential include the quantity of data required by the program, costs involved to obtain this data and how this will be accomplished logistically.
- Both industry and government respondents agreed that different aspects of the program can be better and more efficiently accomplished by different groups.
- To capitalize on the strengths of each group, a program could be structured in such a way that:
- The industry samplers complete the time consuming tasks.
- A smaller group of government samplers provides oversight and acts as a liaison for enforcement if necessary.
- Both industry and government samplers should play a role in communication and improving relations between their groups.
- All surveyed groups were hesitant to participate in the project which may indicate reluctance on all sides to openly discuss difficult aspects of this particular sampling program for the shoreside hake fishery.

Perspectives on Design of a Collaborative Sampling Program for the Shoreside Hake Fishery

Lori K. Jesse*, Steven J. Parker, Mark R. Saelens
Pacific States Marine Fisheries Commission/Oregon Department of Fish and Wildlife
Marine Resources Program, Newport, Oregon 97365
Lori.Jesse@state.or.us

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- Weighing and ranking the importance of Administrative Ease, Program Flexibility, Accountability and Data Quality, and Industry Involvement provides quantitative structure to individual opinion.
- Characteristics were weighted through survey responses then summarized using the AHP.

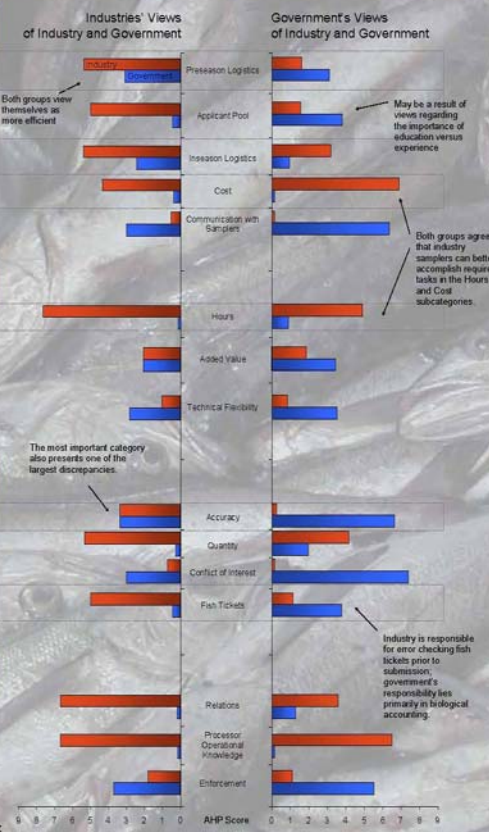
Administrative Ease	How efficiently can the program complete administrative tasks?
Preseason Logistics	How efficient is the program (time and cost to program) in recruiting and hiring shorebased data collectors for all processors receiving hake?
Applicant Pool	Does the program attract candidates with appropriate education level and fisheries experience? Can the program fill positions in all ports where needed and retain them for multiple seasons?
Inseason Logistics	Can the program effectively supervise shorebased data collectors and/or quickly replace a data collector during the season if necessary?
Cost	How important is the overall cost to a sampling program that includes wages, administration, supervising?
Communication with Samplers	Is the program able to communicate with data collectors to efficiently resolve issues as they arise?

Program Flexibility	How adaptable are shorebased data collectors and their tasks?
Hours	Can shorebased data collector's sampling goals be completed within hours allowed by the employer?
Added Value	Can the shorebased data collectors complete additional duties beneficial to a sampling program such as additional biological data collection, data related tasks, work outside a normal 40 hr work week, or aid a data collector in another facility if time allowed?
Technical Flexibility	How adaptable are shorebased data collectors in using new data collection tools (i.e. Pocket PCs for digital data collection)?

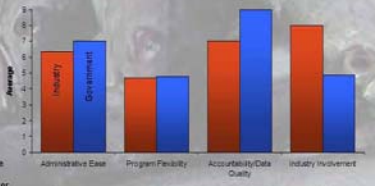
Accountability and Data Quality	How effective is the program in data collection?
Accuracy	Does the accuracy of the data collected meet the needs of the sampling program?
Quantity	Does the program have the ability to accommodate required sampling rates for the fishery?
Conflict of Interest	Is conflict of interest a perceived problem for the program?
Fish Tickets	How effective are shorebased data collectors in minimizing ticket errors and discrepancies prior to submission?

Industry Involvement	How involved is the industry in the sampling program?
Relations/Industry Commitment to Program	Would the sampling program help develop good working relations between managers and industry?
Processor Operational Knowledge	How familiar are the data collectors with processor activities and ensuring product quality?
Enforcement	How effective are shorebased data collectors in maintaining good relations with enforcement?

Overall, sampling Accuracy was deemed the most important subcategory followed by Quantity, Program Cost and Inseason Logistics



Industry ranked Industry Involvement much higher than government; Accountability and Data Quality was scored higher by government than industry



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Acknowledgements

- Thank you to everyone who participated in the survey and provided feedback on the project

Suggested method for improving comprehension recollection in observer trainees: The key to observer training

Sandra M. Vieira

Alaskan Observers Inc. / NOAA Fisheries West Coast Groundfish Observer Program, Northwest Fisheries Science Center – USA

Extended Abstract

It is the intention of every observer trainer that trained observers complete their course with a full comprehension of the material, as well as the ability to have complete and accurate recollection. Recollection is especially important, as access to instructors is limited once observers are deployed. It is crucial that observer trainers present the material so that every attendee can absorb the material; to adapt lessons to suit multiple learning styles. There are many learning style theories, however the Felder-Silverman's *Learning Style Model,* constructed in 1988 and validated in a 1992 study by Soloman and Felder using the *Index of Learning Styles* has been statistically proven, most recently in 2004, to be an accurate methodology and all encompassing form of style to teaching. When testing the *Learning Style Model,* the *Index of Learning Styles* states that students in the field of science learn subject matter by actively processing information by way of physical practice, perceive the information with actual data and facts, visually review new information by inputting with the aids of charts, graphs and diagrams and understand the full subject by making linear connections in a sequential pattern. Any observer program can benefit by embracing and designing their lesson plans to include the *Learning Style Model*'s proven methodology. This model aids in ensuring the observer trainee will recall information in an accurate and absolute manner. Better recall is vital as observer safety and data collection are subjects with little room for error.

The ultimate method is to reach every student in a teacher's class. To do that it is necessary to consider every individuals learning style. There is no single style that is represented in an individual but rather a conglomerate of venues to instill a concept to a student. Information and concepts are presented to the students in a way that they will absorb the material best, as is referenced in Felder and Silverman's *Learning Style Model's* four category model. For example, in the Processing category, Felder and Silverman express two different styles in which a concept may be absorbed, Active and Reflective. Twice as many science students learn new material actively; within a physical activity practicum where as another student may prefer a reflective manner of learning, that is, the reflective learner absorbs the material at hand in a way that they must conceptualise the material in their minds. The ultimate lesson plan would be a design of incorporating both 'active' and 'reflective' teaching components, with the stronger emphasis and time spent on the material to the Active processes, within this particular learning category.

An actual example of these two different processes within the observer world would be to describe briefly to the students how to suit up in an immersion suit, explain to them the safest manner in which to enter a body of water and then describe to them how difficult it may be to right a bottom-up life raft in which to make it usable for safety and then actually have the observer students gear up in an immersion suit, have them jump in the water posing the safety pose and have them practice turning a bottoms-up life raft right side up in order to enter it in hopes to maximise their survival efforts from a necessary abandon ship event. The reflective learner would learn this critical emergency drill in the former discussion and the active learner would understand the concept greatly with the latter practical drill. Using both forms of teaching design would increase the potential information retention for the instructor's entire class.

The Key to Observer Training

Sandra M. Vieira

Alaskan Observers Inc. / NOAA Fisheries West Coast Groundfish Observer Program / Northwest Fisheries Science Center / Seattle, WA., U.S.A.

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Processing

~ Active 67% ~

Learn best by doing something physical with the information

Vs.

~ Reflective 32% ~

Do the processing in their heads

Active

Perception

~ Sensing 57% ~

Prefer data & facts

Vs.

~ Intuitive 42% ~

Prefer theories & interpretations of factual information

Sensing

Input

~ Visual 69% ~

Prefer charts, diagrams & pictures

Vs.

~ Verbal 30% ~

Prefer the spoken or written word

Visual

Understanding

~ Sequential 71% ~

Easily make linear connections between individual steps

Vs.

~ Global 28% ~

Must get "big picture" before individual pieces fall into place

Sequential

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5. Orr, J.W., et al. 2000. Guide to rockfishes (Scorpaenidae) of the genera Sebastes, Sebastolobus, and Adelosebastes of the Northeast Pacific Ocean, 2nd ed. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-117, 47 p.

Photo credits: Jason Phillips, UAA North Pacific Fisheries Observer Training Center and Sandra M Vieira.

Developing tools to assess by-catch trends using fisheries observer data

Bryan Wallace* and Project GloBAL (Global By-catch Assessment of Long-lived species)

Duke University Marine Lab, Center for Marine Conservation – USA

Extended Abstract

Fishery observer data are crucial to strategic management of fisheries as well as to monitoring of incidental by-catch of protected, non-target species. Project GloBAL (Global By-catch Assessment of Long-lived Species: www.by-catch.env.duke.edu), a joint research initiative between the Duke University Center for Marine Conservation and the Blue Ocean Institute, is developing or enhancing methods to characterise by-catch trends in time and space, while examining by-catch across taxa (e.g., marine mammals, seabirds, and sea turtles) and gear types (e.g., longlines, gillnets, and trawls) around the world. Using fishery observer data from the US National Marine Fisheries Service and other available resources, Project GloBAL is currently working on several analyses that deal with three major topics: spatio-temporal trends in by-catch, linking by-catch to oceanography, and assessing population impacts of by-catch. Through integration of analyses in these topic areas, we are undertaking an assessment of by-catch of long-lived marine species at local, regional, and global scales in hopes of informing effective conservation strategies to promote healthy fisheries and to reduce by-catch.

Spatio-temporal trends in by-catch

Identification of by-catch 'hotspots' as well as how by-catch varies in time and space is vital to effective management schemes to conserve protected species taken as by-catch in marine fisheries. Using observer data collected in US Atlantic gillnet fisheries, we developed modeling techniques to increase the precision of by-catch estimates that are dependent upon spatial distribution of observed fishing effort. In addition, these models allowed for identification of spatio-temporal patterns of by-catch of both marine mammals and seabirds. This analysis has implications for improved precision of by-catch rates, for identification of areas of high by-catch in time and space, for recommendations for distribution of observer coverage, and for analysis of potential relationships between high by-catch and oceanographic variables.

Linking by-catch to oceanography

Oceanographic features determine to some extent the distribution of marine animals and of fishing effort in time and space. By combining observer data collected in the US Hawaiian longline fishery with tracking data for seabirds from the Northwest Hawaiian Islands, we are developing models to assess the relationships between fishing effort, by-catch, and prevailing oceanographic variables in the region. This approach has important implications for identification of by-catch 'hotspots' and its potential predictive capabilities.

Population impacts of by-catch

While determination of population-level effects of fisheries by-catch on long-lived marine animals is likely the most important factor for successful conservation, most demographic parameters for these animals are unknown or unobservable. Thus, alternative methods of estimating demographic parameters are crucial. Using observer data collected in the US northwest Atlantic gillnet fishery and strandings data, we have developed estimates of survival and mortality schedules, population growth rates, and mortality effects of by-catch on harbor porpoises. This approach has important implications for filling knowledge gaps about population impacts of by-catch and can help inform managers about relative levels of by-catch on vulnerable populations.

Other analyses that Project GloBAL is currently conducting using fisheries monitoring data include: predicting by-catch from relationships between fishing effort and reported landings; evaluating alternative methods for spatially distributing fishing effort; and estimating relative by-catch impacts of different gear types on geographically widespread animal populations. Through diverse analytical applications of fishery monitoring data, we are developing important tools for stakeholders (e.g., managers, industry, academics, NGOs) to improve our collective ability to address by-catch issues.

Developing tools to assess bycatch trends using fisheries observer data

DUKE CENTER FOR MARINE CONSERVATION

Project GloBAL
Global Bycatch Assessment of Long-Lived Species
www.bycatch.env.duke.edu

Presenter: Bryan Wallace
bwallace@duke.edu

BLUE OCEAN INSTITUTE
Fresh Imagination for Ocean Conservation

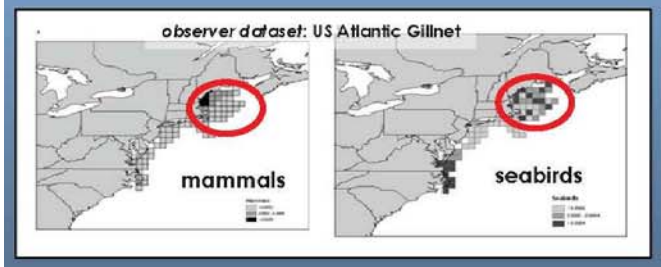
What Project GloBAL does:

We are using fishery observer data and other available resources to develop or enhance methods to characterize bycatch trends in time and space, across taxa (e.g. marine mammals, seabirds, and sea turtles) and gear types (e.g. longlines, gillnets, and trawls) around the world.

Inter-related themes of current research using fishery monitoring data:

spatio-temporal bycatch patterns

Questions:
Where are areas of high bycatch?
Are there related spatio-temporal patterns of bycatch across taxa?

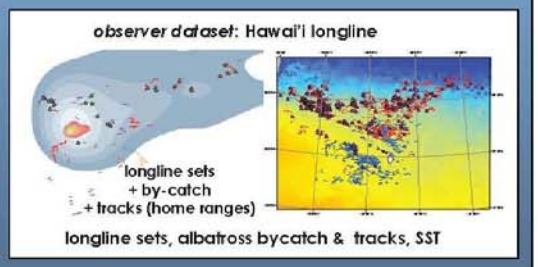


Implications:
- identify bycatch 'hotspots' for multiple taxa
- inform distribution of observer effort
- identify role of oceanographic variables

Contact: Michelle Sims (msims1@duke.edu)

linking bycatch & oceanography

Question:
Can combined analyses of animal distributions, fishing effort, and oceanography predict bycatch?

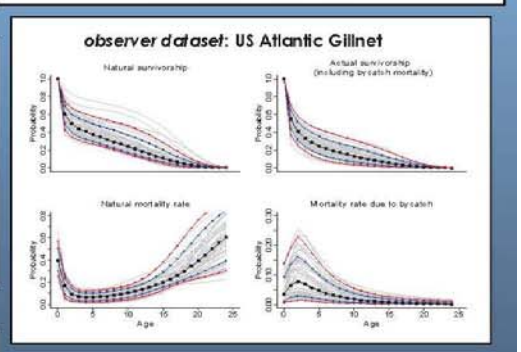


Implications:
- identify overlap of animal distributions & fishing effort in time & space
- identify role of oceanographic variables

Contact: Ramunas Zydelis (zydelis@duke.edu)

population-level impacts of bycatch

Question:
Can we use strandings and bycatch data to estimate unobservable demographic traits of marine mammals?



Implications:
- improve population assessments
- estimate impact of bycatch

Contact: Jeffrey Moore (jemoore@duke.edu)

Utilisation of fisheries observers in mapping the distribution of deep-sea corals in the northwest Atlantic

V.E. Wareham[1, 2], J.R. Firth[1] and Reuben Beazley[3]

[1.] *Department of Fisheries and Oceans Canada, Northwest Atlantic Fisheries Centre, St. John's – Canada*
[2.] *Memorial University, St. John's – Canada*
[3.] *Seawatch Inc., St. John's – Canada*

Extended Abstract

Introduction

The Fisheries Observer Program (FOP) of the Department of Fisheries and Oceans' (DFO) Newfoundland Labrador (NL) Region has a dual mandate: monitoring compliance to fisheries regulations and the collection of scientific and technological data. The introduction of Canada's Species at Risk Act and a movement towards an ecosystem based approach has resulted in additional demands on the program, with one of the most recent projects being the mapping of deep-sea coral distributions. The coral project was a joint effort between DFO and Memorial University (MUN). Data came from two sources; the FOP and DFO Research Surveys. The primary goals of the project are to determine the geographic and bathymetric distribution of deep-sea corals in the Northwest Atlantic Ocean, and to determine which species of deep-sea corals were represented.

Methods

The NL Deep-Sea Corals Project has been utilising platforms of opportunity to collect data from Observers onboard commercial fishing vessels and from DFO Research Surveys. Coral identification guides and sampling protocols were developed and training provided to Observers. Coral records and samples were collected opportunistically by Observers. Samples submitted to MUN/DFO were identified using gross and polyp morphology, and, in some cases, sclerite descriptions using Scanning Electron Microscopy. A ranking system was developed, and was used to qualify individual Observer coral records. Coral records ranked $\geq$ 0.7 were grouped by taxonomic Order and mapped.

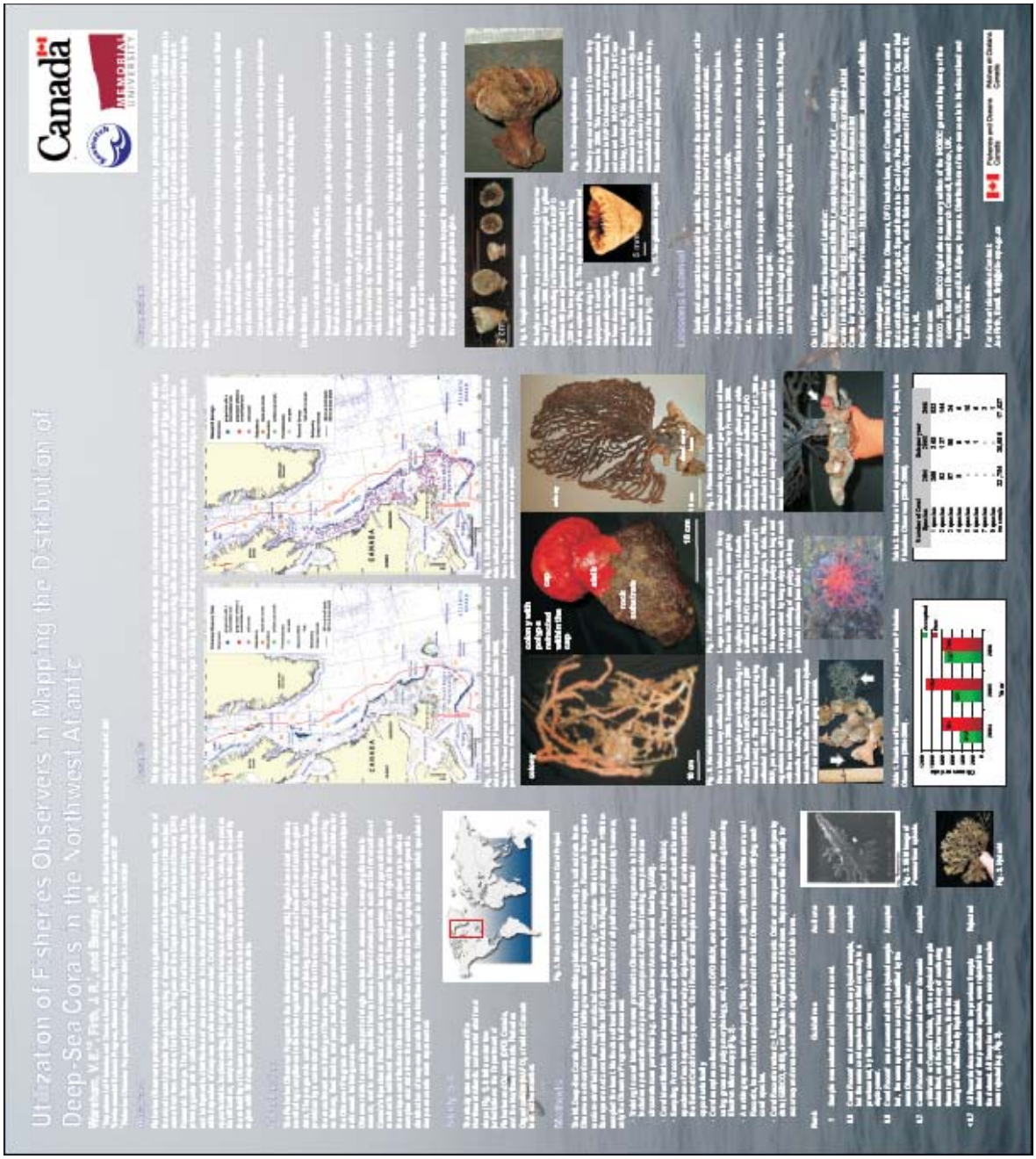
Results and Discussion

Thirty deep-sea coral species were identified with corals broadly distributed along the continental shelf edge and slope, with most species found deeper than 200 m; only nephtheid soft corals were found on the shelf. Coral distributions were highly clustered, with most co-occurring with other species. The Observer Program has contributed to this project by providing 1,710 coral records. Where areas overlapped there was a high correlation between Observer and Research Survey data. Observer participation in the project has been beneficial in spite of some data limitations and operational issues.

Benefits: Observers deployed to fixed gear fisheries provide coral samples from areas that are not fished by Research Surveys with specimens collected being more intact. Commercial fishing vessels operate in a wider geographic area over the entire year and cover greater depth ranges than Research Surveys. Observers provide independent unbiased reporting and a cost-effective way of collecting data.

Data limitations: Observer data is biased by fishing effort. Research Surveys are standardised by depth, gear, and length of tow; sets from the commercial fisheries are not. Observer data reflects a generalised area of capture because positional data is from start of tow. Depth recorded by Observers is average depth fished and may not reflect the actual caught depth. Presence or absence of corals cannot be inferred as an Observer's ability to monitor the catch is limited by catch size, time, and other duties.

Operational issues: Turnover rate within the Observer corps is between 10 – 15% annually, requiring ongoing training and support. Numerous operational issues impact the ability to collect, store, and transport coral samples throughout a large geographic region.


Canada
MEMORIAL UNIVERSITY
Utilization of Fisheries Observers in Mapping the Distribution of Deep-Sea Corals in the Northwest Atlantic

A strategy for improving outreach in fisheries observer programs

Samantha Brooke

National Marine Fisheries Service – USA

Abstract

NOAA's National Marine Fisheries Service (NMFS) defines outreach as two-way communication between the agency and stakeholder groups that establishes and fosters mutual understanding, promotes involvement, and influences behaviors, attitudes and actions with the goal of improving the foundations for stewardship of the nation's living marine resources. As a conservation and management agency, NMFS has a requirement to provide clear information to stakeholders across a broad spectrum. Key observer program stakeholder groups include fisheries observers, industry members, environmental interest groups, and fisheries managers. Stakeholder involvement is critical to observer program success: research in the social sciences demonstrates that a lack of communication and outreach activities can directly affect the collection of the data and its resulting quality. Research also indicates that participation in the management process will improve stakeholder buy-in by increasing opportunities for involvement as well as transparency in the management process. Appropriate staffing and budget resources are needed to effectively conduct communication and outreach activities, especially prior to the implementation of a new observer program. The NMFS National Observer Program (NOP) recently developed a National Outreach Strategy to coordinate and support observer program communication at both a national and regional level. Observer data are used for a variety of scientific and regulatory purposes; therefore, the NOP outreach strategy is designed to promote stakeholders' understanding of the importance of observer programs and their relationship to fisheries management.

A Strategy for Improving Outreach in Fisheries Observer Programs

Samantha Brooke, National Marine Fisheries Service (NMFS)
National Observer Program

Identify

Why should observer programs invest in outreach?

✓**Commitment to Stakeholders**
Accomplishment of NMFS stewardship mission depends upon open and honest exchange with Agency stakeholders (individuals or groups with an interest in the agency's actions).

✓**Outreach Impacts Data Quality**
Research demonstrates that outreach activities improve data collection and data quality through the timely detection and correction of problems.

✓**Increased Participation = Increased Support**
Outreach improves support for observer programs among stakeholders by increasing opportunities for involvement in the management process.

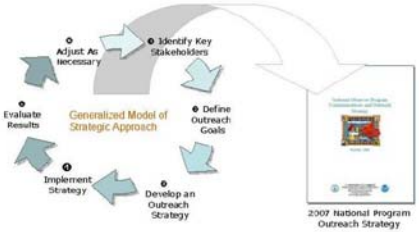
Developing a Cohesive Approach for U.S. Observer Programs

In 2004, the U.S. Office of Inspector General recommended NMFS develop an observer program outreach strategy, including guidance regional program managers could use to establish and reach their outreach goals

Map of U.S. commercial fishery observer program offices located at NMFS Regional Offices ("Region") and Science Centers ("Center").

Plan

Utilizing a strategic approach is recognized as a key element in the development of an effective framework for any stakeholder involvement process.



The National Observer Program (NOP) Outreach Strategy

Target Audiences

Fisheries Managers
Fishermen and the Fishing Industry
Observers
Non-Governmental Organizations
} Outreach Priority (stakeholder groups)

General Public } Raising awareness of observer programs with the general public is a longer term goal of the NOP.

Goal: promoting stakeholders' understanding of the importance of observer programs and their importance in U.S. fisheries management

Share

Best Practices are activities or materials that may lend themselves to being replicated across one or more programs.

The NOP Outreach Strategy promotes sharing of resources across regions and programs. Examples of best practice materials/activities include:

✓**Print**: brochures, fact sheets, flyers, vessel selection letters, annual reports, news releases
✓**Electronic**: program websites, videos, radio interviews, emails
✓**Personal Contact**: coordinated presence at trade shows and conferences, stakeholder meetings/presentations
✓**Visuals**: useful giveaways- pens, mugs, tee-shirts, etc., observer program artwork,
✓**Other**: Requests for program feedback

National Program Tee-Shirt with Ray Troll Artwork

NMFS Keychain

NMFS Booth

Program website

Program Fact Sheet

Annual Report

Questions, Comments, or Suggestions?
Send them to: Samantha.Brooke@noaa.gov
Program Website: www.st.nmfs.gov/st4/nop/index.html

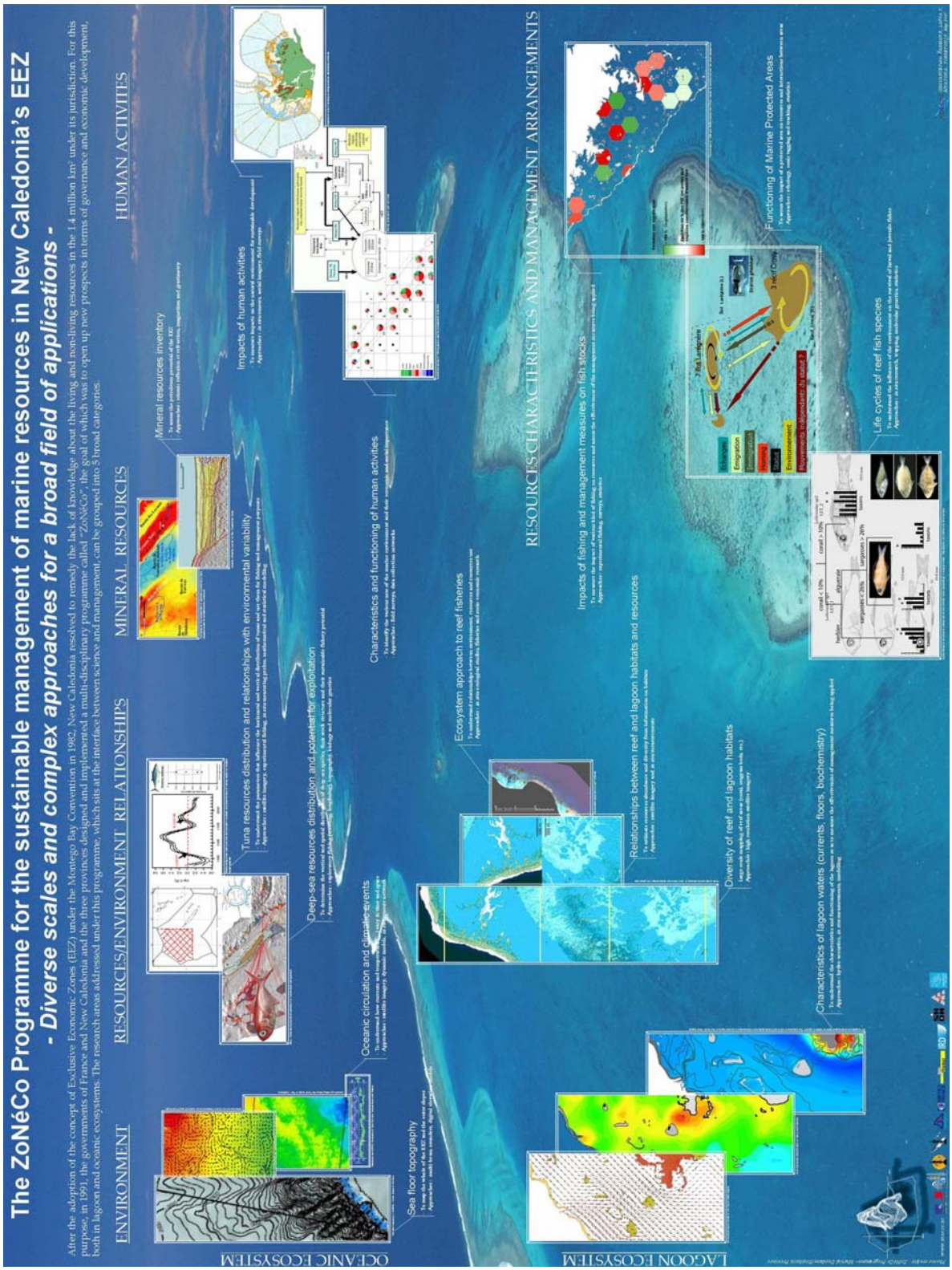
The ZoNéCo Programme for the sustainable management of marine resources in New Caledonia's EEZ – Diverse scales and complex approaches for a broad field of applications

Pablo Chavance*, R. Farman, Y. Lafoa, A. Rivaton and J.P. Torreton

ZoNéCo Program – New Caledonia

Abstract

The Montego Bay Convention, adopted on December 10 1982, officially established the concept of Exclusive Economic Zones (EEZs) extending 188 nautical miles beyond territorial waters. In New Caledonia, in order to remedy the lack of knowledge on EEZ' living and non-living resources, the Governments of France and New Caledonia and its three Provinces, together with Nouméabased research institutions, have designed and launched in 1991 the multi-disciplinary programme called ZoNéCo, aimed at opening new avenues for both EEZ governance and economic development. Extending activities to the lagoon, an exercise commenced in 1999, has become a priority under the 2000 – 2004 plan. With regard to living resources, the programme's objectives have moved on from a prospecting and resource-evaluation approach to management issues or, at least to management decision-making support, with the aim of optimising economic development based on the sustainable use of New-Caledonia's living marine resources. This poster schematically represents the diversity of study's scales and the complexity of scientific disciplines and methods that are called upon, such as swathmapping and seabed imaging, gravity, magnetism, seismic, physical oceanography, satellite remote sensing, phytoplankton biology, fisheries science, and habitat. We can gather studies in 5 major categories, from environment, to resources-environment relationships, to petroleum assessment, to human pressure and to management tools assessment. Over the last 13 years, the multidisciplinary results of the current ZoNéCo programme have led to an improvement in the knowledge of the marine environmen that surrounds New Caledonia, both on lagoon and oceanic compartment.


The ZoNéCo Programme for the sustainable management of marine resources in New Caledonia's EEZ
- Diverse scales and complex approaches for a broad field of applications -
After the adoption of the concept of Exclusive Economic Zones (EEZ) under the Montego Bay Convention in 1982, New Caledonia resolved to remedy the lack of knowledge about the living and non-living resources in the 1.4 million km² under its jurisdiction. For this purpose, in 1991, the governments of France and New Caledonia and the three provinces designed and implemented a multi-disciplinary programme called "ZoNéCo", the goal of which was to open up new prospects in terms of governance and economic development, both in lagoon and oceanic ecosystems. The research areas addressed under this programme, which sits at the interface between science and management, can be grouped into 5 broad categories.
ENVIRONMENT
RESOURCES/ENVIRONMENT RELATIONSHIPS
MINERAL RESOURCES
HUMAN ACTIVITIES
RESOURCES CHARACTERISTICS AND MANAGEMENT ARRANGEMENTS
OCEANIC ECOSYSTEM
LAGOON ECOSYSTEM
Sea floor topography
Oceanic circulation and climatic events
Deep-sea resources distribution and potential for exploitation
Tuna resources distribution and relationships with environmental variability
Mineral resources inventory
Characteristics and functioning of human activities
Impacts of human activities
Characteristics of lagoon waters (currents, floods, biochemistry)
Diversity of reef and lagoon habitats
Relationships between reef and lagoon habitats and resources
Ecosystem approach to reef fisheries
Impacts of fishing and management measures on fish stocks
Life cycles of reef fish species
Functioning of Marine Protected Areas

Observers as educators in the fishing community

Jon L. Combs

NOAA Fisheries – Pacific Islands Observer Program, Hawaii – USA

Abstract

The goal of observer programs is to provide high quality data about the catch of target and non-target species to maintain a sustainable fishery and monitor interactions with protected and endangered species. However, resources limit coverage levels in some fisheries such that there is still some amount of uncertainty that managers must deal with. On unobserved trips, fishermen are often reluctant to share information with fishery managers because they are afraid that the consequences of reporting events may be a closed fishery. Also, fishermen are often unable to identify catch and do not have the tools to try. In addition to data collection, having observers onboard commercial fishing vessels offers an outreach opportunity. The extensive amount of personal contact observers have with crews offers an unprecedented opportunity to pass on knowledge and materials to encourage fishermen to help in preserving resources. With minimal effort and cost, a large impact can be made on the knowledge base of the fishermen and can improve relationships between fishermen and fishery managers. Observers can reinforce the importance of accurate logbook data on unobserved trips. They also have the opportunity to provide hands-on protected species handling training that cannot be provided in class room situations like protected species workshops. While efforts by observers such as those previously described indeed exist today, they are informal at best and are likely inconsistent between observers. Therefore, a formal training should be provided to 'seasoned' observers to educate crews and captains, especially in situations involving protected species. In addition, observers should be provided materials to leave with crews for reference on later, unobserved trips. These efforts will likely serve to encourage fishermen to correctly handle protected species and record more accurate information on unobserved trips, thereby allowing the observer program to have a positive impact on the fishery even when observers are not onboard.

Observers as Educators in the Fishing Community

Combs, J.L., NOAA Fisheries

Introduction

There are currently approximately 42 different fisheries monitored by observer programs in the United States and many more around the world. Each of the programs share common goals: to provide high quality data concerning the catch of target and non-target species, to maintain sustainable fisheries and to monitor interactions with protected and endangered species. Reported catch levels and the number of interactions with other species vary greatly between observed and unobserved trips. This is often a result of insufficient data from fishermen due to the lack of knowledge of proper procedures in reporting and fear of accurately reporting will adversely affect the fishery. With a small amount of effort observers could educate and encourage fishermen to more precisely report fishing operations and give managers a better perspective into the actualities of the fisheries.

The Role of Observes

Observers serve as a liaison between the fishing community and the National Marine Fisheries Service and are often the recipients of complaints ranging from poor weather, to lack of fish, to decreased quotas, to changes in regulations. Generally we are not given enough information to explain or even redirect many of the questions posed to us on a regular basis. By giving observers more information to pass along to the fishermen not only will fishermen gain a greater understanding of what is going on in the fishery, but also look more favorably on observers and our role in the fishery.

Educating Observers to Educate Fishermen

The backgrounds of observers are as diverse as those of the fishermen they work with. Experience can range from never having seen the ocean to former fishermen with years of experience at sea. In order to be useful educating fishermen, observers must first be comfortable in their job and their work environment. For this reason it is best to only assign these extra duties to experienced observers in order for this to be safely and accurately done. Providing seasoned observers with educational materials and additional training can extend the influence of the observer program with little cost and potentially have great returns.

Abstract

The goal of observer programs is to provide high quality data about the catch of target and non-target species to maintain a sustainable fishery and monitor interactions with protected and endangered species. However, resources limit coverage levels in some fisheries such that there is still some amount of uncertainty that managers must deal with. On unobserved trips, fishermen are often reluctant to share information with fishery managers because they are afraid that the consequences of reporting events may be a closed fishery. Also, fishermen are often unable to identify catch and do not have the tools to try. In addition to data collection, having observers onboard commercial fishing vessels offers an outreach opportunity. The extensive amount of personal contact observers have with crews offers an unprecedented opportunity to pass on knowledge and materials to encourage fishermen to help in preserving resources. With minimal effort and cost, a large impact can be made on the knowledge base of the fishermen and can improve relationships between fishermen and fishery managers. Observers can reinforce the importance of accurate logbook data on unobserved trips. They also have the opportunity to provide hands-on protected species handling training that cannot be provided in class room situations like protected species workshops. While efforts by observers such as those previously described indeed exist today, they are informal at best and are likely inconsistent between observers. Therefore, a formal training should be provided to "seasoned" observers to educate crews and captains, especially in situations involving protected species. In addition, observers should be provided materials to leave with crews for reference on later, unobserved trips. These efforts will likely serve to encourage fishermen to correctly handle protected species and record more accurate information on unobserved trips, thereby allowing the observer program to have a positive impact on the fishery even when observers are not onboard.

Education

Education can occur in the form of casual conversations with the captains and crews, as educational materials passed on by observers, or as directed help sessions. The following are all educational assistance observers are able to offer fisherman.

- Help in Identification in Caught Animals
- Assistance in filling out Logbooks
- Relaying Proper Procedures in Handling Protected Species
- Pass on Materials provided by Port Coordinators
- Encourage higher safety standards for all vessels
- Communicate questions between the government and the fisherman

Conclusions

Using observers as educators in the fishing community is a cost effective idea that has great potential to increase the effectiveness of the observer program as a tool for fisheries managers. By using observers that are already in the field and in constant contact with the vessels to better educate them in regulations and safety procedures the observer program can extend its impact beyond just the trips that observers are aboard and have a greater impact on the fisheries.

Guardians of the sea: A collection of international fisheries observer short-stories

Keith Davis

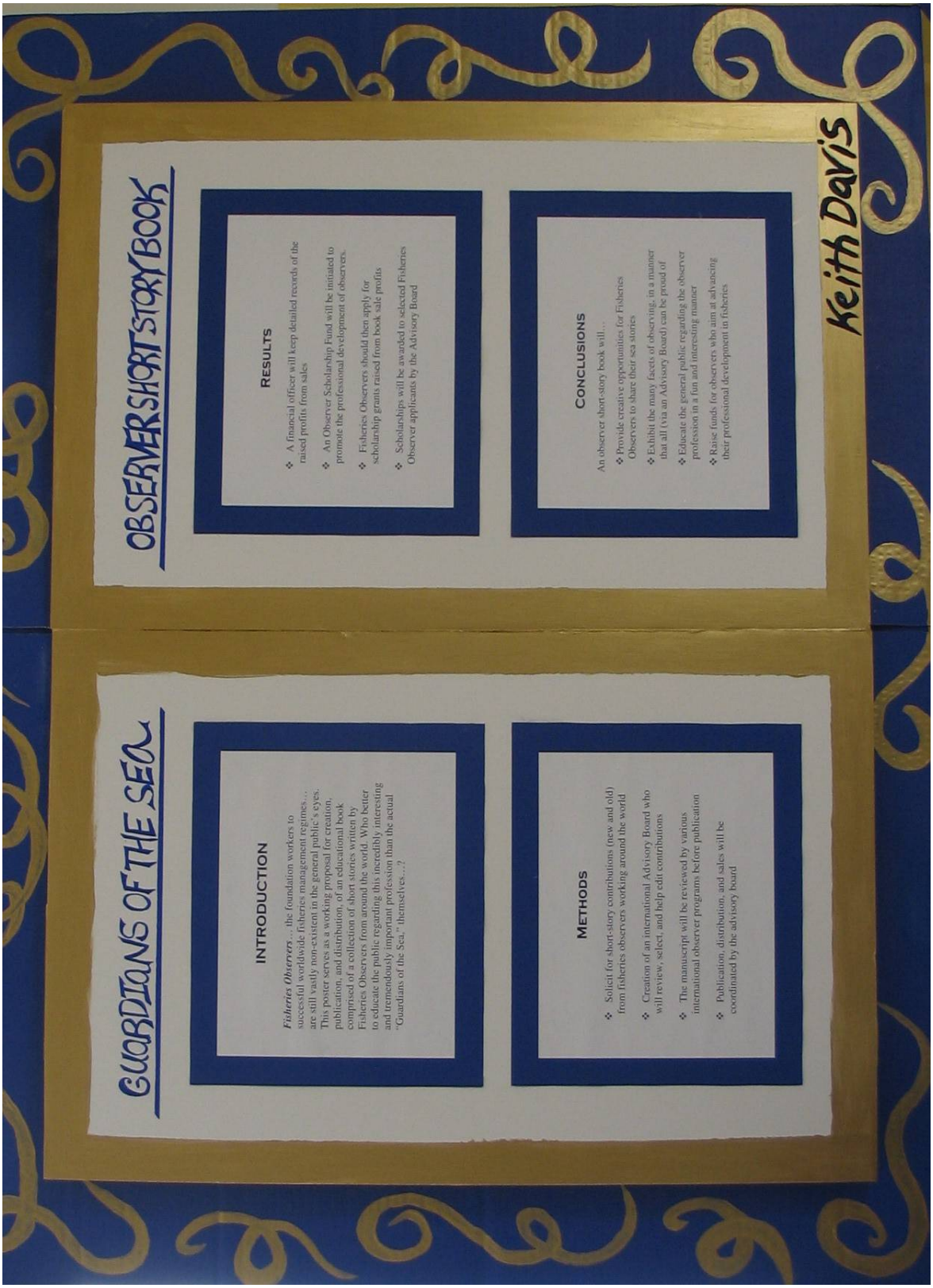
Fisheries Observer, US North Pacific and Pacific Islands – USA

Extended Abstract

To help inform the general public in regards to the Fisheries Observer profession, to promote worldwide observer programs, and to generate funding for future observer career advancement opportunities, I propose the creation of an educational novel comprised of a collection of international Fisheries Observers' short stories. With an international Advisory Panel to coordinate and edit the book, the goal is to create a product that many can be proud of. The majority of the proceeds generated through published sales shall be reserved for helping fisheries observers attend future IFOCs and to help fund other observer career advancement opportunities (i.e., international observer exchange). The General Plan follows in chronological order:

Create an international Advisory Panel to review and direct the publication. The Observer Professionalism Working Group (OPWG) of the IFOC has agreed to take on this role.
Solicit for Observer short-story authors and illustrators from around the globe, encompassing a wide variety of fisheries and exhibiting broad composition content. A poster will be available.
The OPWG will gather all submissions by a designated deadline and begin to select and organise appropriate contributions for the novel.
Coordinate with the OPWG editing the submitted short stories and creative works and include both a Forward and an Afterward to complete the book.
Upon completion, the manuscript should undergo a review period (by numerous international observer and observer program stakeholders).
At the same time, The OPWG, will solicit for publishers, assign a treasurer and make general decisions upon proceed allocations.
Observer applicants can thereafter apply to the OPWG for scholarships extracted from the generated funds.
Please contact: Keith Davis – lblegend@yahoo.com or Glenn Quelch – Glenn.QUELCH@ec.europa.eu for all affairs associated with this project.

Acknowledgements: this project is inspired in part by a project initiated be Jeannette Alas, while working as a fisheries observer in the US north pacific.


GUARDIANS OF THE SEA
INTRODUCTION
Fisheries Observers… the foundation workers to successful worldwide fisheries management regimes… are still vastly non-existent in the general public's eyes. This poster serves as a working proposal for creation, publication, and distribution, of an educational book comprised of a collection of short stories written by Fisheries Observers from around the world. Who better to educate the public regarding this incredibly interesting and tremendously important profession than the actual "Guardians of the Sea," themselves…?
METHODS
Solicit for short-story contributions (new and old) from fisheries observers working around the world
Creation of an international Advisory Board who will review, select, and help edit contributions
The manuscript will be reviewed by various international observer programs before publication
Publication, distribution, and sales will be coordinated by the advisory board
OBSERVER SHORT STORY BOOK
RESULTS
A financial officer will keep detailed records of the raised profits from sales
An Observer Scholarship Fund will be initiated to promote the professional development of observers.
Fisheries Observers should then apply for scholarship grants raised from book sale profits
Scholarships will be awarded to selected Fisheries Observer applicants by the Advisory Board
CONCLUSIONS
An observer short-story book will…
Provide creative opportunities for Fisheries Observers to share their sea stories
Exhibit the many facets of observing, in a manner that all (via an Advisory Board) can be proud of
Educate the general public regarding the observer profession in a fun and interesting manner
Raise funds for observers who aim at advancing their professional development in fisheries
Keith Davis

Pilot survey on the challenges of the Hawaii Longline Observer Program: The observer perspective

Karla Gore[1] and Dawn Golden[2]

[1] *Former NOAA Observer – USA*
[2] *NOAA Fisheries Observer Program – USA*

Abstract

Fisheries observers are integral to marine resource management because of their role in compliance monitoring, quota allocation, and protected species interactions. In Hawaii, as elsewhere, observers are commonly challenged by health and safety issues, language and cultural barriers, and isolating circumstances. This poster presents a pilot survey of observers in the Hawaii longline fishery and identifies themes of concern among them. To provide preliminary case studies for this pilot survey, observers were interviewed regarding their interactions with fishermen, observer contractors, policy makers and industry professionals. Observers voiced concerns ranging from sexual harassment to illegal disposal of marine debris at-sea. Many of these stories have gone unheard. We hope that presenting these initial interviews will spark interest and begin a conversation about observers' shared experiences. Acknowledging the challenges that current observers face can benefit observer programs, but relating observer stories can bring to life this unique profession.

Pilot Survey on the Challenges of the Hawaii Longline Observer Program: The Observer Perspective

Karla Gore
Former Observer, Honolulu, HI

This poster presents a pilot survey of observers in the Hawaii longline fishery and identifies themes of concern among them. To provide preliminary case studies for this pilot survey, six current and previous Hawaii longline observers were interviewed regarding their interactions with fishermen, observer contractors, policy makers and industry professionals. Due to time constraints, this study focused only on observers and does not illustrate a complete picture of the Hawaii longline observer program. Future phases of this project will discuss these concerns with other professionals in the Hawaii longline observer program.

Observers voiced concerns ranging from health and safety issues, the observer lifestyle and career opportunities. This poster presents perceptions from the observer perspective and does not attempt to make claims about the Hawaii Longline Program in general. Presented below are direct quotes from observers related to the challenges raised in the discussions.

HEALTH & SAFETY

"I feel that the safety training [part of NMFS observer training] was good and prepared me to take care of myself in an emergency. I feel that I am better trained on what to do than the fishermen."

"Once I get on the boat, I check to make sure where the life raft is and all of the other safety equipment and then I feel better."

" I tried and tried to reach the USCG in Hawaii but was only able to get a hold of the USCG in Juneau. It didn't make me that confident with the Coast Guard."

" We had a fire onboard our vessel but the captain and crew were so calm and prepared that it didn't make me nervous."

" Our vessel broke down 600 miles from shore and we drifted for 10 days. Finally, another vessel towed us in with a super short line between the two boats, which kept breaking. It was not a safe situation."

" The captain would just turn on the radar alarm instead of standing watch at night. It was unnerving and a cause of great worry."

" It is a little weird getting used to using a bucket [as a toilet] but I usually work out a system with the crew for privacy and it isn't that bad."

"The bedbugs are a real problem. Your bed is really your only sanctuary out there and if that isn't a comfortable place to be—it becomes miserable."

"The bedbugs on some of the vessels are too horrible for anyone to deal with. I came back with bites all over my body. The roaches become your buddies but the bedbugs—that is the real problem."

LIFESTYLE

" I started observing to escape and get away from it all. I have done that and had a great adventure."

"The job enabled me to make a bunch of money to pay off my loans and save up for travel but it makes it hard to have normal relationships and to actually put down roots in any particular place."

"You get addicted to the lifestyle. The money, the time off, the freedom. You try to leave but then you get pulled right back in."

"You are out at sea eating rice and fish and starving. Then you come back to land—drink and eat for a few days and then go back out. It is hard on your body with no consistent exercise and such a bad diet. Things got better when I started taking out my own food."

" Once I got really into surfing, I just couldn't stand being out there. I kept thinking about the surf and what I was missing. That was the turning point for me."

"It's so hard to make friends with non-observers and get involved with things on land. I was here in Hawaii for awhile and hadn't really had a chance to see Hawaii."

" When you come back from sea, you have bills piled up and collection agencies after you. It is kind of hard to explain that you were out at sea for 45 days. It is hard to catch up."

" When I decided to stop observing, I had to quit for awhile in order to find a job. I didn't want to risk missing an interview or job opening."

" It is really hard to plan. I was supposed to go on a short trip but it ended up being much longer. My family had planned their vacation around my estimated trip length and I ended up missing them—and I had no way to really contact them."

" It was great being out there. It gave me chance to take a break from my regular life and just relax and slow down a bit."

CAREER OPPORTUNITIES

" I might observe again—in a foreign country for a couple of months—but nothing more."

" I have limited myself to 17 trips. Once I do that, it will be time to move on."

" There aren't a lot of options with the observer program. I might try to work as a debriefer or I might do something else entirely."

" There don't seem to be a lot of options in the Hawaii longline observer program. You are either an observer or a debriefer. Not many others get other management positions in the NOAA (Pacific Islands Regional) Office."

" I'll be observing for awhile. It is the lifestyle that I have chosen for myself. I'll see where it takes me."

" I've learned a lot and had great experiences but I think I need to get a Masters degree and to try to work in terrestrial resource management."

" This is a job that you can't do forever without going slightly crazy."

These initial interviews with observers were very interesting and provide many opportunities for further discussion. All of the observers had fascinating stories about their experiences as observers and many of these stories have gone unheard. It is my hope that these initial interviews will spark interest and begin a conversation about observers' shared experiences worldwide. This pilot project is the first part of a larger project which will discuss similar concerns with observers and observer related professions in other programs worldwide.

For more information on this pilot survey or if you would be willing to participate in future discussions on observer programs; please contact:

Karla Gore, karlagore@gmail.com, (206)-697-8294

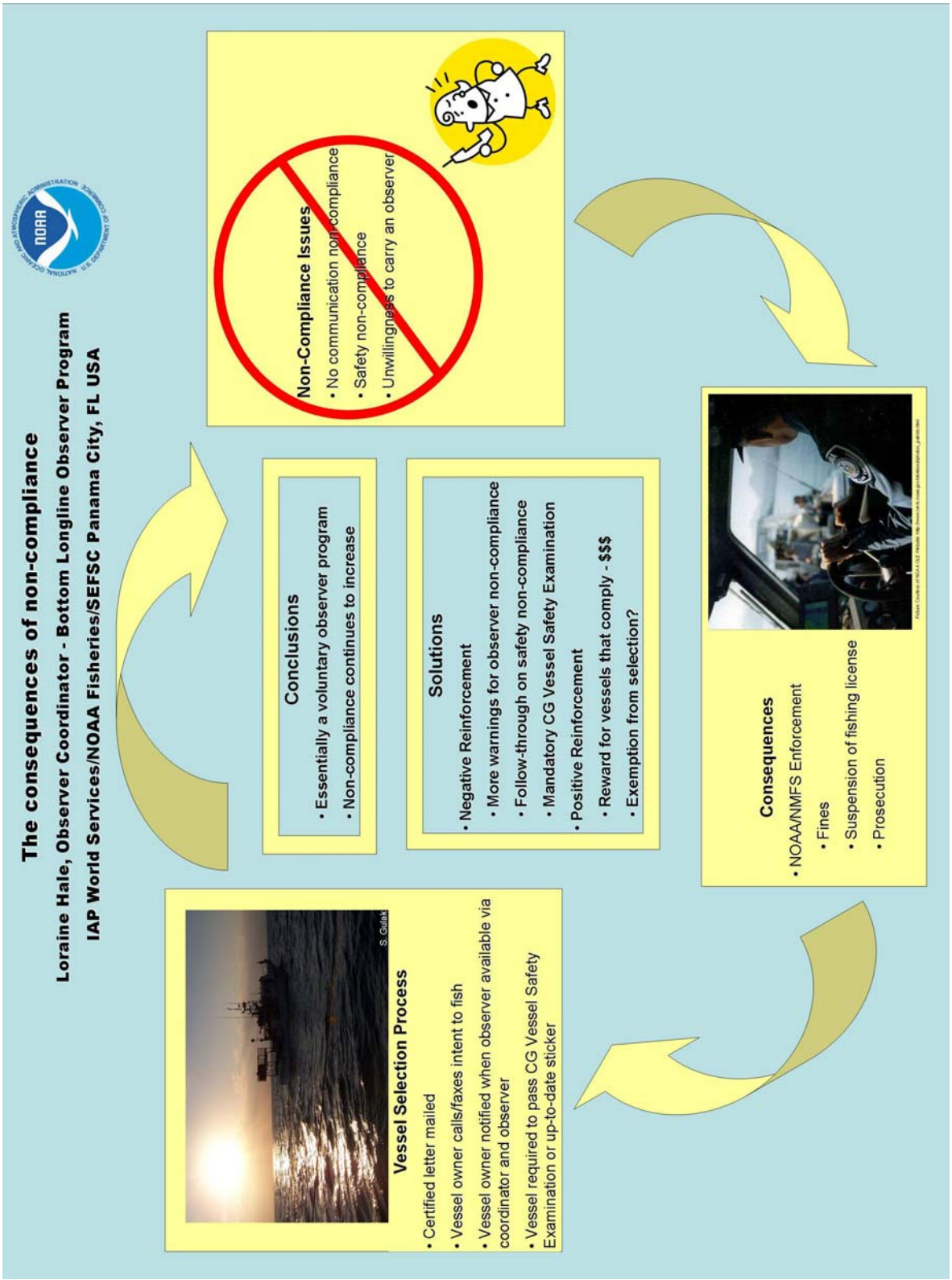
The consequences of non-compliance

Lorraine Hale

Bottom Longline Observer Program, NOAA Fisheries – USA

Extended Abstract

Vessels are selected for observer coverage by the Bottom Longline Observer Program and notified via certified mail. Vessels must contact the program to notify of intent to fish, after which observers are assigned. Noncompliance by vessels is defined as not participating in the observer program after having been selected for coverage in a defined season. Noncompliance can be due active due to not notifying the observer program of fishing activity or avoiding the observer or willfully fishing without an observer, or passive due to safety violations or fishing regulation violations. Observer programs must coordinate with the U.S. Coast Guard, NMFS Enforcement, and NOAA Office of Law Enforcement in cases of noncompliance. The consequences of noncompliance are not well defined and the contact person is not widely known. There are also may be problems with future coverage if a boat is found to be noncompliant. Developing a strategy to improve vessel compliance must be a goal of any observer program, whether through negative or positive reinforcement.


The consequences of non-compliance
Loraine Hale, Observer Coordinator - Bottom Longline Observer Program
IAP World Services/NOAA Fisheries/SEFSC Panama City, FL USA
Vessel Selection Process
• Certified letter mailed
• Vessel owner calls/faxes intent to fish
• Vessel owner notified when observer available via coordinator and observer
• Vessel required to pass CG Vessel Safety Examination or up-to-date sticker
S. Gelsleh
Conclusions
• Essentially a voluntary observer program
• Non-compliance continues to increase
Solutions
• Negative Reinforcement
• More warnings for observer non-compliance
• Follow-through on safety non-compliance
• Mandatory CG Vessel Safety Examination
• Positive Reinforcement
• Reward for vessels that comply - $$$
• Exemption from selection?
Non-Compliance Issues
• No communication non-compliance
• Safety non-compliance
• Unwillingness to carry an observer
Consequences
• NOAA/NMFS Enforcement
• Fines
• Suspension of fishing license
• Prosecution

Why are quota species being discarded in the Southern and Eastern Scalefish and Shark Fishery?

Matt T. Koopman*, A.S. Gason and T.I. Walker

Department of Primary Industries, Queenscliff, Victoria – Australia

Abstract

Approximately 2,860 tonnes of quota species and 12,800 tonnes of non-quota species are discarded annually by the Southern and Eastern Scalefish and Shark Fishery. In response direction from the Minister for Environment and the Heritage, Australian Fisheries Management Authority is committed to significantly reduce discarding of both quota and non-quota species. Reducing discards will benefit the fishery from both ecological and economic perspectives. To reduce discarding, it is important to understand the driving factors. This study investigated the factors influencing the variability of discarding of quota species on four temporal scales – shot, trip, month and annual – using observer data collected since 1992 and Industry interviews. Discard rates and influencing factors were highly variable at all temporal scales. Results have been used to suggest ways of reducing discards. Methods developed can be used to investigate variability in discarding of non-quota species.

DEPARTMENT OF PRIMARY INDUSTRIES

Primary Industries Research Victoria

Marine and Freshwater Systems

Why are quota species discarded in the South East Trawl Fishery?

Koopman, M.T.*, Gason, A.S*. and Cocking, L.**

* DPI Queenscliff, Victoria, Australia

** Australian Fisheries Management Authority (AFMA), Canberra

The South East Trawl Fishery

One of Australia's most valuable fisheries is the South East Trawl Fishery. It has 118 active fishing permits, which use the otter trawling and Danish seine methods of fishing. The boundaries of the fishery extend from Barranjoey Point, off New South Wales (33°35'' S) to Cape Jervis, South Australia (138°08'' E) (Figure 1). Total landings of ~28,000 t are recorded each year, valued at ~$66 million. The fishery supplies most of the fresh fish for the Sydney, Melbourne and Tasmanian markets.

Figure 1. Area of the South East Trawl Fishery

Onboard observations

Monitoring discards in the fishery began towards the end of 1992 after the introduction of output controls that limited catches. An 'adaptive survey design strategy' was developed that utilises past information as well as the most recent logbook and observer data to revise the Integrated Scientific Monitoring Program (ISMP) sampling strategy on an annual basis.

The ISMP covers approximately 2.5% of effort in the fishery, recording retained and discarded catches, length-frequency data, operational data, and collecting otoliths.

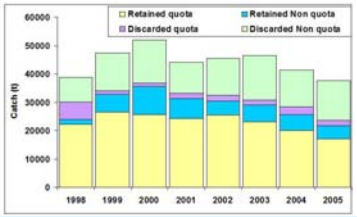
Discarding in the SETF

Approximately 2,860 t of quota species and 12,800 t of non-quota species are discarded annually by the fishery (Figure 2). Discard rates vary greatly by species. In 2005 the main quota species discarded were blue grenadier, spotted warehou, and blue warehou. Large spatial and temporal variations in discard rates are also observed.

In response to a Commonwealth Government Directive, AFMA has made discarding of species subject to total allowable catch limit or quota management illegal in the fishery by December 2007.

The fishery faces huge challenges to meet its obligations. This study aims to identify the factors affecting discard rates using information from three different data sources, analysis of observer data, industry interviews and fishery observer reports.

Figure 2. Retained and discarded quota and non-quota species in the fishery



Methods

- A list of possible factors affecting discard rates of quota species was identified (see Table 1; based on Rochet and Trenkel, 2005) - discard rate is the product of weight discarded and total catch
- 3 data sources were use to identify which factors were likely to affect each species :
  1. observer data (1992-2005) - analysed using GENMOD in SAS
  2. industry interviews undertaken during port visits
  3. anecdotal observer reports and interviews

Models tested

(See Table 1 for description of variables)

Annual Discard rate = Zone + TACJ + TACD + Rec(various lag times) + ε

Monthly Discard rate = Year + Month + Zone + $ + TACM + MCatch + ε

Trip Discard rate = Year + Zone+ TripD +Tcatch + L50 + ε

Shot Discard rate = Year + Month + Depth + Zone + SCatch + ShotD+ ε

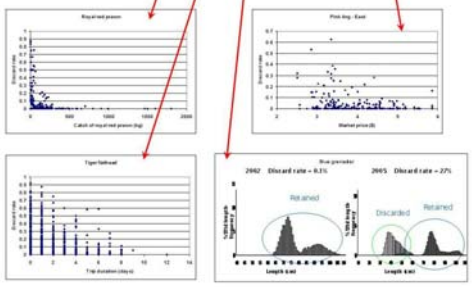
Table 1. Hypotheses tested using GENMOD procedure.

Hypothesis tested	Temporal scale of test	Independent Variable	Variable code	Source of Independent Variable	Dependent variable
Discard rate differs from year to year	**Annual**	**Year**	**Year**		**Annual discard rate**
TAC creates incentives for discarding	Annual	%TAC caught as of end of June	TACJ	Receiver data compared to TAC from AFMA	Annual discard rate
TAC creates incentives for discarding	**Annual**	**%TAC caught as of end of June / Recruitment**	**TACD**	**Receiver data compared to TAC from AFMA**	**Annual discard rate**
Year-class strength determines discard rates	Annual	Recruitment	Rec	Annual indexes of abundance from CSIRO stock assessments	Annual discard rate
Season affects discard rates	**Monthly**	**Month**	**Month**		**Monthly discard rate**
Market prices affect discard rates	Monthly	Average market prices	$	CPI adjusted market prices from the Sydney and Melbourne Fish Markets	Monthly discard rate
TAC creates incentives for discarding	**Monthly**	**% TAC caught at start of the month**	**TACM**	**Receiver data compared to TAC from AFMA**	**Monthly discard rate**
Discard rate is related to total catch of that species in the month	Monthly	Total catch of that species in the month	MCatch	SSIFP data	Monthly discard rate
Trip duration affects discard rates	Trip	Number of days in each trip	TripD	Recorded by SSIFP	Average discard rate for trip
Discard rate is related to total catch of that species	Trip	Total catch for that species	TCatch	SSIFP data	Average discard rate for trip
Length composition of catch determines discard rate	**Trip**	**Length at which 50% of fish are discarded**	**L50**	**Estimated from length frequencies collected by SSIFP**	**Average discard rate for trip**
Shot duration affects discard rate	Shot	Shot duration (hours)	ShotD	Recorded by SSIFP	Discard rate for each shot
That depth affects discard rate	**Shot**	**Average depth of shot**	**Depth**	**Recorded by SSIFP**	**Discard rate for each shot**
Catch of that species affects discard rate	Shot	Catch of that species per shot	SCatch	SSIFP data	Discard rate for each shot

Table 2. Summary of factors affecting discard rates from 3 data sources; A=data analysis (+/- denotes direction of relationship), I=industry, O=observers.

Common name	Scientific name	Catch of that species per shot	Shot duration	Fishing trip duration	Median discard length (mm)	Amount of trawl remaining	Recruitment index	Market price ($)	Season	Total catch of that species per trip	Total catch of all species per trip
Blue grenadier	***Macruronus novaezelandiae***	**A,O**	**+A,O**	**A,O**	**-A,I**	**-A,O**	**+A,I,O**	**+A,I,O**			
Pink ling - east	*Genypterus blacodes*	-A,O	+A	-A	-I,O	-A,O	+A	-A			
Pink ling - west	***Genypterus blacodes***	**O**			**I,O**	**A,I,O**					**A**
Orange roughy	*Hoplostethus atlanticus*		+A,O	A	-A	I,O		+A	A		
Redfish south	***Centroberyx affinis***	**O**	**+A**		**I,O**	**+A,I**	**+A**	**(-)I**	**A**		**A**
Redfish south	*Centroberyx affinis*	-A		-A	A,I,O	+A,I	+A	(-)I	A	+A	-A
Mirror dory	***Zenopsis nebulosus***	**A**		**A**	**I,O**	**+A,I,O**	**I,O**	**A**			
John dory	*Zeus faber*	-A	+A		I,O	I,O					
Inshore ocean perch	***Helicolenus percoides***	**A**	**+A**	**A**	**O**	**O**		**(-)**		**A**	**A**
Offshore ocean perch	*Helicolenus barathri*	-A	+A,I		-I	+A,O		O	O	-A	-A
Tiger flathead	***Neoplatycephalus richardsoni***		**A**	**A**	**I,O[#]**	**O**		**O**			
Eastern school whiting	*Sillago flindersi*				+A,O			I,O			
Silver trevally	***Pseudocaranx dentex***				**O**	**(+)O**		**I**			
Jackass morwong	*Nemadactylus macropterus*				I,O		+A,I	O	O		
Eastern gemfish	***Rexea solandri***	**A**		**A**	**I**	**A,O**	**O**				**A**
Western gemfish	*Rexea solandri*				I						
Blue eye trevalla	***Hyperoglyphe antarctica***					**I,O**	**I,O**				
Eastern blue warehou	*Seriolella brama*			A	I,O	-A,I,O	-A,O	**(-)**			
Western blue warehou	***Seriolella brama***				**I,O**	**I,O**	**O**	**(-)**			
Spotted warehou	*Seriolella punctata*	I,O		-A,O	O	O		(-)O			
Royal red prawn	***Haliporoides sibogae***	**A**	**+A**	**(-)O**				**O**			**A**

*=NO MARKET, #=SIZE LIMITS, @=OCS AGREEMENT, &=NO MARKET FOR SMALL FISH, %=MESH SIZE



Results

- See Table 2 for summary of results. "A" denotes significant result from analysis of observer data, "I" and "O" denote that Industry and at-sea observers thought that factor was important. At-sea observers and Industry were more likely to identify quota restrictions and market price as important factors driving discarding rather than was shown in the analyses
- Analysis of observer data showed that discard rates of blue grenadier, eastern pink ling, western pink ling, northern redfish, southern redfish, mirror dory, offshore ocean perch, eastern gemfish, western gemfish, and eastern blue warehou were significantly effected by quota restrictions
- Recruitment data was only available for 10 species, and was significantly correlated with discard rates for 6 species
- Analysis showed that discard rates of 8 species increased with shot duration. Discard rate of tiger flathead decreased with shot duration
- Spatial and temporal factors were significant for nearly all species
- Catch of a species in a shot, or total catch of that species in a trip was negatively correlated in more than half of the species

References

Rochet, M.-J. and Trenkel, V.M. (2005). Factors for the variability of discards: assumptions and field evidence. *Can. J. Fish. Aquat. Sci.* **62**: 224–235.

Australian Government
Australian Fisheries Management Authority

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Find more information about DPI at www.dpi.vic.gov.au
Department of Primary Industries
PO Box 114, Queenscliff, Victoria, Australia, 3225

Data standardisation as a mode to facilitate sharing/exchanging observers between regions

Neal McIntosh

A.I.S., Inc. Northeast Fisheries Observer Program – USA

Abstract

Sharing or exchanging observers between regions might be easier to accomplish if data collection and reporting protocols were standardised between regional programs. Although not all data collection could be standardised due to regional specific needs and issues, any amount of standardisation would lead to more uniform training between regions. This uniformity would make the exchange of observers and other staff easier since they would already possess the baseline information needed to be functional in any region. An exchange program could be initiated so that once an observer was active in their home region for a predetermined amount of time, and whose data quality was good, would then be considered eligible for the program. The observer could then be exchanged to other regions and only need to complete a 'crash course' of regional differences instead of needing to go through a full training course meant for new observers. From an employer's standpoint this could help with retention of employees and might lead to each region not needing to hold full training courses as often since they would first have the exchange program pool to draw from. This alone might result in significant savings of time and money for a particular program. Also, in the event of a surplus of observers they could be put into the exchange pool instead of being laid off. From an observer's standpoint this would provide active employment during one region's slow period and reduce burnout since it would provide variety which would appeal to the sense of adventure that most observers seem to have.

Data Standardization and Observer Exchange

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A.I.S., Inc. Northeast Fisheries Observer Program
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From Top: Dutch Harbor, Alaska, Astoria, Oregon, and New Bedford, Massachusetts

Sharing or exchanging observers between regions might be easier to accomplish if data collection and reporting protocols were standardized between regional programs. Although not all data collection could be standardized due to regional specific needs and issues, any amount of standardization would lead to more uniform training between regions. This uniformity would make the exchange of observers and other staff easier since they would already possess the baseline information needed to be functional in any region. An exchange program could be initiated so that once an observer was active in their home region for a predetermined amount of time, and whose data quality was good, would then be considered eligible for the program.

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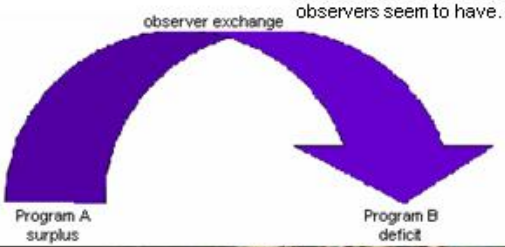
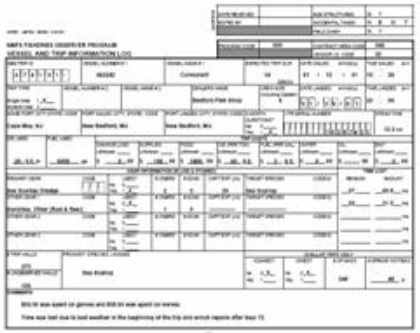




Northeast Fisheries Observer Program Vessel & Trip Log

Northwest Fisheries Science Center West Coast Groundfish Trip Form

Pollock

Barndoor Skate

The positive effects of hands-on safety training

Jon T. McVeigh* and John P. LaFargue

NOAA Fisheries West Coast Groundfish Observer Program – USA

Abstract

The West Coast Groundfish Observer Program (WCGOP) strives to incorporate realistic, hands on safety exercises and drills into their yearly observer safety trainings and briefings. These practical exercises increase knowledge retention, help foster a safety culture, and generate genuine enthusiasm during trainings. In the past, observer safety training was primarily a heavy lecture and video-based curriculum. The WCGOP has shifted to a very hands on training program. Vessel emergency drills aboard commercial fishing vessels, live flare exercises, hands-on safety equipment practicals, open water/cold water exercises, live fire exercises, use of the United States Coast Guard's (USCG) Damage Control Unit for flooding exercises and role playing casualty scenarios. This approach better prepares observers for emergencies by making them familiar with various emergency equipment and scenarios, building the confidence to be effective during an at-sea emergency. These advances in observer safety training require a safety community and would not be possible without working cooperatively with the Alaska Marine Safety Education Association (AMSEA), the USCG, and fellow observer safety trainers from other observer programs.

The Positive Effects of Hands-On Safety Training

Jon T. McVeigh and John P. LaFargue — NOAA Fisheries West Coast Groundfish Observer Program — West Coast U.S.A.

The West Coast Groundfish Observer Program (WCGOP) strives to incorporate realistic, hands on safety exercises and drills into their yearly observer safety trainings and briefings. These practical exercises increase knowledge retention, help foster a safety culture, and generate genuine enthusiasm during trainings This approach better prepares observers for emergencies by making them familiar with various emergency equipment and scenarios, building the confidence to be effective during an at-sea emergency. These advances in observer safety training require a safety community and would not be possible without working cooperatively with the Alaska Marine Safety Education Association (AMSEA), the United States Coast Guard (USCG), and fellow observer safety trainers from programs around the nation. An investment in hands-on methodology and promotion of a positive safety culture help keeps observers safe at sea. Both Fishers *and* Observers benefit from a safer at-sea work environment.

GOALS

➢ Knowledge Retention

Hands-on, realistic trainings provide:

✓ ***Muscle memory***
✓ ***Confidence and***
✓ ***Awareness***

All are ***essential*** to increase chances of surviving an emergency aboard working fishing vessels.

➢ Promote a Safety Culture

Support cross training between programs both nationally and internationally to foster a strong observer program safety culture. Collaborate with other agencies such as the US Coast Guard and help spread a positive safety culture along to the fleet.

IMPLEMENTATION

➢ **Increase small group, hands-on teaching techniques**
Generates interest & increases knowledge retention.
Remove heavy video and lecture based safety training.

➢ ***Get safety gear into the hands of observers!***

➢ **Collaboration, Cross-Training and Cooperation**
Cross train with other observer programs. Incorporate USCG safety trainers and their equipment as well as industry vessels and crew. This creates well-rounded trainers, raises the caliber of safety trainings, allows for sharing of materials and builds a positive safety culture.

RESULTS

Hands-on Training

+

Collaboration, Cross-Training and Cooperation

=

Enthusiastic, Safety Minded Observers, a stronger safety culture and safer fisheries!

Credits: Thanks to US Coast Guard, AMSEA Observer Safety Trainers and the West Coast Groundfish Fishing Industry.
Photo credits: WCGOP

The development of the observer program for the deep-sea fishery in Brazilian EEZ

Roberto Wahrlich

Universidade do Vale do Itajaí – UNIVALI University – Brazil

Extended Abstract

In 1999, the Brazilian Government passed to stimulate the chartering of foreign vessels by national companies. The presence of an onboard observer was mandatory for all the deep-sea foreign fleet. In this context, the UNIVALI University was contracted by the Federal Government in year 2000 to develop an observer program for monitoring foreign vessels operating bottom longlines, otter trawls, gillnets and pots, called PROA.

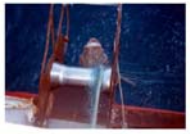
The PROA, created specific guides and data forms for each fishing method, it also was responsible for observer recruitment, training, and evaluation of the quality of observers' data. In 2001, the Government was already using the observers' information for the redefinition of permitted fishing areas for the longline foreign fleet. In 2002, the Deep-Sea Fishery Scientific Committee did the first evaluation of the monkfish (*Lophius gastrophysus*) fishery; using data from 3,793 gillnet observed sets. In 2004, the same Scientific Committee, considering the observers' data obtained in 4,497 trawls, presented a preliminary evaluation for the trawl fishery. Also, recommended several measures for the deep-sea crab (*Chaceon* spp.) fishery, based on data from 5.367 observed pot sets. The deep-sea pot and gillnet fisheries were regulated by law in 2005, which maintained in force the onboard observation scheme. Based on the experience offered by the PROA, the Brazilian Government formalise in 2006 the National Observer Program for the Fishing Industry, giving regulation to the onboard observer's work and future monitoring of any domestic fleet.

ABSTRACT

In 1999, the Brazilian Government passed to stimulate the chartering of foreign vessels by national companies. The presence of an onboard observer was mandatory for all the deep-sea foreign fleet. In this context, the UNIVALI University was contracted by the Federal Government in year 2000 to develop an observer program for monitoring foreign vessels operating bottom longlines, otter trawls, gillnets and pots, called PROA. The PROA, created specific guides and data forms for each fishing method, it also was responsible for observer recruitment, training, and evaluation of the quality of observers' data. In 2001, the Government was already using the observers' information for the redefinition of permitted fishing areas for the longline foreign fleet. In 2002, the Deep-Sea Fishery Scientific Committee did the first evaluation of the monkfish (*Lophius gastrophysus*) fishery, using data from 3,793 gillnet observed sets. In 2004, the same Scientific Committee, considering the observers' data obtained in 4,497 trawls, presented a preliminary evaluation for the trawl fishery. Also, recommended several measures for the deep-sea crab (*Chaceon* spp.) fishery, based on data from 5,367 observed pot sets. The deep-sea pot and gillnet fisheries were regulated by law in 2005, which maintained in force the onboard observation scheme. Based on the experience offered by the PROA, the Brazilian Government formalize in 2006 the National Observer Program for the Fishing Industry, giving regulation to the onboard observer's work and future monitoring of any domestic fleet.

THE DEVELOPMENT OF THE OBSERVER PROGRAM FOR THE DEEP-SEA FISHERY IN BRAZILIAN EEZ

Wahrlich, Roberto.
Universidade do Vale do Itajaí – UNIVALI University

	2000	2001	2002	2003	2004	2005	2006
Fleets monitored by observers (Number of boats)	Bottom longliners (3) Trawler (1)	Bottom longliner (1) Trawlers (7) Pot boats (2) Gillnet boats (9)	Trawlers (12) Pot boats (5) Gillnet boats (10)	Trawlers (3) Pot boats (8) Pelagic longliners (2)	Trawlers (6) Pot boats (5) Pelagic longliners (5)	Trawlers (6) Pot boats (5) Pelagic longliners (3)	Trawlers (3) Pot boats (4) Pelagic longliners (4) Domestic pot boat (1)
							
Coverage indicators	240 days 5 observers	3,175 days 32 observers	4,820 days 38 observers	2,480 days 21 observers	2,841 days 21 observers	2,819 days 22 observers	433 days 18 observers
							
Timeline							
Program evolution	Catch/Effort data; technology Observers selected by previous experience	By-catch data; biological samples Individual training	First Training Course	Establishment of protocols for seabirds and turtles		Training courses turned annually Selection included psychological exams	Periodic psychological and physical exams Monitoring of the domestic fleet
							
Legal and management remarks	Observer mandatory for deep-sea foreign fleet	Fishing areas were restricted for bottom longliners	First evaluation of the gillnet fishery, with data from 3,793 observed sets	Observers' monitoring turned mandatory for the pelagic longline foreign fleet	First evaluation of the trawl fishery, with data from 4,497 observed trawls. Management measures were recommended for the pot fishery based on data from 5,367 sets	The chartering of foreign vessels was closed	The National Observer Program was regulated by Law

A comparison between observed and unobserved vessels data of the Spanish Northeast Atlantic Bottom Trawl Fisheries

Ana Carbonell[1], I. González Herraiz[2], A. Punzón[3], J. Ruiz[2], M. Valls[1] and N. Pérez[4]

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[2] *AZTI. Isabel González Herraiz. AZTI – Tecnalia / Marine Research Division. – Spain*
[3] *Instituto Español de Oceanografía. Centro Costero de Santander. Promontorio de San Martí –Spain*
[4] *Instituto Español de Oceanografía. Centro Costero de Vigo. Cabo Estay –Spain*

Extended Abstract

Abstract

To assess the possible bias of the observers data of the bottom trawl Spanish fisheries for the last three years, 2003 – 2005, a comparison between logbooks and first sale notes information and observed vessels data are made. Logbooks and first sale notes, provided by fishermen associations, and the retained catch estimations, made onboard by the observers monitoring programme provide a data collection that should be integrated.

Introduction and methods

A regular discard sampling programme is been developed under the European fisheries data collection regulation since 2003 throughout observers on board. These data should be integrated with the information from logbooks and first sale notes provided by fishermen associations.

The programme is carried from 2003 in the North-eastern Atlantic and from 2005 in the Mediterranean fishery. Sampling is by fleet targeting species and/or by metier (fleet-targeting species and area). Random sampling on board is assumed. In the Cantabrian (ICES Divisions VIIIc, IXa) and Mediterranean seas is carried out a coastal fishery and in Bay of Biscay (VIIIabd), in Rockall (ICES Subarea VI) and West of Ireland (VII) is carried out a open sea fishery.

Hake retained catch data from observers have been compared with landings from logbooks and/or sale notes. Furthermore, results have been analysed, in order to know both the possible bias of the retained catch estimations versus the estimated landing and the different causes of these bias. Given that the sampling strategies could be one of the main related causes together with the commercial strategies, our results assess the logistic and methodological problems associated with the current sampling strategies and data collection processes.

Results

Comparisons to asses possible bias in ICES Sub areas VI, VII have shown retained and landed catches of the observed trips are proportional (R^2 = 0.79). Retained catches are generally bigger than logbook landed. This could indicate an underestimation of hake landed or an overestimation of the retained catch on board by the observer, due to only 50% on hauls are sampled. Whilst the length distributions in Subarea VI and VII of retained catch have the similar pattern than the length distributions of the landings on the port. Onboard observers programme for STB gears in Divisions VIIbk devoted to megrim and anglerfish show statistical (*K-S* test) significant differences. A large number of small fish disappear from landing distribution. Differences are probably due to; different discard strategy of fishermen when observers are on board and some bias in raising procedure per category to obtain landing values.

In ICES Divisions VIIIabd retained and landed catches of the observed trips are proportional (R^2 = 0.92) but in general, retained catch is slightly small than landings. This could indicate an underestimation of the retained catch on board by the observer.

The length distributions in Divisions VIIIabd of the retained catch have the similar pattern than the length distributions of the landings on the port.

In ICES Divisions VIIIc and IXa: Retained and landed catches of the observed trips have a lower proportional relation (R^2 = 0.42). Differences are important for some metiers and years. There is a clear trend to underestimation in the logbook records. Length Distributions

Divisions VIIIc & IXa for OTB gears show statistical (*K-S* test) significant differences especially in small fish. Differences are probably due to; different discard strategy of fishermen when observers are on board and some bias in raising procedure per category to obtain landing values. Results for pair trawler (PTB) show a similar pattern.

In the Mediterranean subarea 5 (GSA-5) retained and landed catches of the observed trips are proportional (R^2 = 0.90) but in general, retained catch is slightly bigger than landings. This could indicate an overestimation of the retained catch onboard, or an underestimation of landing, since hake captures in the Deep water fishery are lower and scarce, which could produce some bias in the raising procedure to obtain landing values. Length Distribution in GSA-5 obtained on board follow the same pattern to those obtained in port, without statistical significant differences (*K-S* test).

Differences between yearly raised data recorded onboard and total annual sale notes ranged between 1 and 80% depending on the metier. Atlantic OTBs present higher differences than HTB or PTB gears or results from the Mediterranean zone. Most of the differences are in relation with the differences observed in retained and landed catches per trip or in length distribution. However some metiers with good correlation between retained and landing catch or length distribution (case of STB in Divisions VIIIabd) show high total annual differences. In this metier the variability of the retained catch of hake could be higher since there is a small part of the trips that are directed to pelagic species that could not be samples as separated metier because of the low level of sampling. A higher level of sampling could be needed to have a better estimation.

Discussion and conclusions

For a particular fishery the sample rates are assumed to be representative of the entire fishery for the purposes of raising (extrapolating) to the fleet or fishery level, the assumption is open to a range of criticisms. At the country level, aggregate statistical information on fish catches is generally published by species, fleet or area, but more rarely by fishery or metier. In many jurisdictions fisheries tend to have an amorphous or fluid definition. This is partly because several different gears may be used, several species may be targeted on a single fishing trip or by a particular vessel, and because the fishery changes over time. Consequently the attribution of catches to a particular fishery may be difficult.

A comprehensive sampling by on-board observers recording programme is required to obtain accurate estimates. Through the comparison of landings and total raised catch of the observer programmes have no consistently been shown the programme no provide accurate results for some metiers. The analysis of trends should be based on adequate time series.

Acknowledgements

The authors thank the stakeholders and fishermen for their collaboration and contribution to the fishery monitoring project.

A comparison between observed and unobserved vessels data of the Spanish Northeast Atlantic and Mediterranean Bottom Trawl fishery

Carbonell A*, I González Herraiz**, A Punzón***, J Ruiz**, M Valls* and N Pérez****

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SUMMARY:

To assess the possible bias of the observers' on board data in the Spanish bottom trawl fisheries from 2003 to 2005, the retained catch estimations of hake from observers are compared to the landings data from logbooks and first sales notes.

INTRODUCTION & METHODS:

A regular discard sampling programme is been developed under the European fisheries data collection regulation since 2003 throughout observers on board. These data should be integrated with the information from logbooks and first sale notes provided by fishermen associations.

The programme is carried from 2003 in the North-eastern Atlantic and from 2005 in the Mediterranean fishery. Sampling is by fleet targeting species and/or by metier (fleet-targeting species and area). Random sampling on board is assumed. In the Cantabrian (ICES Divisions VIIIc, IXa) and Mediterranean seas is carried out a coastal fishery and in Bay of Biscay (VIIIabd), in Rockall (ICES Subarea VI) and West of Ireland (VII) is carried out a open sea fishery. Hake retained catch data from observers have been compared with landings from logbooks and/or sale notes.

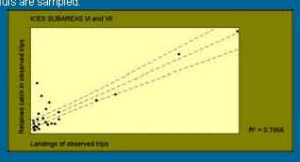
Furthermore, results have been analysed, in order to know both the possible bias of the retained catch estimations versus the estimated landing and the different causes of these bias. Given that the sampling strategies could be one of the main related causes together with the commercial strategies, our results assess the logistic and methodological problems associated with the current sampling strategies and data collection processes.

SPANISH EUROPEAN HAKE BOTTOM TRAWL FISHERIES

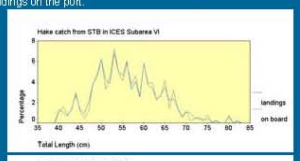
Table 1. Sampling on board. Number of trips and vessels sampled from 2003 to 2005 ICES: International Council of the Exploration of the Sea. From 2005 in the GSA-5: Geographical Subarea 5 (Balearic Islands) to GFCM: General Fisheries Commission for the Mediterranean. HTB: High-opening Trawl. OTB: Bottom Trawl. PTB: Paired Bottom Trawl. STB: Single Bottom Trawl. In yellow color the years of the length distributions shown.

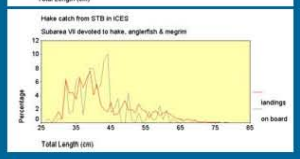
Region	Area	Fleet segment or métier	TRIPS			VESSELS		
			2003	2004	2005	2003	2004	2005
North-East Atlantic Fishery	ICES VI	STB directed to hake & anglerfish	3	3	2	2	1	1
	ICES VII	STB directed to hake, anglerfish & megrim	2	3	1	1	3	1
	ICES VIIbk	STB directed to megrim & anglerfish	7	8	7	7	8	7
	ICES VIIbk	STB directed to hake & anglerfish	2	3	3	2	3	3
	ICES VIIIabd	STB mixed fishery	6	4	11	5	4	7
	ICES VIIIabd	HTB directed to hake	6	7	7	4	5	4
	ICES VIIIc, IXa	OTB mixed fishery	41	43	67	29	24	30
	ICES VIIIc, IXa	PTB directed to blue whiting	11	10	30	9	7	13
Mediterranean Sea Fishery	GSA-5	STB Mixed demersal			28			7
	GSA-5	STB Deep water			18			4

ICES Subareas VI, VII: Retained and landed catches of the observed trips are proportional (R^2 = 0.79). Retained catches are generally bigger than logbook landed. This could indicate an underestimation of hake landed or an overestimation of the retained catch on board by the observer, due to only 50% on hauls are sampled.



The length distributions in **Subarea VI and VII** of retained catch have the similar pattern than the length distributions of the landings on the port.





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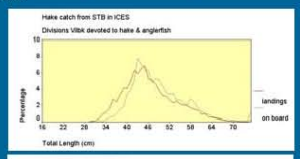

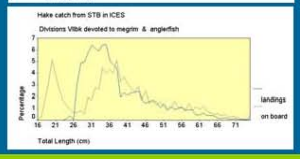

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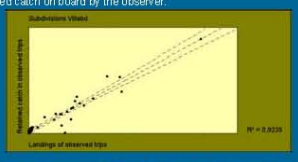

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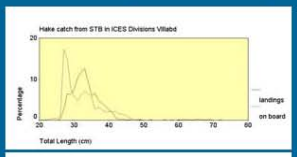
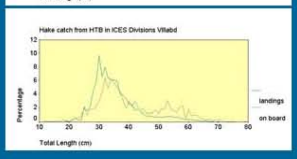
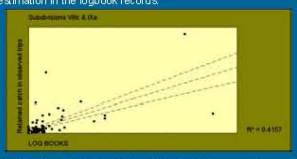
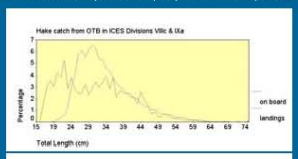


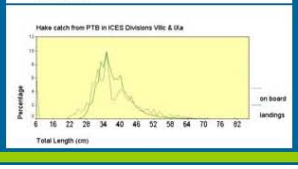


ICES Divisions VIIIc and IXa: Retained and landed catches of the observed trips have a lower proportional relation (R^2 = 0.42). Differences are important for some metiers and years. There is a clear trend to underestimation in the logbook records.

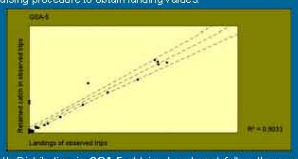


Length Distributions **Divisions VIIIc & IXa** for OTB gears show statistical (K-S test) significant differences especially in small fish. Differences are probable due to; different discard strategy of fishermen when observers are on board and some bias in raising procedure per category to obtain landing values. Results for pair trawler (PTB) show a similar pattern.

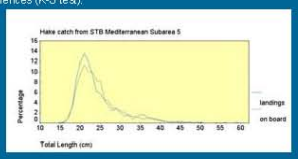


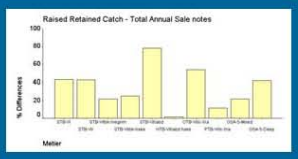


MEDITERRANEAN SUBAREA 5 (GSA-5): Retained and landed catches of the observed trips are proportional (R^2 = 0.90) but in general, retained catch is slightly bigger than landings. This could indicate an overestimation of the retained catch on board, or an underestimation of landing, since hake captures in the Deep water fishery are lower and scarce, which could produce some bias in the raising procedure to obtain landing values.



Length Distribution in **GSA-5** obtained on board follow the same pattern to those obtained in port, without statistical significant differences (K-S test).





Differences between yearly raised data recorded on board and total annual sale notes ranged between 1 and 80% depending on the metier. Atlantic OTBs present higher differences than HTB or PTB gears or results from the Mediterranean zone. Most of the differences are in relation with the differences observed in retained and landed catches per trip or in length distribution. However some metiers with good correlation between retained and landing catch or length distribution (case of STB in Divisions VIIIabd) show high total annual differences. In this metier the variability of the retained catch of hake could be higher since there is a small part of the trips that are directed to pelagic species that could not be samples as separated metier because of the low level of sampling. A higher level of sampling could be needed to have a better estimation.

CONCLUSIONS:

For a particular fishery the sample rates are assumed to be representative of the entire fishery for the purposes of raising (extrapolating) to the fleet or fishery level, the assumption is open to a range of criticisms.

At the country level, aggregate statistical information on fish catches is generally published by species, fleet or area, but more rarely by fishery or metier. In many jurisdictions fisheries tend to have an amorphous or fluid definition. This is partly because several different gears may be used, several species may be targeted on a single fishing trip or by a particular vessel, and because the fishery changes over time. Consequently the attribution of catches to a particular fishery may be difficult.

A comprehensive sampling by on-board observers recording programme is required to obtain accurate estimates. Through the comparison of landings and total raised catch of the observer programmes have no consistently been shown the programme no provide accurate results for some metiers. The analysis of trends should be based on adequate time series.

Acknowledgements:
The authors thank the stakeholders and fishermen for their collaboration and contribution to the fishery monitoring project.

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The impact fisheries regulations and poaching on fish supply of the lakes in north-western European Russia (Vologda region)

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[2] *Vologda Laboratory of State Research Institute on Lakes and Rivers Fisheries – Russia*

Extended Abstract

Vologda region (at 61' 36' – 58'21'N, 34'40 – 47'10'E) is located in the North-West of the European Russia. The region is marginal in relation to the largest drainage basins of Eurasia. The Eurasian drainage divide between the Arctic Ocean (White Sea – Severnaya Dvina River), Atlantic Ocean (Baltic Sea – Lake Onego) and inland drainage (Caspian Sea – Volga River) basins cuts across the territory. There are dense hydrographic network, including 3 basic fisheries large lakes Beloe (1,284 km^2), Kubenskoe (417 km^2), Vozhe (418 km^2).

Since long ago fishery has been an important occupation for the aboriginal populations of the Vologda region and one of the main trades. That is why it was controlled by the government.

The history of fishery on the big lakes of the Vologda region is a typical model for the North-West of the European part of Russia. In 2 last centuries the fishery management highly depended on political events, changes of the power, wars, social and economic settings in Russia. Principles of fishery, legal position of users, fishing load were changing, modernisation of methods and tools of catch was happening, conditions of habitat of fish were becoming worse. The result is quantitative and qualitative changes in the structure of fish community, reduction of biodiversity and fish supply, worsening of catch structure and quality of fish production.

The basic stages in the fisheries history on the large lakes can be pointed out: second half of the 19th century – 1920s. Fishermen used only rowing boats and hand-made catching gears. Fishery efficiency was low, and big catches was achieved by introducing a great number of fishermen. Age and size groups of fish populations were the influence of even fishery load caused by small catches and fishing gear selectivity.

The 1920s – 1950s. Fishery efficiency growth due to technical modernisation of the fishing industry. Trawling caused great selective loading on the young groups of fishes.

The 1960s – 1980s. The trawling was banned and replaced by nets and drift nets. Fishery started to focus on catching valuable species of fish, namely zander, pike, bream. Selective loading changed from young groups to older groups in fish populations.

On the one hand overfishing compensate by conservation catches owing to strict state control. On the other hand the pivotal factor of fish supply decrease is the quick deterioration of the habitat due to warebodies toxic pollution (development of the industry, the chemicalisation of agriculture).

Beginning 1990s the transition from the collective form of fishery to small ventures and individually licensed catching has been carried out. The transition to the new forms of management in fishery has hampered the inspection of the catches. Non-controllable catches are observed due to lack of inspection over fishery and development of poaching.

Last years the state industrial fisheries in Russia were transformed to the businessmen activity. The number of the not state organisations and businessmen, which work in the industrial fishery, and number of recreational fishermen are increasing with every year. The consequences of these factors are increase of fish-tackles number and reduction the control of their use. Now the impacts of fishery to the biomass of fish are maximal and unprecedented in fisheries history.

In 1990s the catch on licenses with using nets was allowed to the citizens. It led to sudden growth of quantity of the used nets and fishermen. As for recreation fishing, in point of

fact it became commercial (legal poaching). As a result of unexampled load on reservoirs there happened a reduction of fish supply. For example, number of fishermen was increased three times for five last years. The number of fish-tackles has increased on the average in four times. Thus the number of drift nets have increased approximately in three times. The number of pound-nets for industrial fishery has increased in two times.

The number of fish-tackles used by citizens under licenses is comparable to total of gears of industrial fishery however the total catches have considerably decreased (official statistics).

This fact contradicts sharp increase of number of fish-tackles. The reason is increase of catches not taken into account by fisheries statistics and prospering poaching after disintegration of the USSR in 1991. Excessive fisheries loading and selective fishing gear. Has caused sharp reduction of biomass and abundance of valuable species of fishes.

Three causes of overfishing can be pointed out: 1. The transition from fishery forms controllable by the state bodies to individual licensed activities, ventures and recreational fishing. 2. The inefficient legal and controlling system and lack of actual management of fishing in the transition period to the new marketing economic relations. 3. The transition to the use of large-meshed nets focusing on fishery of valuable and large-size species of fishes.

Informational base for fishing management established on the long-term monitoring for fish populations and water quality. There is the database of official statistic as month reports total catches from 1938 (30 fish species). Now it includes the date of commercial gears and number fishermen, the ratio of commercial and recreational catches. The database of scientific investigation including the fish population characteristics, for example the age and sax structures of fish populations, mortality and fecundity.

Science basis of fishery regulation is based on calculation of total allowable catches in every fish species and determination of fishes quotes. Distribution of quotes is realised by the department of fishery management through the regional council where officials, representatives of scientific institutions and fishermen take part. Control for using of quotes is realised by the state service general for all waterbodies on the North-West of Russia.

Now the ownership on waterbodies and the control belong to the government, but the use of fish resources is in private property and for the most part belongs to small shareholder. The main problem is rise of unaccounted catches, distortion of statistics data.

Restoration of abundance and biomass of valuable fishes in waterbodies of the Vologda region will be possible only at change the strategy of fishery and at the adequate control for the catches. Before, when fishery belonged completely to the government there was a possibility to compensate the consequences of overfishing by prohibitive measures. For example, prohibition of pelagic trawls in 1960s on all the lakes for keep up the supply of young fish and the introduction of a particular regime of fishery on the Kubenskoe Lake to recover unconnu population. That is why we need the return to the government monopoly on using fish resources for commercial purposes and saving of recreational fishing with limitation of number different gears.

THE IMPACT FISHERIES REGULATION AND POACHING ON FISH SUPPLY OF THE LAKES IN NORTH-WESTERN EUROPEAN RUSSIA (VOLOGDA REGION)

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Vologda region (at 61' 36'- 58'21'N, 34'40-47'10'E) is located in the North-West of the European Russia. The region is marginal in relation to the largest drainage basins of Eurasia. The Eurasian drainage divide between the Arctic Ocean (White Sea – Severnaya Dvina River), Atlantic Ocean (Baltic Sea – Lake Onego) and inland drainage (Caspian Sea –Volga River) basins cuts across the territory. There are dense hydrographic network, including 3 basic fisheries large lakes BELOE (1284 km2), KUBENSKOE (417 km2), VOZHE (418 km2).








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In 2 last centuries the fishery management highly depended on political events, changes of the power, wars, social and economic settings in Russia. Principles of fishery, legal position of users, fishing load were changing, modernization of methods and tools of catch was happening, conditions of habitat of fish were becoming worse. The result is quantitative and qualitative changes in the structure of fish community, reduction of biodiversity and fish supply, worsening of catch structure and quality of fish production.

THE BASIC STAGES IN THE FISHERIES HISTORY ON THE LARGE LAKES CAN BE POINTED OUT:

SECOND HALF OF THE 19th CENTURY – 1920s. Fishermen used only rowing boats and hand-made catching gears. Fishery efficiency was low, and big catches was achieved by introducing a great number of fishermen. Age and size groups of fish populations were the influence of even fishery load caused by small catches and fishing gear selectivity.

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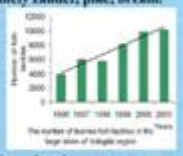
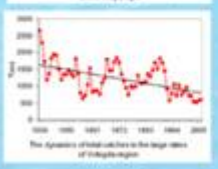
BEGINNING 1990s. The transition from the collective form of fishery to small ventures and individually licensed catching has been carried out. The transition to the new forms of management in fishery has hampered the inspection of the catches. Non-controllable catches are observed due to lack of inspection over fishery and development of poaching.





HOWEVER THE TOTAL CATCHES HAVE CONSIDERABLY DECREASED (OFFICIAL STATISTICS) AND THIS FACT CONTRADICTS SHARP INCREASE OF NUMBER OF FISH-TACKLES.
THE REASON IS INCREASE OF CATCHES NOT TAKEN INTO ACCOUNT BY FISHERIES STATISTICS AND PROSPERING POACHING AFTER DISINTEGRATION OF THE USSR IN 1991.


Three causes of overfishing can be pointed out:

1. The transition from fishery forms controllable by the state bodies to individual licensed activities, ventures and recreational fishing.
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New projects for monitoring the Venezuelan fishing fleet in the Caribbean and in the Western Central Atlantic that would be integrated in a database for fisheries management

Manuel J. Correia[1], Alvin M. Delgado[1] and Carlos E. Gimenéz[2]

[1] Programa Nacional de Observadores de Venezuela de FUNDATUN (FUNDATUN-PNOV)
[2] Fundación para la Pesca Sostenida y Responsable de Túnidos (FUNDATUN)

Extended Abstract

Fisheries monitoring and the collection of data to provide scientific advice for management are inextricably linked in fisheries management and to management in other sectors. The staff of FUNDATUN-PNOV comes working and developing projects in several fisheries circuits, in tries to identify problems of target and non-target species involved in different fishing activities made by Venezuelan fleet in the Caribbean and in the Western Central Atlantic. Some of them must be monitored with urgency (like: deep water demersal fish otter trawlers, the tuna fishery in their different categories, and some local fishing on small-scale), because all of them have arrived at its maximum development or exhibit exhaustion signs, from which urgent measures are required to avoid a collapse.

Proposed new projects for Venezuelan on-board observer programs:

- Measure the effect of TEDs on incidental capture of marine turtles by demersal fish otter trawlers in the Caribbean Sea and adjacent waters of Atlantic Ocean.
- Implement a new On-board Observer Program in tuna purse seiners and bait boats that operate in the Western Central Atlantic.
- Contribute to assessment of the sardine (*Sardinella aurita*) resource in northeastern Venezuela.

All projects would be coordinated and evaluated by the official institutions and national scientific entities, and universities in a susbcribed agreement with FUNDATUN-PNOV.

Other fisheries like the pelagic longliners, must be meticulously observed, due to their potential interactions with marine turtles.

In socioeconomic terms, the importance of the different kinds of fishing arts is undeniable given the immense capacity of jobs that it generates in direct or indirect form. In this sense, it becomes necessary that when being orchestrated a program of scientific observers to collect information '***in situ***' on determined fishing activity plus the information traditionally obtained by administrative civil employees in the ports of debarkation and the data registered in the binnacles of the crews, it is counted with a plan of action previously evaluated by the official institutions and national scientific entities, conceiving the couple, ***resource-unit of production*** in those plans. Finally, a database would be implemented, allowing its integration to regional and international systems.

Main objective of the PNOV proposal

To create a unified database of fishing activities in Venezuela that can be shared between different users which includes compiled observations on tuna purse seiners, bait boats, bottom and pelagic longliners, and deep water demersal fish otter trawlers.

Specific objectives

- To create technical guidelines.
- To create and validate procedures applicable to different fishing activities.
- To train observers to apply the aproved procedures.
- To create and validate a specific software package.
- To create a permanent DATA BANK in PNOV.

Advantages

- The elimination of cumbersome and slow processes.
- The scientific community will obtain up-to-date information to make decisions.
- It will allow for data to be reduced to a series of numbers that can be administrated with different restrictions levels in specific points of interfaces accesses.

Process of collecting and managing data

It will be initiated when the observer arrives at the field office for the revision of data forms completed on-board during a trip. In the process of automatisation it would be activated 3 modules for managing the data:

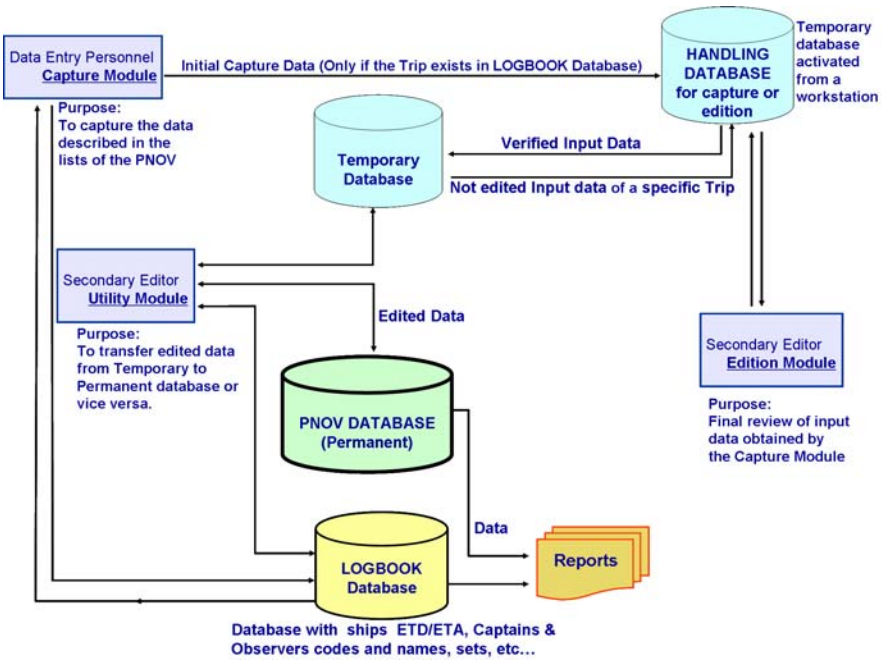
- Module of data input, called 'Capture Module' (Inputting the data from the lists).
- Module of Editing data (correcting and checking the data).
- Module of utilitarian actions, named as 'Utility' (to transfer edited data from Temporary to Permanent database or vice versa).

Additionally, there are 4 connected Databases, to manage the inputted data:

- LOGBOOK DATABASE: Initial Database to input new trips assigned before they leave from the port, estimated times of departures or arrivals (ETD/ETA), captains and observers names and codes, number and kinds of sets, etc
- TEMPORARY DATABASE: this database is proposed to be used while the complete edition process is carried out for a specific trip;
- HANDLING DATABASE: this is proposed to be used for the management and revision of specific information from a trip without interference from the rest of the saved information in the temporary database. It can be activated from different workstations; and
- PERMANENT DATABASE: this is the final phase, inputting of revised and edited data.

Beneficiaries of the proposal

- The national fishing administration and the official entities.
- Independent research scientists as universities and fisheries research institutions.
- The users of the resources such as fishermen and owners of fishing ships, as indirect beneficiaries.



Proposed Scheme of the Operation of an Automated System, Level 0.

PROGRAMA NACIONAL DE OBSERVADORES DE VENEZUELA (PNOV)

New Projects for Monitoring the Venezuelan Fishing Fleet in the Caribbean and in the Western Central Atlantic that Would be Integrated in a Database for Fisheries Management

Correia, M.[1]; Delgado, A.[1]; Gimenéz, C.[2]

[1]Programa Nacional de Observadores de Venezuela de FUNDATUN (FUNDATUN-PNOV)

[2]Fundación para la Pesca Sostenida y Responsable de Túnidos (FUNDATUN).

MAIN OBJECTIVE :

To create a unified database of fishing activities in Venezuela that can be shared between different users which includes compiled observations on tuna purse seiners, bait boats, bottom and pelagic longliners, and deep water demersal fish otter trawlers.

SPECIFIC OBJECTIVES:

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*To create and validate procedures applicable to different fishing activities.

*To train observers to apply the aproved procedures.

*To create and validate a specific software package.

*To create a permanent DATA BANK in PNOV.

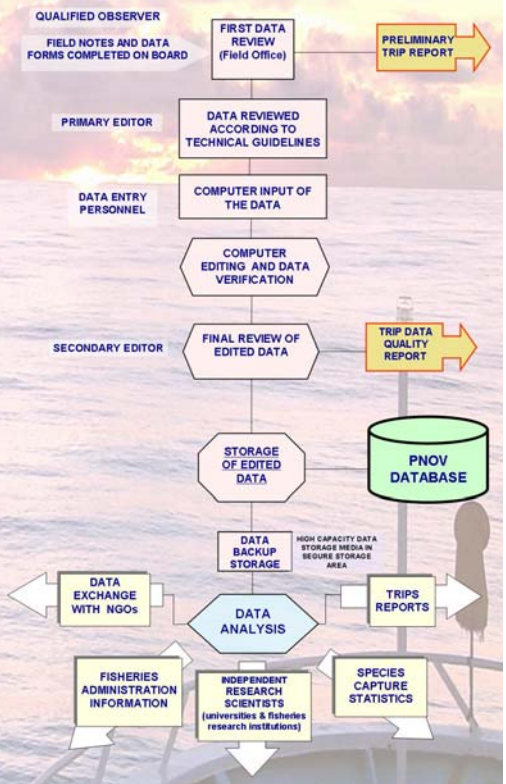
ADVANTAGES:

*The elimination of cumbersome and slow processes.

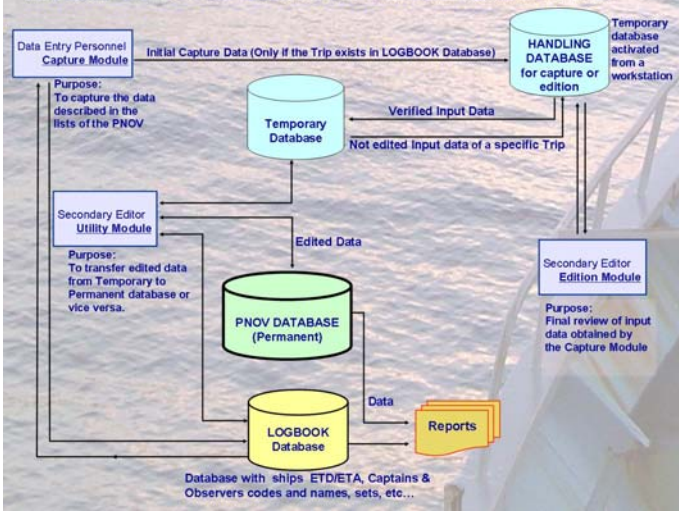
*The scientific community will obtain up-to-date information to make decisions.

*It will allow for data to be reduced to a series of numbers that can be administrated with different restrictions levels in specific points of interfaces accesses.

PROPOSED PNOV DATA ENTRY AND PROCESSING MODEL



Proposed Scheme of the Operation of an Automated System, Level 0.



Proposed New Projects for On-board Observer Programs

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All projects would be coordinated and evaluated by the official institutions and national scientific entities, and universities in a susbcribed agreement with FUNDATUN-PNOV. Some of them are: INIA, INAPESCA & IO-UDO.

ACKNOWLEDGEMENTS:
The authors thank Nickolas Vogel, Mariela Vidal, Freddy Arocha, Trina Garcia and Noel Romero for comments and suggestions that greatly improved this presentation.

Collaboration in observer data collection: An example of observer initiated collaboration in the tagging of California halibut (*Paralichthys californicus*) in the northern central California Trawl Fleet

Brian Forest

Observer, West Coast Groundfish Observer Program; Fishery Enhancement and Research Foundation – USA

Extended Abstract

Introduction

Fishery observers' duties are specific and essential to the programs for which they work. These duties take precedence over special projects, however, opportunities for experienced observers to take on additional tasks may exist as observers become more proficient at their essential duties and no competing priorities exist. Expanding observer duties to include special projects can be useful to further utilise highly trained field biologists and build collaborations with groups outside of NOAA Fisheries. Data collected through observer special projects can augment existing data sets and, in some cases, represent the only recoverable data in certain strata. As observers become more proficient, special projects could be assigned as time may become available, with experienced observers are in the unique position of being able to evaluate their actual workload in the different fisheries they work, and the most qualified to determine the feasibility of taking on specific additional duties. This collaborative project, initiated and co-developed by observers, helps ensure that additional duties are appropriate in scope and scale while contributing to an expansion of our understanding of fisheries resources that might not otherwise occur.

Background and development

The Fishery Enhancement and Research Foundation (FERF), a San Francisco based non-profit is conducting basic research into the biology of California Halibut to study the potential for developing a hatchery within San Francisco Bay. Supported by a 2003 grant from the San Mateo County Fish & Wildlife Commission, FERF has conducted tagging in and around San Francisco Bay to help quantify temporal and spatial migration patterns in and out of the bay. The aim of this project is to examine under what conditions the release of juveniles could be effectively used to enhance recruitment to the fishery and future spawning success within the bay. This work has taken place through the efforts of local Commercial Passenger Fishing Vessels, the Marine Sciences Institute of San Mateo County, and volunteer anglers. The author, an observer in the West Coast Groundfish Observer Program (WCGOP) and a FERF volunteer, worked with program staff to develop a special project for observers to expand this tagging project to include observed vessels operating offshore. In July 2006, evaluation and tagging of California halibut were approved for inclusion in the duties of observers based in Monterey and San Francisco, California. In December, observers were supplied with tags, tagging needles, recovery container and protocols for selecting up to five halibut per tow for measurement and tagging. As a special project, outside the normal duties of observers, tagging is the lowest priority task for observers and is not performed if time to complete standard sampling protocol is limited.

Progress and discussion

Of the 388 fish that have been tagged since 2004, 40 have been tagged by observers aboard vessels trawling for halibut since December 2006. Due to limited effort by recreational anglers between December and March, these observer efforts represent the only tagging that has taken place during these months. In this respect, observer involvement in tagging compliments the previous scope of the project by continuing tagging when others are not on the water. The tagging performed by observers is spatially complimentary as well, due to the fact that trawlers are required to operate at least three miles from shore (with most tagging actually taking place much further off than that), while recreational anglers will rarely pursue this fish in those locations. There appears to have been a gap in successful spawning events between 2001 – 2003 (with the regularity of

such failures motivating consideration of a hatchery program). Thus a limited number of undersized fish were available in the first two years of the project (2004 & 2005), resulting in a short time at liberty for the majority of tagged individuals and possibly explaining the current tag return rate of under 2%. Tag returns thus far have been limited with only one return of a legal size fish close to the area in which it was tagged. As recently tagged fish mature and the public and industry become more aware of the project, this rate of return can be expected to increase, with the efforts made by observers providing for more temporally and spatially complete datasets.

Thanks to Jonathan Cusick, Janell Majewski, John LaFargue, Jen Cramer, the San Mateo County Fish & Wildlife Commission, the Marine Sciences Institute and all of the anglers and observers helping continue this project.

Photo Credit: Richard Alvarado, www.divebums.com
Inset: John Budrick

Collaboration in Observer Data Collection:

An Example Of Observer Initiated Collaboration In The Tagging of California Halibut (*Paralichthys californicus*) In The Northern Central California Trawl Fleet

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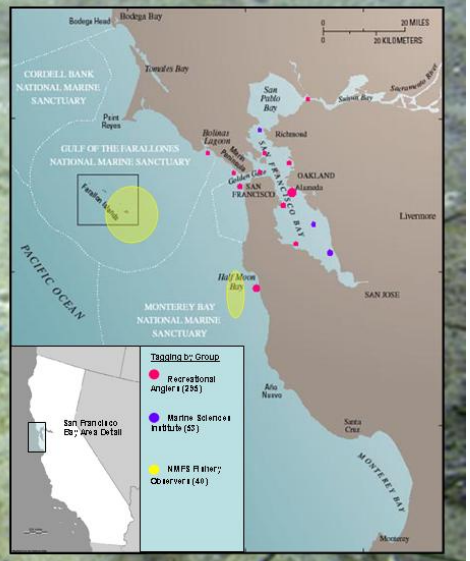
Fishery observers' duties are specific and essential to the programs for which they work. These duties take precedence over special projects, however, opportunities for experienced observers to take on additional tasks may exist as observers become more proficient at their essential duties and no competing priorities exist. Expanding observer duties to include special projects can be useful to further utilize highly trained field biologists and build collaborations with groups outside of NOAA Fisheries. Data collected through observer special projects can augment existing data sets and, in some cases, represent the only recoverable data in certain strata. As observers become more proficient, special projects could be assigned as time may become available, with experienced observers are in the unique position of being able to evaluate their actual workload in the different fisheries they work, and the most qualified to determine the feasibility of taking on specific additional duties. This collaborative project, initiated and co-developed by observers, helps ensure that additional duties are appropriate in scope and scale while contributing to an expansion of our understanding of fisheries resources that might not otherwise occur.

METHODS

Observers are provided with criteria for evaluating the condition of undersized, trawl caught halibut and asked to place up to five randomly selected individuals in "Excellent" condition in a water filled container for recovery before processing. As quickly as possible, the fish is tagged with a numbered cinch-zip tag through the anterior dorsal muscle (as pictured). The tag is inserted to a depth of approximately 1cm and exists the muscle on the same side as it was inserted, 4-5cm distal and cinched to leave 1cm on either side of the sleeve, the remainder being trimmed. Measurements are then taken to the nearest cm and the fish is released. Tag number and length are recorded on the observer's Biospecimen Form and entered into the WCGOP database.



BACKGROUND AND DEVELOPMENT

The Fishery Enhancement and Research Foundation (FERF), a San Francisco based non-profit is conducting basic research into the biology of California Halibut to study the potential for developing a hatchery within San Francisco Bay. Supported by a 2003 grant from the San Mateo County Fish & Wildlife Commission, FERF has conducted tagging in and around San Francisco Bay to help quantify temporal and spatial migration patterns in and out of the bay. The aim of this project is to examine under what conditions the release of juveniles could be effectively used to enhance recruitment to the fishery and future spawning success within the bay. This work has taken place through the efforts of local Commercial Passenger Fishing Vessels, the Marine Sciences Institute of San Mateo County, and volunteer anglers. The author, an observer in the West Coast Groundfish Observer Program (WCGOP) and a FERF volunteer, worked with program staff to develop a special project for observers to expand this tagging project to include observed vessels operating offshore. In July 2006, evaluation and tagging of California halibut were approved for inclusion in the duties of observers based in Monterey and San Francisco, California. In December, observers were supplied with tags, tagging needles, recovery container and protocols for selecting up to five halibut per tow for measurement and tagging. As a special project, outside the normal duties of observers, tagging is the lowest priority task for observers and is not performed if time to complete standard sampling protocol is limited.

TAGS
Specially curved tagging needles are employed to permit entry and exist on the eyed side of the fish. Tags are numbered with instructions for the terminal angler to record length in mm or 16ths of an inch, latitude, longitude and a phone number for reporting the capture.

PROGRESS & DISCUSSION

Of the 388 fish that have been tagged since 2004, 40 have been tagged by observers aboard vessels trawling for halibut since December 2006. Due to limited effort by recreational anglers between December and March, these observer efforts represent the only tagging that has taken place during these months. In this respect, observer involvement in tagging compliments the previous scope of the project by continuing tagging when others are not on the water. The tagging performed by observers is spatially complimentary as well, due to the fact that trawlers are required to operate at least three miles from shore (with most tagging actually taking place much further off than that), while recreational anglers will rarely pursue this fish in those locations. There appears to have been a gap in successful spawning events between 2001-2003 (with the regularity of such failures motivating consideration of a hatchery program). Thus a limited number of undersized fish were available in the first two years of the project (2004 & 2005), resulting in a short time at liberty for the majority of tagged individuals and possibly explaining the current tag return rate of under 2%. Tag returns thus far have been limited with only one return of a legal size fish close to the area in which it was tagged. As recently tagged fish mature and the public and industry become more aware of the project, this rate of return can be expected to increase, with the efforts made by observers providing for more temporally and spatially complete datasets.

Photo Credit:
Richard Alvarado, www.divebums.com
Inset: John Budrick

Thanks to : Jonathan Cusick, Janell Majewski, John LaFargue, the San Mateo County Fish & Wildlife Commission, the Marine Sciences Institute and all of the anglers and observers helping continue this project

Histological validation of a visual maturity key for Pacific cod, *Gadus macrocephalus*

Sandi Neidetcher*, Jim Stark, M. Elizabeth Conners and Mei-Sun

National Marine Fisheries Service – Alaska Fisheries Science Centre – USA

Text from Poster

Introduction

Important information such as spawning location, duration, and seasonality require knowledge of the gonad developmental stages of individual fish. Visual staging based on the external and internal appearance of gonads can be a quick and easily applicable tool to assess maturity stages. Though these methods allow for increased sample sizes, they are often inaccurate and subjective especially when gonads are in transitional stages of development. Histology, though labor intensive and costly in comparison, allows for a more accurate classification system based on oocyte developmental structures. To assess the validity of our visual staging key we compare visual changes in maturation observed in the field with advancing histological structures present in these specimens. The AFSC Fisheries Interaction Team (FIT) began assessing spawning condition for Pacific cod during a field study concerning the potential for commercial trawling to cause localized depletion of Steller sea lion prey in the Unimak Pass area of the Bering Sea. Because the fishery targets spawning aggregations, understanding spawning processes in space and time, and associated with movement pattern are important to this research.

Maturity key development

FIT researchers faced challenges in evaluating cod spawning condition during initial cruises due to the lack of maturity documentation for Bering Sea Pacific cod. Previous staging work by AFSC Resource Assessment and Conservation Division employed five of six stages from a maturity key developed for Pacific cod along the west coast of Canada by Foucher & Westrheim (1990). A very similar key was documented by Tyler (1995) for Pacific cod southwest of Vancouver Island, Canada. The key presented here combines the five stage descriptions provided by Foucher and Westrheim with the sixth stage added by Tyler. Photographs and additional detail have been added to help clarify visual staging characteristics. Though not shown here, a similar key is being developed for males.

Methods

We examined a large number of Pacific cod ovaries over winter to gain an accurate picture of female cod maturity stages through the season. The data presented here were collected during the months of January, February, and March of 2003 in the central Aleutian Islands. Histological specimens were selected using a length-stratified collection scheme where three to five cod of each cm category were collected. Each of the 255 sampled cod were evaluated using the visual key, then ovary tissue samples were collected and preserved in 10% Formalin. Additionally, the frequency of ovary stages in the overall cod catch was determined by classifying every cod from a systematic subsample of fishing gear.

Histology

Ovaries were removed in the field and placed in a cloth bag with a label then persevered in 10% Formalin. At the lab, ovary sections were placed in a tissue cassette lined with a biopsy bag or sponge to prevent contamination. Tissues were dehydrated through a graded ethanol series, cleared and embedded in a block of Paraplast, sectioned to thicknesses of 0.003 and 0.005 mm, mounted on a slide, and stained with Harris haematoxylin and eosin. Individual ovaries were classified according to the abundance of the most advances stage of oocytes present in the histological section. For this presentation, three structures are used in classification. Immature fish were identified by the presence of perinucleus structures, but lacking vitellogenesis and post-ovulatory follicles. Vitellogenesis, or the accumulation of yolk, represents a developing stage. Spawning and spent fish are identified by post-ovulatory follicles.

Discussion

In conclusion, histological structures which mark changes in oocyte maturation are well represented by visual changes seen in the field. For this analysis, categories for spent and spawning cod were combined. Spawning fish, once subjected to the trauma of capture and handling, release oocytes quickly. Typically these fish, though spawning upon capture, are spent at the time of sampling. When staging is simplified by combining these two categories and are then compared to the most easily identifiable histological structures, the data agree with a 95% accuracy rate. Using these constraints, we were able to reject our null hypothesis. Specimens collected during subsequent cruises included photographic images which may assist in further differentiation with additional histological staging. Charted below are the ovary stage frequencies for the overall cod catch data collected concurrently with the histological data during the 2003 cruise. 2247 ovaries were coded over the winter cruise series. The charts demonstrate useful information easily obtained using the visual maturity key.

Histological Validation of a Visual Maturity Key for Pacific cod, *Gadus macrocephalus*

Sandi Neidetcher, Jim Stark, M. Elizabeth Conners, Mei-Sun Yang
National Marine Fisheries Service, Alaska Fisheries Science Center

Introduction

Important items for such an operating location, duration, are accurately resolve knowledge of the gonad developmental stages of the Pacific cod. Visual staging based on the overall gonad appearance of gonads can be a quick and easily applicable tool to assess maturity stages. Though these methods show both promise and simple ease, they are also inaccurate and subjective especially when gonads are in transitional stages of development. Histology, though labor intensive and costly in comparison, allows for a more accurate classification system based on oocyte development and structures. To assess the validity of our visual staging key, we compare visual changes in maturity observed in the field with a corresponding Histological assessment performed in the laboratory. The EFSC Fisheries Ecologist Team (FET) began assessing spawning condition for Pacific cod during a field survey concerning the potential for commercial trawling to cause localized depletion of Steller sea lion prey in the Gulbrush Pass area of the Bering Sea. Because the fishery targets spawning aggregations, we assessing spawning processes in space and time, and conclusions with respect to prey are important to the research.

Maturity Key development

FET researchers faced challenges in evaluating cod spawning condition during initial cruises due to the lack of maturity assessments for the Bering Sea Pacific cod. Previous staging work by AFSC Resource Assessment and Conservation Division employs the of stages from a maturity key developed for Pacific cod along the west coast of Canada by Foucher and Westerheim (1996). A very similar key was accomplished by Tyler (1996) for Pacific cod south-west of Vancouver Island, Canada. The key presented here combines the three stage descriptions provided by Foucher and Westerheim with the three stage scheme by Tyler. Photographs and additional results have been added to help clarify visual staging characteristics. Though not shown here, a similar key is being developed for males.

Methods

We sampled a larger number of Pacific cod ovaries over the winter to gain an accurate picture of female cod maturity stages through the season. The six preserved here were collected during the months of January, February, and March of 2004 in the central Gulf of Alaska. Histological specimens were collected using a length-weight collection scheme where three to five cod of each one category were collected. Each of the 256 samples cod were analyzed using the visual key, the ovary tissue samples were collected are preserved in 10% Formalin. Additionally, the frequency of ovary stages in the overall cod catch was assembled by classifying every cod from a systematic subsample of fishing gear.

Immature
Gonads small, close to vertebral column, may be difficult to sex. Ovaries appear as pink or transparent paired sacs, no oocytes are visible to the eye.

Developing
Gonads small, to about ½ the length of body cavity. Ovaries form 2 tapered, distinct lobes having well-developed blood vessels. Transparent and/or opaque orange oocytes are distinct and visible through the ovary wall.

Prespawning
Ovaries form 2 large distinct lobes. Most eggs appear as mature clear ova, some oocytes remain interspersed throughout the ovary

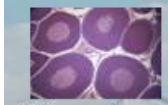
Spawning
Eggs run under slight pressure to the body. Ova are loose in the ovary.

Spent
Gonads are still large, but appear flaccid and watery. Ovaries may contain remnants of disintegrating ova and associated structures.

Resting
Ovaries small, firm, may have some black or silver color. No oocytes are visible to the eye.

Histology

Perinucleus



Vitallogenesis

Post Ovulatory Follicles

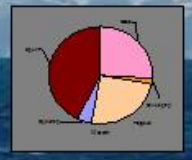
Ovaries were removed in the field and placed in a cloth bag with a label then preserved in 10% Formalin. In the lab, ovary sections were placed in a tissue cassette then with a biopsy bag or sponge to prevent crushing. Tissues were subjected through a graded alcohol series, cleared and embedded in a block of paraffin, sections to thickness of 0.005 and 0.005 mm, mounted on a slide, and stained with hematoxylin and eosin. Individual ovaries were classified according to the presence of the most advanced stage of oocytes present in the histological section. For this presentation, three structures are used in classification. Immature fish were identified by the presence of perinucleus structures, but lacking vitallogenesis and post-ovulatory follicles. Vitallogenesis, or the accumulation of yolk, represents a developing stage. Spawning and spent fish are identified by post-ovulatory follicles.

Table 1. Misclassification matrix comparing visual maturity key and histological assessments of female Pacific cod maturity stage (samples from 2004 and 2005 research cruises). Shaded boxes indicate agreement between the two methods.

	Visual Maturity				
Histology	Immature	Developing	Prespawning	Spawning/Spent	Total
Perinucleus	80	2	0	2	84
Vitallogenesis	1	53	83	3	140
Post Ovulatory Follicles	4	0	1	30	35
Total	85	55	84	35	259

Discussion

In conclusion, histological assessments which were changed to accommodate are well represented by visual changes seen in the field. For the analysis, categories of spent and spawning cod were combined. Spawning fish, once subjected to the stress of capture and handling, release oocytes quickly. Typically, these fish, though spawning upon capture, are spent at the time of sampling. When staging is simplified by combining these two categories and are then compared to the more easily identifiable histological assessments, the visual agree with a 96% accuracy rate. Using these conservative, we were able to reject our null hypothesis. Specimens collected during subsequent cruises include photographic images which may assist in further differentiation with visual and histological staging. Charts below are the ovary stage frequencies for the overall cod catch and cod collected concurrently with the Histological assessment during the 2004 cruise. 256 Ovaries were collected over the winter cruise series. The charts are used to identify frequencies of early stages using the visual maturity key.



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Electronic Monitoring in the Area 'A' Crab Fishery: An Industry Initiative

Jason Scherr[1]*, Bryan Rusch[2], Geoff Gould[3]

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[2] *Department of Fisheries and Oceans – Canada*
[3] *Area 'A' Crab Association – Canada*

Extended Abstract

The Area 'A' Dungeness crab fishery on the North Coast of British Columbia was facing challenges in the late 1990s. Effort in the Area 'A' crab fishery began to increase in the early 90's in response to high catch levels and an improved market demand for Dungeness crab. Although the number of crab licenses was limited in 1991, downturns in other fisheries resulted in increased fishing pressure as vessels redirected effort. The 50-vessel Area 'A' crab fleet began experiencing high rates of gear vandalism, trap theft and catch theft. Management reforms were to be introduced to limit effort through the introduction of vessel trap limits in order to bring the total gear in the fishery to below 36,000 traps. Enforcement agencies were unable to monitor the fishery, enforce the proposed management measures, nor address the theft and vandalism issues.

Archipelago Marine Research Ltd. began working with the Area 'A' Crab Association to develop a monitoring program that was both affordable and effective. In 2000, fishers implemented a comprehensive technological-based electronic monitoring (EM) program, the first of its kind in any fishery. All vessels in the fishery were equipped with an EM system that automatically logged various data during all fishing trips. Digital video technology surpassed its tape-based predecessor, allowing higher image storage capacity and the ability to directly access specific imagery. GPS information provided pinpoint accuracy in a fishery where distances of a few meters can be critical. Another important sensor in the EM system was the hydraulic pressure transducer to monitor work conducted by the vessel's winches. Oscillations in hydraulic pressure corresponded to trap hauling and could be easily detected in the data record.

One of the main technical challenges of the EM system was individual identification of the 36,000 traps in the fishery. Radio frequency identification (RFID) technology was adopted and soon proved the only way to accomplish trap identification given the large number of traps, the fast pace of trap hauling and setting operations, and the wet, dirty conditions of the fishing deck. Each vessel marked their crab traps by inserting pre-assigned RFID read only tags into trap buoys. The buoy is passed over a scanner while the trap is being hauled, providing a simple and efficient means to identify the trap. The identity of traps is checked against the inventory to identify the owner. After completion of a month of fishing activity, the EM system is serviced and data retrieved for analysis. The analysis is focused on making an objective assessment of whether the vessel complied with fishing regulations. The EM data set provides a very powerful analytical tool because of the large volume and the interrelated information. Information from

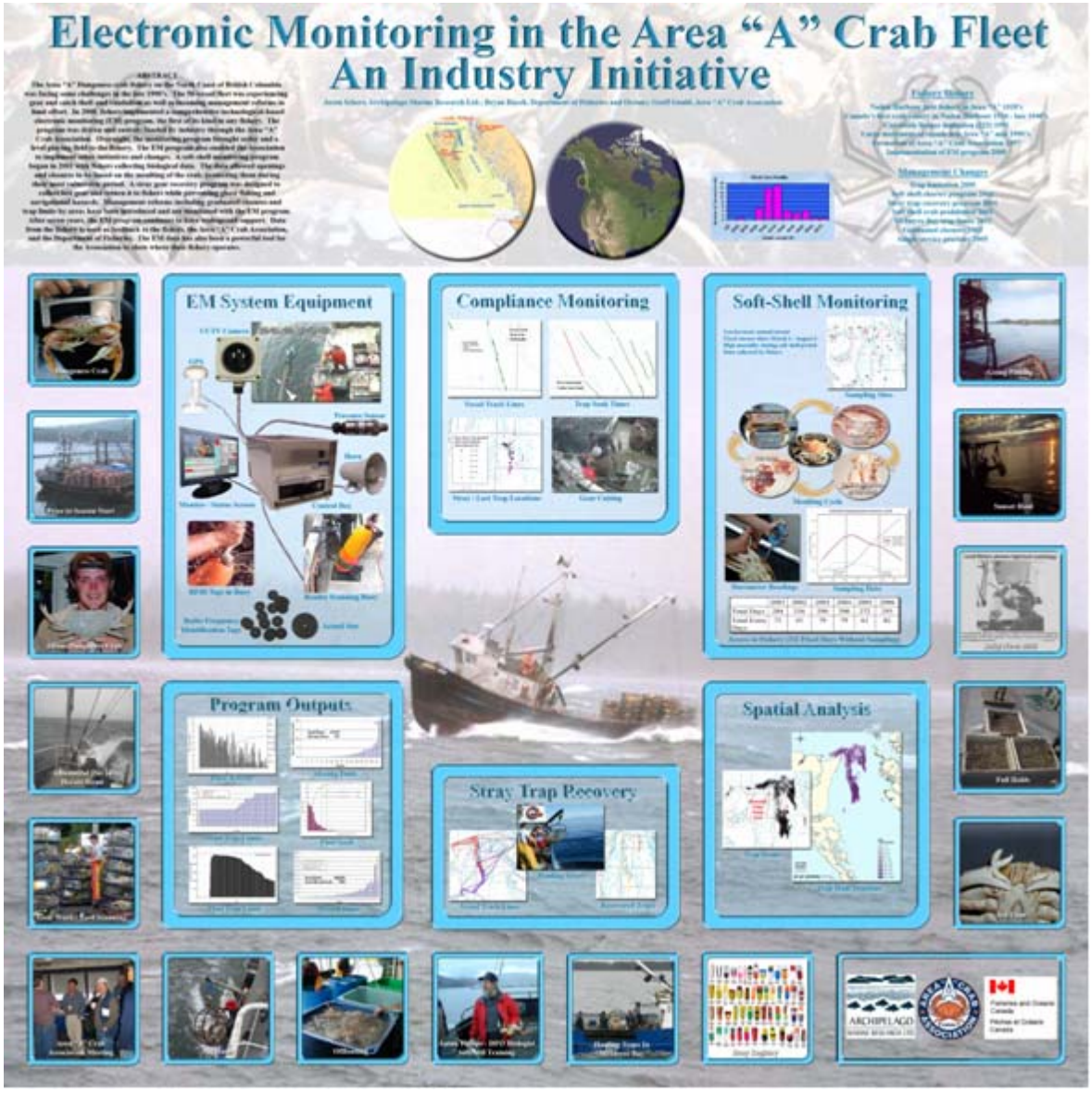
the GPS, RFID tags and hydraulic sensor is examined with database and GIS software to spot anomalous events, such as failure to scan traps. In such cases, the video imagery associated with the event is observed. Reports from the data analysis alert fisheries authorities and the Area 'A' Crab Association to compliance issues in their fishery, including hailing practices, trap scanning, trap limits, and trap soak times. As well, routine reports to fishers following analysis of sampled data outline any issues identified and provide positive feedback for good compliance.

Of equal importance to the design and operation of the EM systems are the rules that govern its' use. The monitoring service is provided through the Area 'A' Crab Association and there are strict requirements to ensure fishers comply with the rules. During a fishing trip, fishers must keep the EM system unit continuously powered, not interfere with any of the sensors, and scan all traps when hauled. Failure to meet these requirements could result in fines being levied by fisheries authorities, or other penalties levied by the Association.

The program was driven and entirely funded by industry through the Area 'A' Crab Association. Overnight, the monitoring program brought order and a level playing field to the fishery. Due to the success of the monitoring program, and Association pursued further management changes. A soft-shell monitoring program began in 2001, with fishers collecting biological data from predetermined sampling locations, to monitor the crab moult and modify the opening and closure timing to best protect crabs during their most vulnerable period. Additionally, the soft-shell monitoring program increased fishing opportunities available to the fleet. The fishery could be extended past previously used fixed closure dates or opened prior to the fixed opening date based on the sampling data provided. Over the first six years of the sampling program, the fishery has gained enough extra days to equal two full seasons based on the fixed dates.

The soft-shell monitoring program has allowed for the introduction of a gradual closure system that closes fishing areas and the moult progresses and allows for the orderly removal of gear from the fishing grounds. A stray gear recovery program was designed to collect lost gear and return it to the fishers while preventing ghost fishing and navigational hazards. Gear loss of up to 10% per year is normal and gear left on the grounds from the previous season creates problems by becoming entangled in gear set the following year.

After seven years, the EM program continues to have widespread support. Data from the fishery is used as feedback to the fishers, the Area 'A' Crab Association, and the Department of Fisheries. This data series has provided a powerful tool for crab fishers and the Association to demonstrate where their fishery operates in response to concerns and proposals affecting the crab fishery in Area 'A'.


Electronic Monitoring in the Area "A" Crab Fleet
An Industry Initiative
EM System Equipment
Compliance Monitoring
Soft-Shell Monitoring
Program Outputs
Stray Trap Recovery
Spatial Analysis

An Observer Program for marine turtle by-catch mitigation across the Eastern Pacific Ocean

M. Mug[1], Martin Hall[2], T. Mituhasi[3], Alvaro Segura[1]*, N. Vogel[2] and S. Andraka[1]

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[2] *IATTC – USA*
[3] *OFCF of Japan*

Extended Abstract

This is the largest artisanal long-line fisheries observer's program ever implemented in Eastern Pacific Ocean. It began in March of 2004 as part of a major effort to abate marine turtle by-catch. Longline fishing for tuna and tuna-like species in the Pacific threatens the survival of marine turtles, particularly leatherback turtles, which some experts believe that will disappear from the Pacific by mid-century if current trend continues. Large circle hooks can reduce marine turtle by-catch by two thirds without adverse impact on target catch in some fisheries.

The program has three working principles:

- No one wants to catch or kill turtles.
- No one wants to put fishermen out of business.
- Fishermen participation in the program is voluntary.

Fishermen are asked voluntary carry long-lines rigged with experiments to test J-hooks against circle hooks, and accept onboard observers. The program seeks a massive substitution of J-hooks and the adoption of best fishing practices, relying on fishermen direct hands-on experience and data collected from their own fishing operations.

The observer, duties and additional work

Recruitment and training

Observers are recruited mainly from fishing ports. We look for people with some level of formal education, including but not restrictive to higher education, and sailor schools, but they are hard to find. We also recruit former fishing vessel crew members.

The observers are trained in: species identification, turtles handling techniques, data sheets filling and the observer responsibilities on-board.

In preparation to sail

Observer's work starts from the very first steps of hooks exchanges and line preparing. Many times this work is doing while onboard, during the trip traveling to the fishing grounds. Keeping the experiment setting is observer's responsibility during the fishing trip.

Data collection and turtle handling

Observers collect important information from the fishing trip, including fishing gear structure, sets, fish catch and turtle by-catch. Data is reviewed for consistency and errors, and entered into a regional database for later statistical analysis. Observers use gears to release hooked and entangled turtles such as dipnets, dehookers, and also train fishermen in better fishing practices.

They adapt to different working conditions (vessel sizes, fishing gear and trip lasting), are asked to collaborated in fishing work due to space limitation and captain willing to have them onboard.

This program will help countries lay the foundation for sustainable long-line fisheries.

The long-line fleet in the EPO

Distant water long-line fleet (DWLLF)
Fishing grounds: international waters within EPO only. Not allowed to fishing within Economic Exclusive Zones (EEZs), part of this fleet land catches in coastal nation ports and use them for logistic matters (water, food, fuel, medical treatment, etc). some vessels have reflagged in coastal countries. There aren't yet observer in vessels of this fleet.

Coastal water fishing fleet

Fishing grounds: EEZs and international waters, according with navigation autonomy of the vessel. The observer coverage is around 400 vessels to date.

Classification of the fleet

- Small scale longliners: under 15 m and less than 20 GRT, which are the majority of vessels participating in the project.
- Artisanal outboard motored skiffs known locally like: tiburoneras, lanchas, pangas, fibras.
- Caracteristics: crew between three and five. Fishing trip: no more than 48 hours on average, except when fishing in association with a larger mother boat.
- Inboard diesel powered motors; storage hold or weelhouse might be forward or aft. The weelhouse in some cases is small or with small capacity, different sizes of the deck, the fishing trips lasting from five to 22 days.

Testing solutions for science based conservation

Fishing vessels in 8 latin America countries (Mexico, Guatemala, El Salvador, Costa Rica, Panama, Colombia, Ecuador an Peru) are testing different types and sizes of circle hooks depending on the fishery characteristics, following and experimental design that should provide statistical evidence on the effect of the hooks with regards to sea turtle hooking rates, target catch rates and location of hooking.

Conclusion

- This project is building the knowledge and conditions for marine turtle by-catch elimination, in long-line fisheries, by promoting testing and adoption of circle hooks and best fishing practices.
- For smaller fishing vessels, hooking leatherbacks turtles can be a real safety risk if attempts to bring the turtle onboard are done. For these smaller vessels, we will have to provide the proper tools to release the turtle while it is in the water. For other smaller turtles, we need to provide dipnets. Current funding is not enough to provide these tools to fisherman participating in the project.
- Dehooking tools are being modified following advice and knowledge that fishermen provide. Now the traditional coiled de -hooker is being substituted by the J tip de hooker, a model suggested by fishermen.
- Knowledge and technical advice is being very valuable. Handling methods are being modified with the helps of these experts as the help of a veterinarian with a great experience handling hooked sea turtles.
- Observers with the best performance come from the fishing sector. These observers are or have been fishermen themselves and understand how to work with other fishermen. They are better accepted than biologist or other technicians, and can do their work in difficult vessels and sea conditions.

An Observer Program for Marine Turtle By-catch Mitigation

By-catch Mitigation in Long-line fisheries across the Eastern Pacific Ocean (EPO)

Contact: Moises Muig - moisesmuig@wwfca.org
Fisheries Senior Program Officer for Latin America & The Caribbean . WWF

The Program

This is the largest artisanal long-line fisheries observer's program ever implemented in the Eastern Pacific Ocean. It began in March of 2004 as part of a major effort to abate marine turtle by-catch.

Longline fishing for tuna and tuna-like species in the Pacific threatens the survival of marine turtles, particularly leatherback turtles, which some experts believe will disappear from the Pacific by mid-century if current trend continues. Large circle hooks can reduce marine turtle by-catch by two thirds without adverse impact on target catch in some fisheries.

The program has three working principles:

Working principles of this program are:

1. No one wants to catch or kill turtles
2. No one wants to put fishermen out of business
3. Fisherman participation in the program is voluntary

Fishermen are asked to voluntarily carry long-lines rigged with experiments to test J hooks against circle hooks, and accept onboard observers. The program seeks a massive substitution of J hooks by circle hooks and the adoption of best fishing practices, relying on fishermen direct hands-on exerience and data collected from their own fishing operations.

Experiments are conducted in 8 countries: Mexico, Guatemala, El Salvador, Costa Rica, Panama, Colombia, Ecuador and Peru. In each country, a team formed by representatives from fishing authorities, fishermen, NGO's and academia educate and reclut fishermen and organizes experimental fishing trips. Observers are trained in fish and turtle species identification, data collection, and turtle manipulation and releasing techniques.

The observer, dutiesand additional work

Recruitment and training

Observers are recruted mainly from the fishing ports. We look for people with some level of formal education, including but not restrictive to higher education, sailor and seamans schools, but they are hard find to find. We also recruit former fishing vessel crew members.

The observers are train in: species identification, turtles manipulation techniques. data sheets filling, the observers responsibilites on board.

In preparation to sail

Observer's work start from the very first steps of hook exchanges and line gearing. Many times this work is repeated while onboard, during trip while traveling to the fishing grounds. Keeping the experiment setting is responsibility of the observer during the fishing trip.

Data collection and turtle handling:

Observers collect important information from the fishing trip, including fishing gear structure, sets, fish catch and turtle by-catch. Data is reviewed for consistency and errors and entered into a regional database for later statistical analysis. Observers use equipment to release hooked and entangled turtles such as dipnets, dehookers, and also train fishermen in better fishing practices.

They adapt to different working conditions (vessel sizes, fishing gear and trip lasting), are asked to collaborate in fishing work due to space limitation and captain willing to have them onboard.

This program will help countries lay the foundation for sustainable long-line fisheries.

The observer always must conduct and supervise turtles handling, dehooking, resucitation, and release.

Other work within the vessel:

- Maintaining fishing experiments in place for all sets, bait preparation and hook bailing, buoys handling and storage.

- Identify a safe place for data logs, documents and equipment on deck, deehoker, dipnet, pliers, and a good working station.

The long-line fleet in the EPO.

Distant water long-line fleet (DWLLF)

Distant water fishing trip in Manta: the big vessels at distance are part of this fleet, also there is a purse seine tuna vessel.

Fishing grounds: international waters within EPO only. Not allowed to fishing within Econocmic Exclusive Zones (EEZs). Part of this fleet land catches in coastal nation ports and use them for logistic matters (water, food, fuel, medical treatment, etc.). Some vessels have reflagged in coastal countries.

Observers coverage: not yet.

Coastal water fishing fleet.

Fishing grounds: EEZs and international waters, according with navigation authonomy of the vessel.

Observer coverage: around 400 vesselso date.

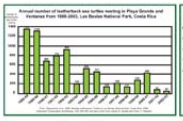
Clasification of the fleet:

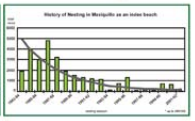
Small scale longliners: under 15 m and less than 20 GRT, which are the majority of vessel participating in the project.

Artisanal outboard motored skiffs: tiburoneras, lanchas, pangas, fibras.

Caracteristics: crew between three and five, sometimes more if long-line is set and pulled manually; inboard diesel powered motors, storage hold or weelhouse might be forward or aft. The weelhouse in some cases is small or with little capacity, weelhouse with accommodation for the crew, different sizes of deck, fishing trips lasting from five to 22 days.

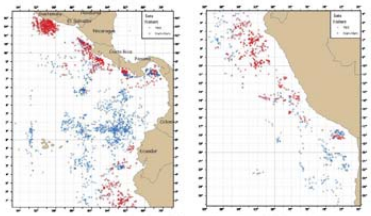
Caracteristics: crew of two or three, outboard motors, no roof, very small working space. Fishing trip duration: no more than 48 hours on average, except when fishing in association with a larger mother boat.





Testing solutions for science based conservation

Fishing vessels in each country are testing different types and sizes of circle hooks depending on the fishery characteristics, following an experimental design that should provide statistical evidence on the effect of the hooks with regards to sea turtle hooking rates, target catch rates and location of hooking. A voluntary on-board observer program collects valuable information to understand the fishing operations, and the interactions with the turtles. Crew and captain are trained on the use of



Maps of experimental long-line sets. TBS+ tuna, billfish; swordfish sets. Mahi-mahi+ mahi-mahi sets.

Conclusions:

- **This project is building the knowledge and conditions for marine turtle by-catch elimination, in long-line fisheries, by promoting the testing and adoption of circle hooks and best fishing practices.**
- **For smaller fishing vessels, hooking leatherbacks turtles can be real safety risk if attempts to bring the turtle onboard are done. For these smaller vessels, the will have to provide the proper tools to release the turtle while it is in the water. For other smaller turtles, we need to provide dip nets. Current funding is not enough to provide these tools to fisherman participating in the project.**
- **Dehooking tools are being modified following advice and knowledge that fisherman provide. Now the traditional coiled de-hooker is being substituted by the J tip de-hooker, a model suggested by fishermen.**
- **Knowledge and technical advice from expert veterinarians with experience working with turtles is being very valuable. Handling methods are being modified with the help of these experts.**
- **Observers with the best performance come from the fishing sectors. These observers are or have been fishermen themselves and understand how to work with other fishermen. They are better accepted than biologists or other technicians, and can do their work in difficult vessels and sea conditions.**

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4. WWF - Central America
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6. WWF - Peru
7. Duke University/APECO, Peru
8. CENDEPESCAR/ Salvador
9. PROBIOMA/Guatemala

Improving the knowledge base and identifying management options for the reduction of sea turtle interactions in Vietnamese fisheries: Preliminary assessment of hotspots and recommended next steps for onboard fisheries observer program

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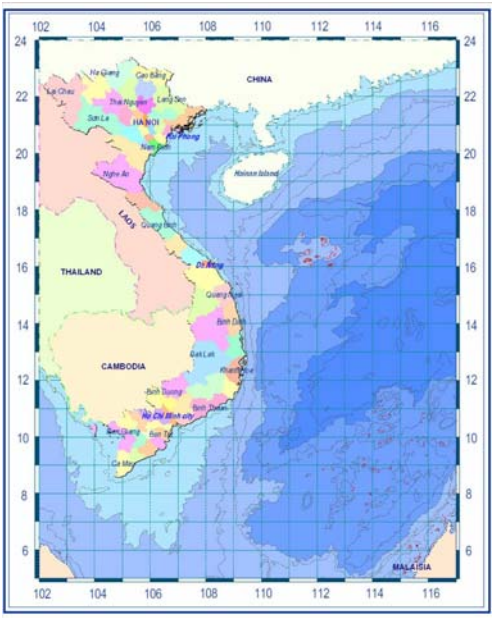
Extended Abstract

Summary

In order to better ensure the protection of sea turtles, the Government of Vietnam and WWF Vietnam have launched a two-stage project entitled '*Improving the Knowledge Base and Identifying Management Options for the Reduction of Sea Turtle Interactions in Vietnamese Fisheries*', with support from the US National Oceanographic and Air Administration (NOAA) and WWF International. The project is divided into two phases. Phase I – completed in April 2007 – focused on more-detailed fleet description in priority provinces, identification of geographic 'hotspots', and relative impacts of different gear types with respect to sea turtle mortality inside Vietnamese waters. Phase II will focus of the implementation of a first-of-its-kind Observer Program in the long-line fleet, in order to ground-truth data, determine baseline on catch rates for target fish and for by-catch, as well as document baseline socio-economic parameters. The project will close with the completion of the Observer Program. Looking forward into the future, an experimental design can be developed for gear replacement (i.e., circle hooks) trials, based on a scientifically robust and community-supported program on gear replacement. Additionally, while the Observer Program will focus on long-line fisheries, a management Options Paper will be developed for gillnet fisheries, relying heavily on the information collected under the project.

This report describes the major results of the first component, providing data and maps on the characteristics and extent of sea turtle interactions with key Vietnamese fisheries through initial research, community meetings and interviews. A first-ever quantitative estimate of the impact of selected offshore and inshore coastal fisheries has been made. Comprehensive data pertinent to the fishery hotspots in Vietnam has been produced, together with data on interactions with sea turtles - size of fleet, trends, seasons, timing, mesh size etc. This information, summarized herein, informs preliminary recommendations on the way forward, specifically with respect to the design and structure of an Observer Program (for long-line fishing boats).



Background

Five species of marine turtles are found within the territorial waters of Vietnam – green, hawksbill, olive Ridley, loggerhead and leatherback. Studies have revealed that all marine turtle populations in Vietnam have been heavily impacted by humans, and all species are declining. Threats include egg collection, harvesting for food, drugs, and handicrafts, as well as by-catch in gillnet, trawl, and long-line fisheries.

In order to promote the protection of marine turtles, the Vietnamese government became a party to two regional memorandums of understanding (MoU): MoU on ASEAN Sea Turtle Conservation and Protection (ratified in 1997) and the MoU for the Protection of Marine Turtles and their habitats in the Indian Ocean Southeast Asian Region (ratified in 2001). Additionally, in 2002 the Vietnamese government, with the assistance of WWF and IUCN began a multi-component project to develop conservation strategies for the protection, conservation and remediation of marine turtle populations and their habitats. This project included components addressing trade, Government and public awareness-raising, population surveys, satellite tracking and other areas. In 2003, the government of Vietnam released its Marine Turtle Conservation Action Plan, aimed at improving the protection and management of threatened marine turtles in Vietnam.

In line with this plan, for the period of 2006 – 2008, WWF in cooperation with the Research Institute of Marine Fisheries have launched a two-stage project 'Improving the knowledge base and identifying management options for the reduction of sea turtle interactions in Vietnamese fisheries'. The following objectives for the By-catch Project were endorsed:

- Improve the knowledge base regarding fisheries-turtle interactions in Vietnamese waters by identifying geographic hotspots for incidental by-catch in Vietnamese fisheries.
- Enhance the understanding and awareness of government authorities and commercial fisheries operating in Vietnam about sea turtles and fisheries.
- Based on preliminary survey results and analyses, design and implement a pilot Observer Program for long-line fisheries.
- Depending on Observer program results, identify next steps, including experimental design of circle hook trials.
- Support capacity building, improved communications, and cooperation for government and industry to develop management options jointly.

Methodology

The initial stage of the project entailed collecting information on fishing fleets (composition, target species, gear types etc.) and compiling and documenting existing information, including unpublished literature regarding interactions between Vietnamese fishing fleets and sea turtles. Following the review and several meetings of experts, three (3) priority provinces were identified for more detailed data collection, based on their reported levels of by-catch. The three provinces chosen were Binh Dinh, Phu Yen, Khanh Hoa. The majority of the long-line fleet in these areas primarily target tuna and mackerel.

The project then organised a community workshop, to elicit more input from fishermen on turtle-fishery interactions and to conduct a survey (questionnaire and semi-structured interviews) in the three provinces, with over 50 individual fishermen participating.

Results

Description of Fisheries:

Binh Dinh is a significant province for capture fisheries – in 2005, total catch was 107,195 tons of which over 90% were taken by gillnet, trawl net, purse seine and long-line. More than 60% of Binh Dinh boats fish outside of the province.

Phu Yen is another important province for capture fisheries, with recent years witnessing particular focus on expanding offshore tuna

fisheries. The province hosts 4,110 fishing boats of which approximately 865 are operating offshore, while 609 boats have engine power ≥ 90 HP. Approximately 200 new boats were built between 2004 and 2005 under the national offshore fisheries program. Due to declining fisheries and poor harvests, no more boat were built in 2006.

Khanh Hoa offers one of the more productive fishing grounds in Vietnam. In 2005, total catch was 66,000 tons in which 80% was from gillnets, trawl, purse seine and long-line.

Table 1: *Fisheries development in Binh Dinh period 1990 – 2005.*

Year	1990	1995	2000	2005
No. of motorised boats	2,676	4,051	5,163	6,256
Total HP	42,280	93,989	190,503	242,542
Total catches (tons)	31,000	58,500	75,500	107,195
Average tons/HP	0.733	0.622	0.396	0.442

(Binh Dinh Dept. of Fisheries, 2006)

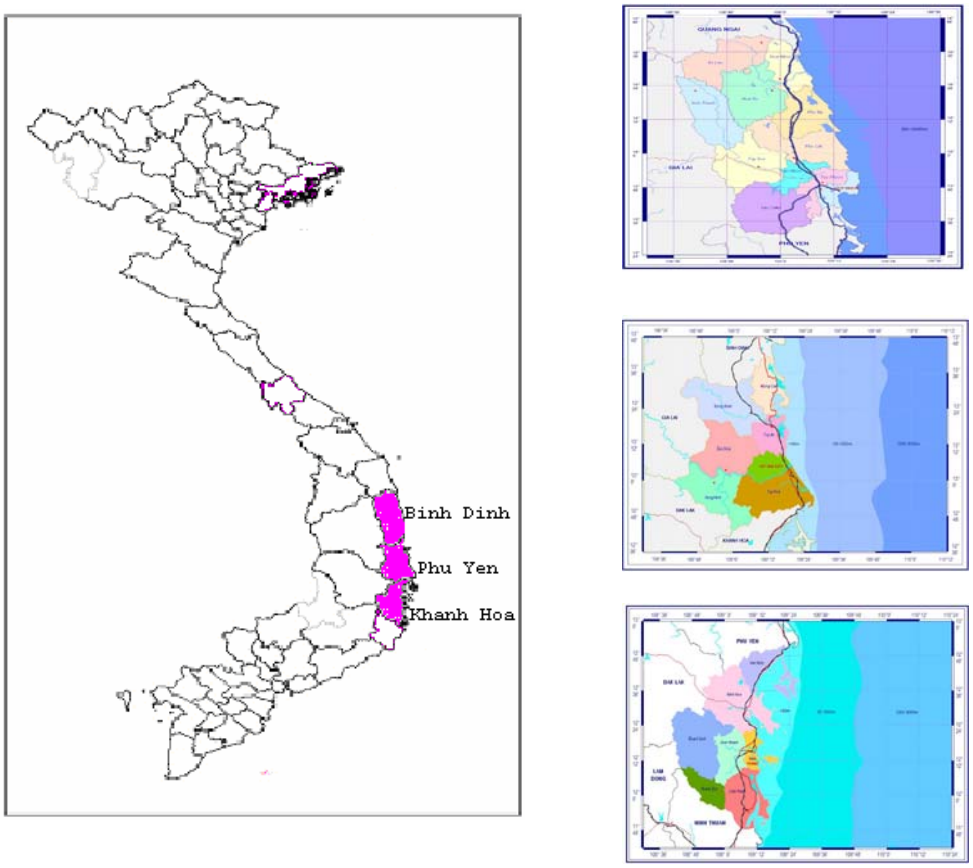


Figure 2: *Map of Vietnam and three priority Provinces, Binh Dinh, Phu Yen and Khanh Hoa.*

Table 2: *Fishing fleet structure in Khanh Hoa by HP group and by gear in 2006.*

Power group	Trawl net	Purse seine	Gill net	Long-line	Others
< 20CV	106	260	235	187	1,918
20 – < 50 CV	233	796	175	85	355
50 – < 90 CV	289	270	157	82	19
90 – < 150 CV	88	64	86	60	28
150 – <400 CV	6	5	22	9	24
≥ 400 CV				2	1
Total	722	1395	675	425	2,345

Fishing Grounds, Seasons and Gears: Fishing boats in the three provinces are generally divided into two groups depending upon engine capacity. Boats of small size and engine power less than 90CV normally operate in shallow water, from 20 to 60 meter depth, at distances from 15 – 60 nautical miles offshore. These boats are operating round-year and using trawl, gillnet, and purse seine with short fishing trip (daily to weekly period). The catch is dominated by pelagic and bottom fish.

Fishing Grounds: In the last few years, the number of boats over 90HP has increased very quickly in all three provinces, especially drift net and long-line boats for targeting oceanic tuna. The fishing grounds for thes boats are offshore areas, deeper than 60m and more than 70 nautical miles offshore, around the Parcel and Spratly archipelagos, offshore waters of the central provinces (from Da Nang to Binh Thuan) and southern waters of Southeast China Sea.

Seasons: Fishing seasons follow two monsoons: the Northeast (from October till January) and Southwest (February till September) monsoons. For the tuna fisheries, the main fishing season is from December to June; big boats may operate all around the year. Normally, from December to Tet (in February), two fishing trips are done around Truong Sa (100° – 130N°) and from Tet to June, another 5-6 trips are conducted (from Tet to April: beyond 140°N, April to June or later: 70° – 100°N).

Gear – Longlines: Long-line fisheries gears consist of three main parts: main line with floats; gangions; and J-hooks. Floats are separated by 800 – 1000m and hang 16 – 20 hooks.

Structure/attributes (longlines):

- 1,500 gangions; 50 arms' spread by 20 arms' depth; 6 hour set time; 1 hour waiting time; 12 hours harvesting; one operation/day; or
- 600 – 800 gangions; 40 arms' spread by 18 – 20 arms' depth; 4hours setting time; 1.5 hours waiting time; 5 hours harvesting time; 2 operations/day;
- Deepest hooks are at about 40 arms' spread under the water surface;
- Bait: flying fish (caught or bought at sea) or cuttlefish (bought at sea);
- Fishing trip: 25 days average;
- Target species: Tuna, mackerel, sail fish;
- Cost: 25 days x 2.5 millions/day = 120 – 130 million VND / trip.

Other Gears:

Purse Seine

- Net: 18m x 500m (alternative gear: anchovy purse seine).
- Target species: Tuna, mackerel, anchovy.
- The fishing grounds is about 1 nautical miles from coast line.

Pair Trawl and Single Trawl:

- Opened Mouth net, normally, 16 – 18m in length with float at the surface side and weighting belt at bottom side.
- The net body and cod-end mesh size 2a mean 5 – 46mm; however, for 'Cao Bay' a kind of Chinese designed trawl, the mesh size is variable from 5 – 300cm and increasing from cod end to opened mouth net.
- Target species: all demersal fish or trash fish for lobster aquaculture in Phu Yen.
- Trawling time: 3 – 4 hour trawling.
- Fishing trip duration: 1 – 2 days.
- Fishing ground: Along the Central coast from Da Nang to Binh Thuan, about 3 nautical miles from the coast at the depth of 20 – 30m.

Gillnet (Drift gillnet):

- Simple design, with a single layer nylon net, or double or triangular layers.
- Common mesh size is 2a = 40 – 60mm and its length range from 1,500 to 15,000m.
- The height of net is 15 – 20meters from the floating nodes in the surface water line to the weighting line at bottom side.
- Net: (21m x 80m)/panel x 150 panels (approx. 12km – 15km).
- Net is set 2m under the water surface.
- Depend on the boat's engine power, the fishing grounds range from 1 nautical mile to about 100 nautical miles from VN coast line.
- Fishing trip duration for the offshore: 1 – 2 weeks.
- Target species: Tuna, mackerel, swordfish.
- Many boats have changed gear to hand line for cephalopods. Flying fish gill-netters are operated all year and accompany with tuna long-line to provide bait for long-line boats.

Table 3: *Fishing grounds and target species catches at three selected provinces.*

Gear Type	Fishing ground and trip duration	Target and non-target species
Pair trawl nets	At depth of 50 – 100m nearby Phu Yen to Binh Thuan	Sepia, Lolligo, bottom fish such as: Trichiuridae, Synodontidae, *Plemiptenus upenoides*, Mullidae, Leiognathidae, crabs
Single trawl net	Shallow water areas such as, Dai Lanh, Van Phong, Cam Ranh lagoons and baylets	Bananard, Monodon, *Peunaeus metamerguiensis*, Leiognathidae, Synodontidae, Cobia (Rachycentridae), squids
Drift gillnets at boat equipped engine < 90CV	Offshore seawaters far away 10 –50 nautical miles and fishing often takes 4 –7 day per trip.	*Sarda orientalis*
Drift gillnets at boat equipped engine > 90CV	Fishing operation often takes 15 – 20 day per trip.	Scombridae, *Sarda orientalis*, *Chromis notatus*
Bottom Gillnets	Phu Yen to Ninh Thuan Seawater at depth of 64 – 190 m	*Plemiptenus upenoides*, Cavangidae and other pelagic fishes
Fish Aggregated Devices	Nearshore areas at 3 selected provinces	Engrulidae, Synodontidae, Cavangidae (Decapterus), Cluppidae, squids.
Purse seine – light at night time	Phu Yen to Ninh Thuan seawater	*Atule mate*, Cluppidae, *Rastrelliger albacares*, *Auxis rochei*
Curtain set nets	Phu Yen to Khanh Hoa seawater at depth of 30 – 100m	Engrulidae, Cavangidae, Cluppidae, squids, Auxis rochei, Rachycentridae, Leiognathidae, Holocentrida.
Tuna long-line	Covering fishing ground from Paracel to Spratly archipelagoes at longitude 110,000 outmost and Latitude 7,000 to 17,000 E	*Thunnus albacares*, *Thunnus obesus* and others.
Handling fishing	Nearby Phu Yen to Khanh Hoa Seawater	Scombridae, Siganidae, Rachycentridae.
Handling squid fishing	Phu Yen to Ninh Thuan, Binh Thuan Vung Tau seawaters	Sepia, Lolligo
Others: scoop nets, Set nets	Seashore, islands and Shallow seawater from Phu Yen to Binh Dinh and Binh Thuan provinces	Tuna, Engrulidae, *Chromis notatus*, *Megalaspis cordylam*, swimming crabs, bananard shrimp, Rachycentridae, Leiognathidae, Mugilidae.

Encounters:

Based on the primary data of the three selected province's reports, more than 55% of total marine fisheries catches are harvested by purse seines, trawls, long-lines, gill nets and drift nets. The total sea turtle mortality comprised by these gears, at the local level, is still not mentioned in the provinces' reports. However, all of opinion showed that sea turtles are often encountered and die due to:

- Late releasing and escaping from the nets/hooks.
- Improper discarding from the nets or boats.
- Entanglement in fishing nets.
- Ghost fishing of lost gear.
- Infection.

The annual fishing mortality and post-catch mortality of sea turtles, categorised by fishing gears, was also estimated by the fishermen that participated in the workshop. It is estimated that:

- 85% of turtles caught in gillnets were alive, when surfaced.
- The proportion of turtles caught by long-lines is likely higher than by gillnet.
- On average, each year, 5 to 10 turtles were entangled by individual gillnet boats while 10 – 15 were caught by lines (gillnet is operated 10 months/year while line operated 4 months/years).
- For trawls, it is reported from Phu Yen that, both single and pair trawls caught sea turtles, even though there is no official data about this issue.

Before 1990, the Kien Giang region of SW Vietnam was considered to have the highest density of turtles in Vietnam. However, based on the results of this recent project, generally the large area off the Central and South-Central coast of Vietnam – south of the parcel Archipelago and shouldering International waters – is considered the most likely area geographically for encounters (for inside Vietnamese waters). This area is reported, anecdotally, as having many hawksbills in particular, but with all species being encountered. There are few if any turtles encountered on the Vietnamese side of the Spratly archipelago, though reportedly found in harvests north and east of the archipelago. Fishermen also mentioned that, for offshore fisheries, sea turtles are most often seen in the spring, predominantly green, hawksbills and leatherback turtles.

Conclusions

- Significant levels of all five species of sea turtles are being incidentally caught in Vietnamese waters. An exact figure of annual mortalities cannot be established, however an approximation of at least one thousand mortalities a year, likely more, is reasonable.
- While sea turtles are caught as by-catch throughout all of Vietnam's territorial waters, incidents are highest in the waters off Central and South-Central Vietnam.
- Fisheries originating in the provinces of Phu Yen, Binh Dinh and Khanh Hoa are particularly prone to sea turtle by-catch, given their fleet size, fishing intensity and the expansion of long-line fisheries in these provinces.
- By-catch is also common in fisheries operating outside of Vietnam's territorial waters. However, given the sensitivities involved and the high level of by-catch inside Vietnamese waters, future mitigation efforts should focus on activities inside Vietnamese waters.
- There is a growing, though still insufficient, awareness among fishermen and local authorities regarding the status of sea turtle populations, existing laws and regulations.
- There is strong potential for developing an Observer Program and future experimental trials of gear replacement in the priority provinces.
- The use of simple de-hooking and line-cutting devices on long-line boats could significantly reduce sea turtle by-catch inside the hotspot region.
- Given the expansion of long-line fisheries in the priority provinces, mitigation measures (i.e., circle hook replacement) need to be immediately explored, commencing with the ground-truthing of information obtained through a modest Observer Program.
- For long-lines, the information obtained provides a good understanding of hotspot fisheries and/or provinces, as a foundation for a future Observer Program.
- While long-line fisheries are most intense during the spring and early-summer, an Observer Program established outside of this period would provide sufficient samples and observance opportunities to ground-truth data and develop an adequate database from which to base any future gear replacement trials.

Recommended Next Steps (Long-line Program):

- An Observer Program for long-line fisheries in the three provinces should be launched, by August or September 2007. The program should consist of 5 – 10 boats for each of the three selected provinces, over a period for data collection of at least one month/boat. The majority, if not all, of these boats should be those targeting tuna.
- Officials from the provincial Department of Fisheries (DoFi) should be used as on-board observers, 'Outside' observers (i.e., University students or otherwise) would likely not be accepted by boat captains and crew, and furthermore there is a need to assist DoFi to expand their capacity for local management (i.e., which is well-matched to the Project.)
- Ahead of the Observer Program, training for onboard observers and crew should be provided. The training should be integrated with additional awareness-raising and community training on de-hooking and rescue/resuscitation methods.
- RIMF should provide a lead role in coordinating the Observer Program and in liaison with the three individual provincial Department of Fisheries.
- Further data collection and interviews for gillnet fisheries is required (ahead of developing an Options Paper); this should be developed in a different forum than the proposed Observer Program and community awareness workshops proposed above.
- RIMF and DoFi should develop an MOU or 'agreement of confidentiality' for the proposed Observer Program, in order to reduce the chance of mistrust among local fishermen and to better ensure their cooperation.
- While the project partners strongly recommend that the proposed Observer Program be confined to fishing trips inside Vietnamese waters, the program should be developed with a view to assess the need (and the potential for) an expanded Observer Program that includes the longer trips that may involve harvesting in International waters.

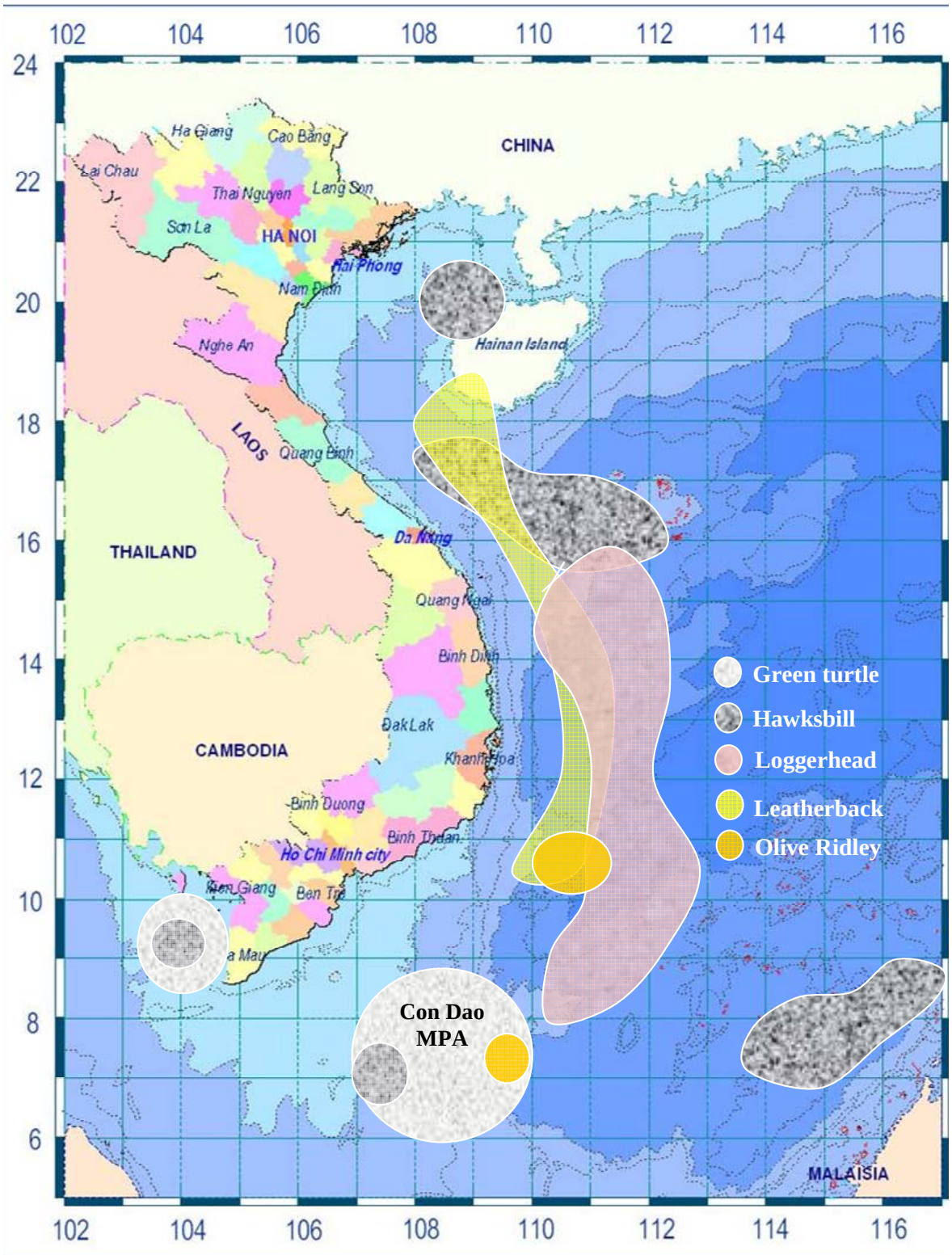


Figure 3: *Hotspots for Sea Turtle Encounters in Vietnam.*

A) B)

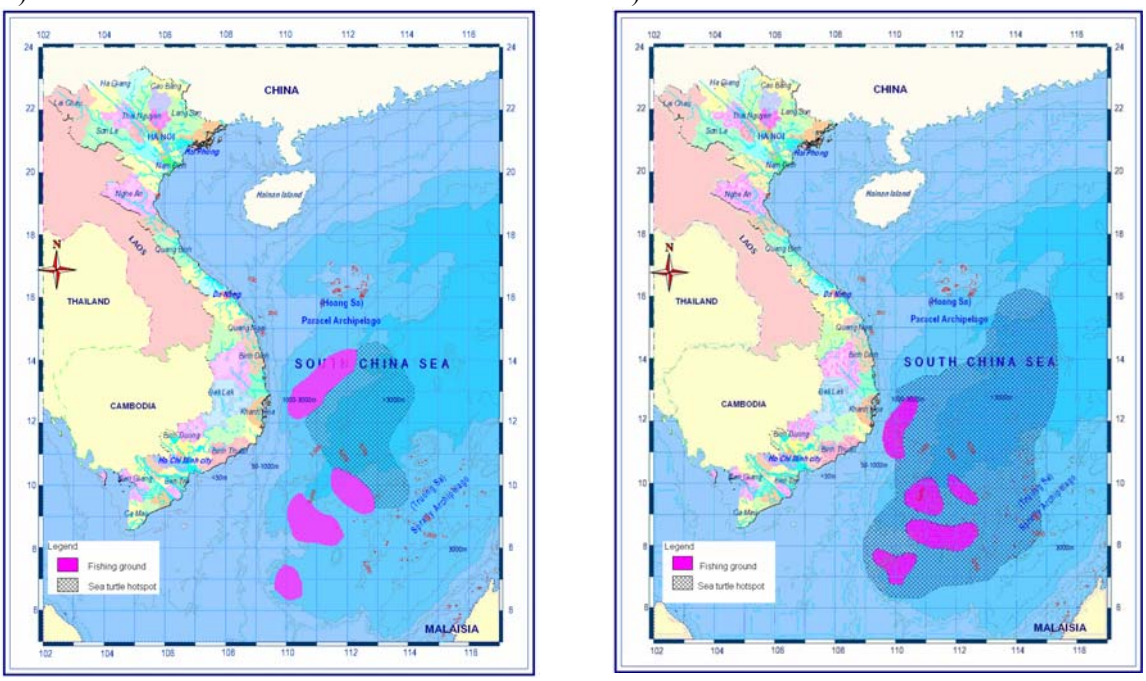


Figure 4: *Overlay of fishing grounds for long-line operations with hotspots of Incidentally-caught sea turtle during A) North-East Monsoon and B) South-West Monsoon.*

A) B)

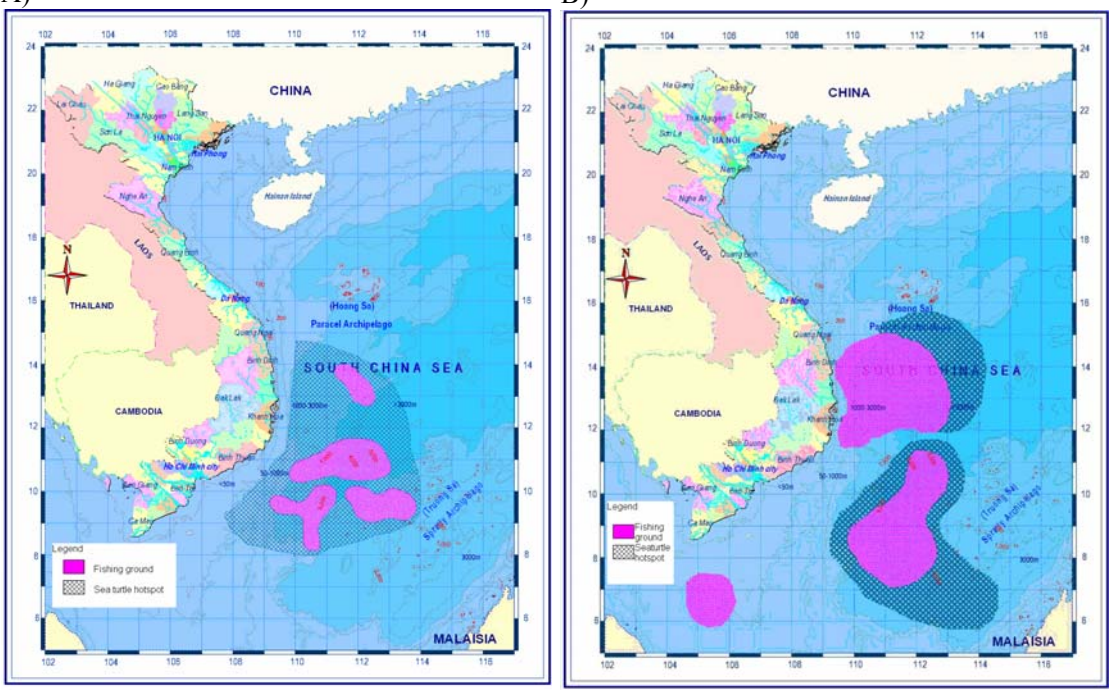


Figure 5: *Overlay of fishing grounds for drift and gillnet operations with sea turtle hotspots during A) North-East Monsoon and B) South-West Monsoon.*

Data quality in relation to observers' length of employment

Amy S. Van Atten*, Katherine McArdle, Sara Wetmore and P. Yoos

Northeast Fisheries Observer Program , Northeast Fisheries Science Center – USA

Extended Abstract

Does data quality increase with observer experience? Observers must work independently under harsh and variable conditions and the workload of completing logs and sampling catch is enormous. Their role is critical as they work under the eye of the fishing industry, as a representative of the National Marine Fisheries Service (NMFS). NMFS must ensure that observer data are of high quality and the performance of individual observers must be monitored. As observers become more experienced, their performance is expected to increase, as they have a better knowledge of how to complete the logs successfully, follow sampling priorities, and can gather information and samples at a faster pace.

In 2002, the NEFOP implemented a bonus system for observers in order to reward outstanding work and promote higher data quality from the source. For the past five years we have adjusted the bonus system so that observers can be fairly evaluated, it does not create incentives for falsifying data or withholding details of an event, it does not impact decisions of safety at sea, it can be realistically tracked by office staff, and it promotes better data collection techniques and more observed trips. The NEFOP has received critiques and survey results from the observers on what their thoughts were on the bonus system. Many legitimate concerns were raised, resulting in much groundwork for the entire NEFOP and modifications in the bonus system over time. We have adjusted the evaluation criteria to be fair across all types of trips (gear types and trip length); improved the formatting of the logs for easier completion; improved reference documents and trainings for observers and debriefers; scheduled more frequent meetings and debriefings; stayed in regular contact with observers through email, cell phones, and websites; and increased outreach to industry to promote cooperation. We feel that the system has gone through most of its major changes and will now serve well to track observer's performance through time.

The bonus award has five components: (i) eligibility; (ii) data quality score; (iii) field performance score; (iv) extra credit score; and (v) calculation of the monetary award. Steps 1 through 4 are done on a quarterly basis (three months), starting with the first month of the contract. Step 5 is done on an annual basis at the end of the contract year.

Due to the modifications made to the bonus evaluation methods and contractual changes, we are only reporting the conclusions of this past contract year. The contract started on April 1st, 2006, so the quarters are identified as: Quarter 1 (April 2006 – June 2006), Quarter 2 (July 2006 – September 2006), Quarter 3 (October 2006 – December 2006), and Quarter 4 (January 2007 – March 2007).

There are 42 current observers included in this study. Each observer was classified into an experience category: less than 1 year (7 observers), 1 – 2 years (21 observers), 3 – 4 years (7 observers), 5 – 10 years (3 observers), and > 10 years (4 observers) of service (Table 1).

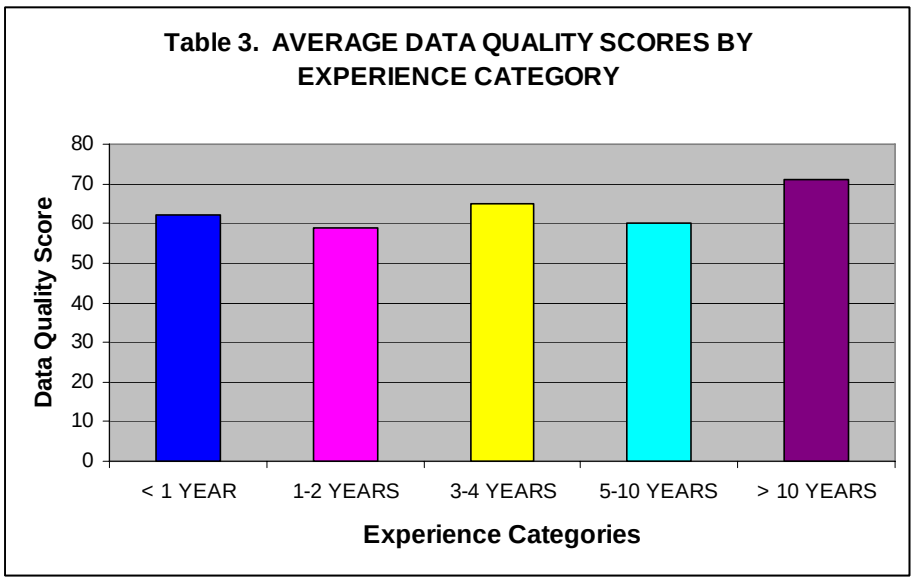
In order to evaluate whether data quality improved over the year, the quarterly data quality scores were averaged by experience category. In order to examine if data quality was better for more experienced observers, the annual data quality score was averaged by experience category. In order to examine whether field work and overall performance improves with experience, we averaged the scores on communication with the editor, willingness to improve, progress in data collection and quality, field performance, captain feedback, area lead input, and bonus points by experience category.

The bonus results from the 2006 – 2007 contract year do not show clear trends of performance changing with experience. Most of the more experienced observers score consistently higher scores than less experienced observers. However, new observers are also

capable of scoring well on the data quality bonus evaluation. Individual observer scores changed from quarter to quarter, possibly due to environmental challenges.

There may be some seasonal challenges, such as extreme temperatures, rough seas, dangers on deck, and limited fishing effort, that affect the observer's data quality scores from quarter to quarter. The data quality score was highest during the summer months and lowest during the toughest winter months. Within an experience category, individual observer performance did range significantly. In categories with a smaller sample size, an individual with poor performance may affect the average score.

Other evaluation factors should also be used in judging an observer's performance, such as sampling their rate in relation to the appropriate requirements, how well they document unusual events or critically important events, helping with outreach, observing on the more difficult vessels, and willingness to travel or take trips on short notice. It is important not to use the bonus scores as a stand alone method to evaluate observer's performance however it may be useful to track data quality of individuals over time. (See poster for complete text and tables).



Data Quality in Relation to Observers' Length of Employment

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Abstract

Does data quality increase with observer experience? Observers must work independently under harsh and variable conditions and the workload of completing logs and sampling catch is enormous. Their role is critical as they work under the eye of the fishing industry as a representative of the National Marine Fisheries Service (NMFS). NMFS must ensure that observer data are of high quality and the performance of individual observers must be monitored. As observers become more experienced, their performance is expected to increase, as they have a better knowledge of how to complete the logs successfully, follow sampling priorities, and can gather information and samples at a faster pace. The bonus results from the 2006-2007 contract year do not show clear trends of performance changing with experience. Most of the more experienced observers score consistently higher scores than less experienced observers. However, new observers are also capable of scoring well on the data quality bonus evaluation. Observers with <1 year experience, observers with 3-4 years of service, and the observers who have been with the program for more than 10 years score a bit higher than the 1-2 year range and the 5-10 year range. It may be that communication with debriefers and other NMFS staff may be decreased during those periods. Individual observer scores change from quarter to quarter, possibly due to environmental challenges. Data quality scores may be useful to track data quality of individuals over time, but should be averaged over the year – then compared annually.

The Bonus System

PURPOSE: Reward outstanding work and promote higher data quality

MUST ENSURE THAT:

- ***Observers can be fairly evaluated***
- ***Does not create incentives for falsifying data or withholding details of an event***
- ***Does not impact decisions of safety at sea***
- ***Can be realistically tracked by office staff***
- ***Promotes better data collection techniques and more observed trips***

RECENT IMPROVEMENTS:

- ***Formatting of the logs for easier completion***
- ***Better reference documents and trainings for observers and debriefers***
- ***Scheduled more frequent meetings and debriefings***
- ***Regular contact with observers through email, cell phones, and websites***
- ***Increased outreach to industry to promote cooperation***

BONUS COMPONENTS:

- ***Eligibility***
  - ***three months after the completion of the 3-week training***
  - ***must complete 36 days over a three month period***
  - ***ineligible if an observer is decertified for data quality reasons or for violating the standards of conduct***
- ***Data Quality Score - 80 points (Makes up 80% of the total score)***
  - ***data quality review worksheet is completed for each trip***
  - ***timeliness in reporting the trip and sending in data***
  - ***completeness and formatting of fields***
  - ***following sampling protocols***
- ***Field Performance Score – 20 points (Makes up 20% of the total score)***
  - ***communication with debriefer***
  - ***willingness to improve data***
  - ***overall progress in data collection and data quality***
  - ***overall attitude about the program***
  - ***vessel selection***
  - ***feedback from Captain Interviews and Fishermen Comment Cards***
- ***Extra Credit Score - 5 points***
  - ***"Observer of the Month Award"***
  - ***retaining whole fish for training***
  - ***suggesting innovative techniques for sampling***
  - ***helping to develop protocols in newly observed fisheries***
  - ***breaking into a new port or new fishery***
  - ***bringing in whole marine mammal or sea turtle samples***
- ***Calculation of the Monetary Award***
  - ***Score of 85 = no award is given***
  - ***Score 85 – 89 = $50 per eligible sea day***
  - ***Score 90 – 105 = $100 per eligible sea day***

If an observer works 12 days per month and achieves a perfect score,
the annual pay out could be $14,400.

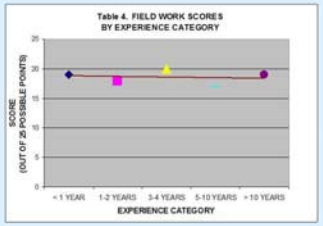
Score Evaluations & Results

The most recent NEFOP observer provider contract started on April 1st, 2006, so the quarters are identified as: Quarter 1 (April 2006 – June 2006), Quarter 2 (July 2006 – September 2006), Quarter 3 (October 2006 – December 2006), and Quarter 4 (January 2007 – March 2007).

There are 42 current observers included in this study. Each observer was classified into an experience category: less than 1 year (7 observers), 1-2 years (21 observers), 3-4 years (7 observers), 5-10 years (3 observers), and > 10 years (4 observers) of service (Table 1).

Did data quality improve over the year? In order to evaluate whether data quality improved over the year, the quarterly data quality scores were averaged by experience category. The average data quality score for quarter 1 (April-June) was 64, quarter 2 (July-September) was 67, quarter 3 (October-December) was 65, and quarter 4 (January-March) was 63 (Table 2). The only noticeable trend was in the 3-4 year range that actually decreased over the year.

Was data quality better for the more experienced observers? In order to examine if data quality was better for more experienced observers, the annual data quality score was averaged by experience category. There is not a large difference in data quality scores, although it was higher for the most experienced group (Table 3). The most experienced observers with more than 10 years of service did score the highest points for data quality.



Does field work improve with experience? In order to examine whether field work and overall performance improves with experience, we averaged the scores on communication with the editor, willingness to improve, progress in data collection and quality, field performance, captain feedback, area lead input, and bonus points by experience category. The average field work scores did not differ much by experience category. The 3-4 year category scored the highest in field performance (Table 4).

Conclusions

- High variability of how well individuals can collect data regardless of their time in service.
- Do not show clear trends of performance changing with experience.
- Most of the more experienced observers score consistently higher scores than less experienced observers. However, new observers are also capable of scoring well on the data quality bonus evaluation.
- Individual observer scores changed from quarter to quarter, possibly due to seasonal challenges, such as extreme temperatures, rough seas, dangers on deck, and limited fishing effort. The data quality score was highest during the summer months and lowest during the toughest winter months.
- Within an experience category, individual observer performance did range significantly.
- Important not to use the bonus scores as a stand alone method to evaluate observer's performance.
- Data quality scores may be useful to track data quality of individuals over time, but should be averaged over the year – then compared annually.

Photo Credits: Northeast Fishing Vessel by A. Van Atten;
Observer Debriefing by Don Parkinson, Enterprise
Map background by B. Gervelis

Designing a monitoring system for the U.S. Pacific Groundfish Trawl Individual Quota Program – key questions

Stephen Freese

NOAA Fisheries, National Marine Fisheries Service, Northwest Region – USA

Extended Abstract

The Pacific Fishery Management Council (the organisation responsible for coordinating management of fisheries off California, Oregon, and Washington) is proposing regulations for implementation by the National Marine Fisheries Service (the organisation responsible for managing marine EEZ fisheries) a new management system for the groundfish trawl fishery. This system is a trawl individual quota program (often called an Individual Transferable Quota-ITQ, or an Individual Fishing Quota-IFQ). The groundfish trawl fishery consists of over 90 species of groundfish, including overfished species that provided in 2005 about 250,000 tons of harvests worth $50 million in ex-vessel revenues to over 25 ports through the efforts of about 150 active trawlers, 6 motherships, 17 mothership-catcher vessels, and 5 catcher-processors. The major question is what monitoring systems have to be put in place if the Trawl IQ program is to be implemented by 2010? To put this program into place, existing state (3 state fish ticket, shoreside port sampler, and logbook programs) and federal monitoring programs (two human observer, one camera, and one vessel monitoring system) and will have to be upgraded and integrated with additional reporting systems that track ownership and trading of transferable individual quotas. In developing this program and the associated costs, there is a need to frame the various issues so that a meaningful dialogue can happen among those who currently monitor the fishery, and between the fishing industry, other members of the public, and fisheries managers. The purpose of this project is to develop a series of key questions based on existing information and presentations being made at this Conference to help aid discussions and analyses under the processes of the *Magnuson-Stevens Conservation and Management Act* and the *National Environmental Policy Act*.

How are fishery observer data used?

Timothy Lescher

Frank Orth & Associates – observer provider for the National Marine Fisheries Service, Southwest Region – USA

Extended Abstract

In the field, observers are frequently asked by captains and by the public where the information they are gathering goes, and how it is used. There are many users of the data and the specimens collected by observers and a variety of ways in which these data are used. The users include the National Marine Fisheries Service (NMFS), and its researchers in particular. In the Southwest Region of NMFS, fishery observers aboard drift gill net vessels have collected common thresher shark data and specimens. Stomach contents have been analysed, and diets contrasted during warm water and cool water transitional periods. Shortfin mako shark and common thresher shark livers, which were collected by observers, are currently being tested for their level of mercury. Short-beaked common dolphin DNA samples collected by observers have revealed possibly two or more separate stocks in the Pacific Ocean. Historical observer data from the drift gill net fishery was used to help NMFS determine what a suitable closed area would be off California to protect leatherback sea turtles. Swordfish DNA, otoliths, and parasite samples collected by observers are currently being analysed to help better understand the swordfish stock structure and migration. These studies are beneficial to the fishing industry and fisheries managers to help them understand the health of target fish populations, and the health of other marine organisms that come into contact with the fisheries. It is important to have an understanding of why observers are collecting data, and how that data is used.

Propagation of uncertainty in by-catch estimates through VPA stock assessment models

Andrew B. Cooper[1] and Robert J. Trumble[2]*

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Extended Abstract

The estimation of total removals is of crucial importance to stock assessment. Despite the fact that catch and mortality associated with by-catch are typically assumed known without error in stock assessment procedures, uncertainty in estimates of these quantities will propagate through the assessment procedure into uncertainty about the estimate of stock size and status. Similarly, bias in estimates of by-catch may lead to bias in estimates of stock size and status, with underestimates of by-catch mortality generally leading to overestimates of stock size and an overly optimistic view of stock status. MRAG Americas undertook a study for the Northeast Fishery Science Center to evaluate the propagation of uncertainly from discards estimated from the groundfish observer program data administered by the Center.

Allowing for uncertainty in discards in a VPA / ADAPT model can have profound implications for both point estimates and their associated uncertainty. Changes in the point estimate for total weight of US discards can have direct effects on the point estimates for population size and fishing mortality rate for those ages present in the discards. The impact, however, is dependent upon the absolute amount of discards and the amount of discards relative to the total catch of fish at that age. Using a Bayesian framework to incorporate uncertainty in discards allows the stock assessment model to estimate a total weight of US discards that differs from the value at the mode of the prior, and hence the value used when discards are assumed known.

The degree to which the estimate of total weight of US discards differs from the mode of the prior depends upon both the variance of the prior and uncertainty in the likelihood fit of abundance to the indices. The larger the variance in the prior, the greater the flexibility the model has in estimating total weight of US discards. The different estimates in total weight of U.S. discards will, in turn, produce different estimates of abundance and fishing mortality. Even when assuming low variance in the prior for total weight of US discards, the uncertainty in the abundance for discarded ages could be significant. With prior variance realistically being somewhere between 1/10th and 1/6th times the natural-log of the mode, CVs for abundance estimates of completed cohorts can easily reach 25 – 30%. For incomplete cohorts, CVs for abundance estimates could reach as high as 40 – 60% depending on age and proximity to final year. The impact of this uncertainty on management targets and thresholds based on SSB-recruit relationship was not examined here, but would likely be significant.

The impact of uncertainty in discards is limited, in part, by the backward-calculating nature of the model itself. Changes in point estimates and uncertainty can only propagate backward in time. If there is no discarding of older individuals, then incorporating uncertainty in discards will not impact those older age classes, unless one also incorporates uncertainty in the age distribution of discards. Even then, backward calculating models are likely to underestimate the impact of uncertainty in discards and in landings because the uncertainty can propagate in only one direction. Forward projecting models may propagate these uncertainties in a more accurate fashion because uncertainty in catch of young age classes will propagate forward and uncertainty in catch older age classes will require varying levels of initial recruitment of that cohort. With discards typically comprising only a small portion of total catch, this analysis demonstrates how extremely sensitive VPA / ADAPT models may be to other sources of uncertainty in the components of total catch. Rather than examining how other sources of uncertainty may affect VPA / ADAPT models, switching to statistical catch-at-age models that are designed specifically to address such issues is recommended.

SHORT ABSTRACTS OF OTHER POSTERS PRESENTED AT THE CONFERENCE

Monitoring challenges in a rationalised fishery

Jason Anderson* and A. Kinsolving

NOAA Fisheries – USA

Abstract

The Alaska region implemented an individual fishing quota (IFQ) system in 1993 for halibut and sablefish harvested in and off the coast of Alaska. The halibut and sablefish IFQ program was intended to address various management and economic concerns by reducing fishing capacity and allocating secure quotas among fixed gear participants. The *American Fisheries Act* (AFA), implemented in 1998, effectively rationalised the Bering Sea pollock fishery by allowing the formation of cooperatives among a closed class of vessels and processors. This created one of the largest rationalised fisheries in the world. Additionally, the National Marine Fisheries Service (NMFS) is in the process of proposing two separate management actions that would implement complex rationalisation programs in the Bering Sea and Aleutian Islands flatfish fishery, and the rockfish fishery in the Gulf of Alaska. While these quota programs allow participants to maximise productivity, they also increase the likelihood of deliberate misreporting and create a need for very accurate, near real time catch data. To manage rationalised fisheries properly, NMFS must have data that provides acceptable accounting of the total catch by species and area for each quota account. Based on the lessons learned from early quota based programs, NMFS has developed rigorous monitoring programs that seek to meet clearly articulated monitoring and catch accounting goals for quota based fisheries. To meet these goals, NMFS is adapting available monitoring tools to the existing statutory and regulatory structure. At the same time, we are developing new and innovative monitoring tools which may decrease our reliance on observers, provide for better monitoring data, and decrease costs to industry.

A portable electronic data capture system for recording observer data in the field

R. Ayers

Cefas, Suffolk – U.K.

Abstract

Fisheries research, assessment and management rely heavily on basic information from population, landings and catch sampling. This sampling is both labour intensive, and, in common with most data collection exercises can be vulnerable to human error. Cefas has developed an integrated unit to collect this data. The system provides a robust and extremely flexible method for collection of vessel, catch and discard data and can interface with digital equipment such as callipers, balances and GPS. Project managers can easily specify a range of data parameters and set targets to meet either general or highly specific sampling requirements. These targets together with a range of validation and quality checks are used to prompt operators whilst sampling, which can be particularly useful for single handed operation in the field. The system is designed for use onboard research vessels, commercial vessels, fish markets and for the majority of field sampling tasks where storage of large numbers of measurements is required.

Achieving observer professionalism and credibility through observer knowledge base retention

Evan Bing-Sawyer

WCGOP – USA

Abstract

The cost to a fishery monitoring program of losing an experienced observer knowledge base is greater than just the burden of training new observers. Not only is this knowledge base particularly important for programs that rely on observers to contact vessels and coordinate specific ports, but a seasoned observer's experience is also a valuable commodity to any program. Through interactions with vessel operators and working at sea, observers develop valuable problem-solving skills that cannot be provided through classroom training. It should be the goal of each program to retain such skills. Observer knowledge loss can be reduced in three main ways. The first method to reduce observer knowledge loss is to increase observer retention with incentives and benefits. Second, experienced observers should act as mentors of novice observers, guiding them around the port(s) in which they will be working to point out potential problems and help to build rapport with vessel operators. And finally, programs should develop a database or repository where observers can document specific vessel and port information so that new observers will have a better understanding of their role as observers. In support of these recommendations, observer responses to a preparation and training survey will be presented. The use of some, or all, of these methods by a program will promote a more efficient and credible program that provides the industry with consistently knowledgeable observers.

Advantages and disadvantages of contract observers at the Pacific Islands Regional Observer Program

Kevin Busscher

Pacific Islands Regional Observer Program, Hawaii – USA

Abstract

The Pacific Islands Regional Observer Program (PIROP) has been placing observers onboard Hawaii longline vessels since 1994. In 2000, the PIROP converted from federally employed observers to contract observers. There are several advantages and disadvantages to using an observer contractor. The contractor can complete the hiring process quickly which enables the program to keep coverage at a consistent optimal level. Observer gear and equipment purchases can be completed promptly by the contractor. The contractor handles all the logistics of observer deployments. These changes have enabled the PIROP to place more focus on observer training, data quality, and overall management of the program. Although having the contractor complete all logistics for observer deployments saves the program resources, it can also weaken relationships between the industry and NOAA because the contractor is seen as the face of the program. The contractor gets paid for training observers and veteran observers cost the contractor more. This has the potential to cause a higher incentive to have more training classes and lower incentive for observer retention. Since the contractor does not get paid if the data are determined unusable, there can be a low incentive to report bad data collection practices. All this can put a strain on program staff and lower the data quality. In addition the contractor makes approximately 200 K for each percentage of coverage. This can result in a higher incentive for the contractor to go above the target coverage. This can result in major funding issues for the program.

A photographic guide for identification of South West Atlantic's seabirds. An observer contribution for observers

Guillermo Cañete[1]* and M. Royo Celano[2]

[1] *Fundación Vida Silvestre Argentina, Buenos Aires, Argentina INIDEP-AA*
[2] *Scientific Observer*

Abstract

By-catch has a serious impact on the health of seabird populations some of which are seriously threatened. Observers play a key role in by-catch assessment, monitoring and mitigation. The effectiveness of their work depends on their ability to identify seabirds under real on-board work conditions. Generally, all the guides are counting on the fact that we can hold the birds in our hands, hurt or dead. This guide tries to simplify the identification using binoculars or camera. It's true that many details could be los but, thankfully, seabirds will stay alive. The guide puts special emphasis on the recognition of seabirds from an observer's point of view, onboard fishing vessels. For this reason, bird identification is supported by photographs. This guide is the result of the opportunity to be onboard (more than 200 sea days), the skills of a biologist-scientific observerprofessional photographer, and the passion of a person to invest his 'after hours' on the deck, taking pictures. Fundación Vida Silvestre Argentina (FVSA), with the support of ABC and WWF, jointly with Aves Argentinas (AA), INIDEP and National University of Mar del Plata, helped to produce this unique guide.

Industry-funded Sea Scallop Observer Program: An Observer Provider's Perspective

Jerry Cygler* and K. Cygler

East West Technical Services – USA

Abstract

Sea Scallops are one of the highest value species landed in the United States and the fishery has experienced profound growth in recent years, providing opportunities to a struggling east coast fishing industry. In 2006, an industry-funded program was implemented under the Atlantic Sea Scallop Fishery Management Plan through a scallop total allowable catch (TAC) and days-at-sea (DAS) set-aside program. Under this emergency action, scallop vessels are required to procure certified fishery observers for specified scallop fishing trips. The purpose of the program is to monitor finfish, particularly yellowtail flounder, and endangered species by-catch. East West Technical Services is a family-owned and operated Observer Provider for the National Marine Fisheries Service as well as a U.S. Army Corps Disposal Inspector Provider EWTS provides trained fisheries observers for the 2006 – 2007 industry-funded sea scallop fishery. From an observer provider prospective, there are significant successes and benefits to an industry-funded program, such as increased flexibility and choice options for industry members, diversified business opportunities for small companies, and an increase in the quality of data collected at sea. There are also some hurdles and improvements to such a program, including lack of institutional organisation and potential confusion about course of action for unexpected events. We offer our perspectives and propose a framework for future industry funded programs that will benefit the fishing industry, small businesses, and the quality of fisheries data collection.

Pacific Islands Observer Program

J. Kelly

NOAA, NMFS, PIRO, Hawaii – USA

Abstract

This is a video of the Pacific Islands Observer Program. It reviews all the aspects of what it takes to be a Pacific Islands Regional Observer; traianing, the fishery, safety, life at sea, life aboard acommercial longline vessel, species identificaiton; fish, marine mammals and sea birds. Participants in this video are observer program staff, observers and commercial fishing boat captains and crew. The video is narrated by Mr. Richard Kupfer a former fisheries observer and currently the observer coordinator in Pago, Pago, American Samoa. The video takes place in the observer program training room, program staff offices, Seafares Institute, Hawaii Institute of Marine Biology at Coconut Island and commercial fishing vessels. The video was created and edited by observer program staff.

Observing multiple fisheries in the US southeast – Doing more 'floating' than usual

Simon J.B. Gulak

IAP World Services / NOAA Fisheries, Florida – USA

Abstract

Although the idea of a cross-trained observer moving among different fisheries observer programs would seem beneficial to all involved, the result is often imperfect. The demand for field staff fluctuates often, making efficient sharing among observer programs complicated. Variations in methodologies, required equipment, and areas covered further hamper the logistics. Three programs in Florida have successfully utilised cross-trained observers: the shark bottom longline and shark drift gillnet observer programs in Panama City, and the pelagic longline program in Miami. The two longline programs share many data collection strategies because of the similarities between the fisheries, but switching to the shark drift gillnet observer program provides a greater challenge. Although the longline protocols are comparable, there are major differences in deployment lengths, size of the vessels covered, and the equipment observers bring aboard for all three fisheries. Observer programs, especially the small ones like those based in Panama City, are reliant upon flexible and well-trained observers. Successfully shared observers benefit by broadening their experiences and maximising their time in the field, and changing fisheries can also help alleviate boredom. Observer programs that take advantage of cross-trained observers obtain well-rounded field staff who are capable of dealing with many different situations and increase their potential for observer retention.

Field identification of roundscale spearfish, *Tetapturus georgii*, in the northwestern Atlantic

Georg F. Hinteregger

NOAA Fisheries, Pelagic Observer Program, Rhode Island – USA

Abstract

For more than 10 years, the Pelagic Observer Program (POP) at the NOAA Fisheries Southeast Fisheries Science Center has been collecting data on a billfish, the roundscale spearfish, *Tetrapturus georgei*, previously not reported in the northwest Atlantic. Recently a scientific paper based on POP observer data and samples (Shivji *et al*., 2006) has been published that will encourage greater interest in the roundscale spearfish by fishery scientists and managers and, perhaps, especially, billfish sports fishermen. In the absence of any description in the available field guides, a poster that provides color ID photos of the roundscale spearfish, the white marlin (*Tetrapturus albidus*), and the longbill spearfish (*Tetrapturus pfluegeri*)with text and highlights of diagnostic features will be valuable for fishermen and researchers. While the roundscale spearfish and white marlin are superficially similar, key diagnostic features such as the position of the anal opening relative to the anal fin height and even lateral scale shape can be used to distinguish these species while alive at boatside. The poster is designed so that it can be reduced to standard page size without loss of detail and reproduced on an ordinary color printer by downloading it from the POP website or other NOAA Fisheries websites. The poster gives a phone number and web address where more information can be accessed and sightings, anecdotes, catch or catch-and-release information reported. Unknown outside the tiny universe of the northwestern Atlantic swordfish longliners and their observers, the road to the widespread acceptance of another billfish, a billfish that appears to be by far the most common Tetrapturus in some offshore areas, is bound to be bumpy. However, the case of the roundscale spearfish may provide encouragement to observers to realize that, in the course of routine data collection, it is still possible to make scientific discoveries on the decks of a commercial fishing vessel.

Estimation of sharks by-catch in Korean tuna longline fishery by on-board observers

Seon-Jae Hwang*, K. Soon-Song, M. Dae-Yeon and A. Doo-Hae

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Abstract

The Korean government has operated international observer programs for monitoring distant-water fisheries including tuna fisheries since 2002. In 2006, trained observers were deployed aboard commercial Korean tuna longline vessels to estimate shark by-catch in the Pacific and Atlantic Ocean. We compared circle hooks and J-hooks with respect to shark by-catch rates. In the Atlantic Ocean, the total number of sharks caught by 62,657 size-4.0 traditional J-hooks were 188, comprising 12 species. The dominant species were Carcharhinus falciformis (N = 97, 51.6% of the total catch in number) and Prionace glauca (N = 39, 20.7%). In the Pacific Ocean, 297 sharks comprising 8 species were caught by a total of 62,464 hooks (15,616 J-hooks and 46,848 circle hooks with 3 different size-types). The Pseudocarcharias kamoharai was dominant (N = 139, 46.8%), followed by Alopias vulpinus (N = 83, 27.9%). Overall catch rates of sharks were 3.0 sharks/1,000 hooks in the Atlantic and 4.7 sharks/1,000 hooks in the Pacific. The fins comprised, on average, 4.6% in wet weight and 0.53% in dried weight of the total body weight in the Atlantic and 5.2% and 0.65% in the Pacific. We could estimate the round weight of certain sharks species used for fin production.

Developing an Electronic At-Sea Data Entry System for Observers from New Zealand's Ministry of Fisheries

Kimon George

Ministry of Fisheries, Wellington – New Zealand

Abstract

New Zealand's Scientific Observer Programme runs as part of the Ministry of Fisheries' (MFish) Observer Services group and employs around 50 observers and 8 shore staff. MFish observers are placed on selected commercial fishing vessels to collect independent catch effort, biological and other information relevant to the operation of the Quota Management System. Approximately 5500 vessel days are observed each year. In 2005 MFish implemented a project to provide observers with the capability to capture fisheries information at sea using rugged field computers. The project required the identification of appropriate hardware (field computers), the development of data entry and error checking software, and a trial of three electronic forms on five field computers aboard commercial fishing vessels. The use of electronic forms allows for easy data entry of information as it is collected by observers. Error checking will occur in real time. Observers are able to correct mistakes immediately, resulting in more accurate information being collected. Duplication of the same data on many paper forms is removed, resulting in increased observer productivity. When fully implemented, at-sea data entry will reduce the need to purchase post-trip data entry services. A tender process conducted in 2006 identified a local company, Pocket Solutions Ltd., as the preferred supplier of the hardware as well as to develop the customised software. Five hardware platforms have been acquired and software development began in May 2006. The trial is scheduled for late in 2006, with a full implementation of the system expected to be completed in 2007.

Observer at-sea data collection project

Holly McBride, O. Jackson, Erin Kupcha* and B. North

NOAA Fisheries – USA

Abstract

All commercial fishing trips observed by the National Marine Fisheries Service, Northeast Fisheries Science Center, Fisheries Sampling Branch are required to submit preliminary trip and incidental take information within 24 hours of the end of the trip. Additionally, trips participating in Special Access Programs must submit catch summaries for quota monitored species. These requirements were established to provide NOAA Fisheries managers and analysts with quick access to key data fields. Observers would call in the preliminary data to their area coordinator, who would call in the data to the Woods Hole lab where it would be keyed into the Observer Contract (OBSCON) database. A data entry program has been developed for the HP iPAQ, using the Mobile 5.0 operating system, to automate the previous call-in procedures. The HP iPAQ, a Personal Digital Assistant, was selected because of size, cost and internet capability. The program utilises screens tailored for each fishery with appropriate audit checks and data file output. Observers upload data directly into Oracle tables using a secure website. This approach has been successful in providing cleaner data in real time.

Strengthening observer programs through advocacy and education

Elizabeth Mitchell* and Keith Davis

Association for Professional Observers, Washington – USA

Abstract

Though fisheries managers, non-governmental organisations (NGOs) and fishermen rely on observer data to assess stocks, quotas, by-catch levels and compliance to fisheries regulations, observers are often isolated with little connection to the processes involved in the analysis of the data they collect. The Association for Professional Observers (APO) serves to educate and provide a forum for observers and other interested parties to share ideas and develop a better understanding of the nature of observer programs. The APO is a non-profit organisation founded in 1995 by a small group of fisheries observers from the North Pacific Groundfish Observer Program with the goal to educate and support observers. As APO became more involved in national fishery management policy decisions pertaining to observer programs, the organisation expanded to include representation from programs nationally and internationally. The APO is committed to strengthening solidarity amongst observers, encouraging communication between various stakeholders and promoting the conservation and sustainability of marine and other aquatic ecosystems. The APO meets annually and publishes a quarterly newsletter, The Mail Buoy.

Addressing the sea turtle by catches in the longline fisheries: The Panamanian observer program in the eastern pacific

L Pacheco[1]*, A. Segura[1], M. Mug[1], S. Andraka[2], T. Mituhasi[3] and Martin Hall[4]

[1] *WWF-CA, Panamá*
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Abstract

Some of the sea turtle populations inhabiting the eastern Pacific have been decreasing for many years and by catches in fisheries are believed to be one of the causes of the decline. Of the different approaches to mitigate the impact of hooking in longline gear, the replacement of the traditional J-hooks by circle hooks appeared to be one of the most promising, and it was decided to test them in the Panamanian fisheries targeting tunas (*Thunnus albacares*), mahi-mahi (*Coryphaena hippurus*), sharks (*sensu latu*) and others. One of the main features of the experiment was an observer program designed to obtain evidence of the differences in sea turtles and on target species hooking rates. Fishing trips from surface and bottom longline fisheries were sampled. Circle hooks of sizes 16/0 and 15/0 replaced J-hooks, Japanese tuna hooks, or smaller circle hooks. The data collection system consists of five forms, recording vessel information, gear characteristics, effort, catches, and by catches. As of today, the initiative in Panamá has sampled 50 fishing trips, representing more than 150,000 hooks. The observer program is showing substantial reductions in hooking rates with the much wider circle hooks. Another important activity of the observers is the training of the fishers in the use of instruments to dehook and disentangle turtles, that are provided by the program. This program in Panamá is sponsored by World Wildlife Fund, the Inter-American Tropical Tuna Commission & the Overseas Fishery Cooperation Foundation of Japan and is supported by the Panamanian fisheries authorities. The program works on a voluntary basis, relying on the cooperation and trust from a varied group of stakeholders.

Role of NGO and fisheries sector cooperation in the management of fishery in south Indian state

Joseph Sebastian Paimpillil

Center for Earth Research & Environment Management, Kerela – India

Abstract

As the southwest monsoon sets in over southern India, the fisheries sector and the fishing communities and traders is a mite worried by the annual 45-day monsoon ban on trawling and the safety at sea for the fishermen. For almost 20 years now, Kerala had annual fishing closure as a fisheries management tool. The first 45-day trawl ban was imposed by a sustained and strategically focused campaign by the traditional fishing sector, led by the Kerala Independent Fish workers Federation. The main impetus for the trawl ban is its resource conservation value and the potential to prevent violent physical conflicts between the artisanal small-scale sector and the mechanised sector. The Fish Farmer's Development Agencies (FFDA's) had played an important role in creating awareness among the fisheries community about the importance to guard against any dilution of the principle of a precautionary approach to fisheries resource management and the need to conserve the State's marine resources by engaging both the traditional and mechanised sectors in reasonable resource management. The NGO's in fishery sector had initiated programmes for fisheries development by involving and organising fishermen groups, fish farmers and unemployed youths. One highlight of an ongoing process of participation of local fishing communities, NGO's and their relationships with the local state (grama panchayath) is in the allocation and control of fishery resources in the Cochin estuary of Kerala. The strengthening of such community initiatives through 'learning communities and NGO's' is the only way to deliver good fisheries resources governance. By implementing the annual monsoon trawl ban and fisheries resource management effectively and fairly, Kerala state NGO and fisheries co-operation can show others how to manage fisheries resources and conflicting resource users in a reasonable and healthy manner.

Training Videos – Development of videos for the purpose of training observers

Michael Vechter

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Abstract

Videos are an effective tool for training. Video can be inherently interesting and can improve comprehension through visual stimuli, motion, and audio. Videos can also provide a means of exchanging information with other programs. In addition videos provide information to the fishing industry, and serve recruitment needs. While videos are an effective tool in any training they are more labor intensive to produce than many people would expect. This poster shows the design, development, and production steps used in making a training video. The North Pacific Fisheries Observer Training Center has produced videos that are used to train for several different observer programs. From script development to editing to the final production phase the effort involved can be tremendous. The poster will display the process and steps to creating a useful training video. The logistical difficulties of getting aboard a commercial fishing vessel make it imperative that the time spent aboard is used efficiently. All the required scenes must be recorded before weather or unexpected circumstances terminate the voyage. The makes the planning steps the most important aspect of producing a training video.

Peruvian Fishimg and Discharge Control Program

Raúl Ponce

Viceministerio de Pesquería – Ministerio de la Producción, Lima – Perú

Abstract

Perú has the world's first place exporting fishmeal and the second place with an anchovy annual fisherybetween 6 and 9 million tons, with more than 1,300 fishing vessels operating in our EEZ alongshore of 3,000 Km. For those reasons the Peruvian goverment working together with the fishing men and the fishing industrialmen, created the 'Peruvian Fishing and Discharge Control Program' in 2003. At that time, the illegal industrial fishing in Perú was estimated in 20% of the total tons catched and discharged in a year by the 'Sociedad Nacional de Pesqueriá' (SNP). It means about 1'600,000 annual tons. (average of the last 15 years). The economical impact of this kind of illegal fishing was more than US $ 360 millions annually. The 'program' was created outsourcing its execution to a particular company. This company executes the program with more than 500 Fishing Engineers contracted like fishing inspectors. These inspectors are placed all the year at each discharged point and fishing scale in all the fishmeal and fishoil industrial installations. The function of the inspectors are: insure vessel identification., verify the fishing authorisation, verify the vigency of fishing authorisation, verify the type and quality of the resources to be discharged, control the fishing capacity autorisated., control the length of the resources, control the correct use of the scales, verify the scale calibration certificate and verify the serial number of the VMS equipment onboard. The start of the Program was the result of very near coordination between the SNP in representation of the main fishmeal and fishoil industries and the 'Ministerio de la Producción'. The fishmeal and fish oil industries financed the entire program, with an annual value of US$ 5,900,000, recognising the monitoring program provides benefits through building an environment of trust and loyal competence. The Program met its objectives in the first year, meaning a very important reduction in the illegal fishing activities, showing that the industry and the government can work together to better control fishing activities.

Status and impact of the Prawn Fishery in Malindi – Ungwana Bays: Implications for Management and Conservation

Kennedy Akweyu Shikami

Ministry of Livestock and Fisheries, Coast Province – Kenya

Abstract

The shallow water prawn fishery in Kenya is restricted by the Fisheries Act Cap 378 to 5 nm and beyond. However, there have been incidences where trawling is reported below the 5nm with some cases to 0.8 nm and near the river mouths. Huge discards of by-catch mainly juveniles and low value fish have been associated with an escalation of resource use conflicts from artisanal fishers utilising the same fishing grounds and other stakeholders. Other issues of concern are the impacts on benthic communities and other marine life including endangered species; sea turtles and other interlinked ecosystems to the major prawn fishing grounds. In order to address the concerns by policy/decision makers, research scientists, conservationists and local resource users, a stakeholder participatory research approach is to be applied. Sustainable utilisation of prawns as the target species in trawling against resource use conflicts and environmental degradation issues are discussed.

Artisan Longline Fisheries Observer Program in Guatemala

E. Villagran[1]*, S. Perez[2]

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Abstract

Derived from the concern on incidental mortality of sea turtles in the longline fisheries worldwide, UNIPESCA and WWF, with support of the Inter-American Tropical Tuna Commission – IATTC – have launched an initiative in 2004 for the substitution of type J-hooks for circular hooks in the artisan longline fisheries of Guatemala. The main objective is to evaluating the efficiency of circular hooks in reducing incidental catch of sea turtles. The initiative includes the establishing of an observer program on board artisan vessels to gather information on sea turtle mortality and circular hooks' catch efficiency. The results obtained to date indicate higher fish catch efficiency with circular hooks number 14/0, as well as a significant reduction in the sea turtle hooking rate, in comparison with J-hooks and circular hooks number 15/0. Establishing an observer program has been a key element for the production of scientific information in this initiative; to date the program has 27 observers distributed among 4 fishing communities of the Guatemalan Pacific. The observers are trained by fishing technicians on the procedures to complete data forms and to identify sea turtles. This is the first observer program established in Guatemala and it has proved to be an appropriate way to obtain fisheries information; therefore, the fisheries administration is considering establishing similar programs for other fisheries.

APPENDICES

APPENDIX 1

International Fisheries Observer Conference Impact Assessment

– Responses to the World Fisheries Trust Questionnaire –

Total number of submissions: 25

Current involvement in the fisheries observer profession *(check all that apply)*	**Female**	**Male**
Fisheries observer	4	2
Shore-based member of an observer provider/contracting company	1	3
Staff of a governing body	5	7
User of observer data *(e.g., fisheries manager, scientific analyst, NGO member)*	5	7
Fisherman/fisherwoman, fishing industry representative	0	0
NGO representative	0	1
Student	1	0

1. **Gender and ethnicity:**
   - Females = 11
   - Males = 14
   - Ethnic minority in country being represented = 0

2. **What is the principal focus of fisheries observer/monitoring program(s) in the country you represent?**

   Responses from females:
   - Longline fisheries with hooks.
   - Gather biological data. Surveillance information.
   - Compliance and scientific information.
   - To collect data about seabirds and train observers to work as an environmental educator.
   - Tuna longline fisheries in the Indian Ocean.
   - Collection of verifiable fishery statistics and fish biology data.
   - Variable as there are many programs. The one I interact with the most has a focus on total fish catch estimation and species composition.
   - Data collection for fisheries management. Stock assessment. Wildlife mitigation methods.
   - Multipurpose, primarily by-catch analysis and stock assessments for commercial fish stock, marine mammals, seabirds and turtles.
   - Collection of fisheries data for use in monitoring fisheries regulations, assess stocks, understanding by-catch.
   - To understand what is being discarded.

Responses from males:

- Fisheries/stock management (government); by-catch of seabird, turtles, mammals (NGOs and government).
- Two principal foci: tuna/dolphins program, turtle by-catch program; there are some monitoring in shrimps trip, but these are not constant effort.
- Fisheries management, conservation issues.
- Basically, to monitor a fleet from another country that is fishing small pelagic fish in our waters and their activities have to be done 40 miles off-shore.
- Sea turtle by-catch; community-based fisheries management (pilot sites).
- Now, tuna purse seiners in Pacific Ocean; in near future, shrimp trawlers, bait boats, tuna purse seiners in the Caribbean and Western Central Atlantic.
- By-catch management reduction.
- Dolphin protection, regulations, enforcement of resolutions.
- To make experiments onboard, alternating different hooks shapes; best practices of manipulation of the turtles hooked and entangled and how to release it.
- At this time, we only have a small artesanal fisheries observer program, but we are trying to implement another program for the commercial shrimp fisheries.
- Industrial longline fisheries: observer program conduct at regional scale. Try to improve monitoring program for small scale coastal fisheries.
- Science/compliance.
- Monitoring for total catch and discard amount and composition.
- Pelagic longline. Collecting data (biological, environmental).

3. How does this observer/monitoring program contribute to fisheries management?

Responses from females:

- Care for sea turtles.
- The data collected inferring species, length, frequency, weight, CPUE, which helps fishery management.
- Allows for real-time monitoring of by-catch so vessels can move and TACs are rarely exceeded.
- Compliance enforcement. Scientific data – stock assessment/ecosystem analysis movement studies/special protected species projects.
- As we are concerned about seabird by-catch, it helps the country to reach better quotas for tuna, (Atlantic Ocean).
- It is a trial observer program. In the future observer data will be used for grade assessments.
- For stock assessment purposes.
- Variable (across countries I have worked in.) Each observer program patchy. Some claim more than they can deliver. Some good on problem-solving/adaptive, others bureaucratic and conservative. The “flashies” not always the best.
- Quota monitoring, mitigating by-catch and evaluating by-catch method efficiency.
- Our observer data is considered one of, if not the most reliable source of independent fisheries data. It is used in most aspects of our fisheries management.
- Stock assessments, information on incidentally taken mammals, turtles and boats.

Responses from males:

- Fishing effort and stock availability is assessed by the government programs. These programs suggest season closures.
- Talking only from the point of view of the turtle by-catch program, the data available contributes to taking decisions about the most effective hook.
- Collecting catch/effort data, biological data, biological samples, by-catch data.
- This program is relatively new; however, all the data that is being collected will be part of the data to be used for stock assessment of small pelagic fish.
- Sea turtle by-catch mitigation; species composition and inventory.

- Providing data to national scientific entities and official institutions.
- Data to understand/mitigate by-catch; data to manage individual vessel quotas.
- Observer data is used in stock assessment which in turn is used for management measures. Yes, for the extension of the program and for the kind of data that are being collected.
- Improving the amount and quality of information for stock assessment and other purposes of the Fisheries Administration.
- Provide data for managers and science.
- By-catch/discard rates used in setting limits.
- By giving a more accurate information.

4. How will/can your participation in the conference contribute to development of observer programs or fisheries management in the country you represent?

Responses from females:

- To improve the programs, training and the way to administrate the data.
- Our observer programme is still developing. I am going back with new ideas and information.
- Get a lot of new ideas on quality control of DOS data and safety.
- It was amazing to participate in this conference because I could see and exchange ideas and concerns about how to improve our observer program. I will share this information with my staff. It was very useful to come here.
- Taking into account of this international character of observers/programs and of their implementation.
- Picked up new ideas and networking important. Also gave out information and relevant contacts.
- Promote better communication, inclusion of observer program in management and regulation development. Don't overburden data collectors, respect their limitations.
- I hope to meet people from other countries who may be interested in working on by-catch mitigation research in the future.
- Increased understanding of observer program issues (e.g., problems), development, re-assessment and use. I will bring this back with me to use in future communications and ideas on improving our own programs/data.

Responses from males:

- Acquiring new tools on stock assessment through observer data. Improving observer data and discards estimation.
- I'm the coordinator of a program, and pay attention to the conference which offered a wide look at the problems and possible solutions that I can implement in my country.
- To improve procedures in general, establishing international/regional cooperation and sharing information.
- In a way of reinforcement, some actions to persuade fishing authorities about the importance of having observers programs in terms of monitoring fleets and also the quality of data.
- Learn technical elements in OP design; networking and identification of resource people, experts, etc. Present a different point of view.
- Many participants brought here are in early stages of the development of observer programs. Many ideas on design; better understanding of data handling.
- Help development of issues in different workgroups.
- Our observer program is new, in this kind of workshop there are lots of issues for us (e.g., women onboard). Through the study of these themes, we can bring to the agenda how to implement it.
- I have a better knowledge on the great potential to develop observer programs in my country, and I also have many ideas to start with.

- Ideas and good advice about best monitoring/sampling strategies to implement at the local scale.
- Active listening will help one bring back some good ideas that I can use in our program.
- Sharing of information, ideas and contacts will help us to improve upon our program's current operations and output.

5. Has the conference provided good networking experience? Approximately how many new contacts were made? How could networking be improved?

Responses from females:

- It has. The contacts that I made are all in the Latin American region with the potential to develop regional work.
- Yes, I have made 5 good contacts. Networking can be improved by using the web and e-mail.
- Very good. About 15 new contacts.
- Yes; >20; A day off in middle to sightsee w/group (e.g., hiking, whale-watching, fishing, etc).
- Yes, of course. I made very good contacts with at least 18 persons and we will keep in touch by e-mail.
- Yes, the conference has made a good networking experience. More than 15 persons.
- Yes.
- Yes. Mmmm. Some firmer contacts than others. Perhaps 25 ones that perhaps would be ongoing. Others maybe expanded on if attend another conference. Small groups better for networking. Have introductions made by another helps the shy, the speakers of second language, etc.
- Yes. Breaks could be longer. Didn't have much time to talk and look at posters during breaks. Assign time during conference to fill out surveys.
- Excellent – 50? Recommend a random small group icebreaker at beginning for all groups.
- Yes, about 50. Recommend a social event with assigned seats away from the groups you came with.

Responses from males:

- Approximately 20 contacts, and several else to contact later.
- For sure, IFOC provided great possibilities to share experience, since we were allowed to make contacts with a big variety of organisations; many contacts were made but depends on us if the contacts remind in active way; so is necessary to keep contact.
- Yes. A Latin American network can be improved by establishing experienced exchanges.
- It's been great to meet people from different countries and see what they are doing within their observer programs and I probably have by now more than 20 new contacts.
- Yes, great networking. Over 10 relevant new contacts.
- Absolutely yes. I made about 30 contacts.
- Probably a dozen critically important contacts, and other 20 – 30 very valuable.
- Yes, +10; conference website should provide background info of participants, features of observer programs and contact information.
- Yes, even in this conference I meet with colleagues of the same NGO for the first time – 15; recommend to be given a list of the side meetings in advance.
- The conference provided very good networking experience, and I made 10 new contacts from many parts of the world.
- 15 new contacts; better network improvement if participant listed by organisation/type of organisation/institute/ and country.
- 10 – 15 good contacts.

- At least a dozen new contacts and renewing connections with contacts made through previous conference attendance. Having organised social events every evening has dramatically increased potential for networking.

6. Do you have recommendations for enhancing the full participation of persons from different countries at future international fisheries observer conferences?

Responses from females:

- To make work groups by regions to exchange experiences.
- It would be good if some observers from my country are able to attend the next conference.
- Give sponsoring to people who did not have opportunity before.
- Yes, I think maybe should be more effective if in the work groups, could be split in smaller groups where everybody could have opportunity to participate without necessarily being in front of a microphone.
- It would be better if the conference can encourage more developing countries to make more networking.
- In addition to direct invitation, attempt to engage funds from various NGOs and charity grants.
- Introducing participants to others in smaller groups, especially in areas that smaller nations have indicated an interest in.
- Have breakout groups of various topics with specific questions to discuss and then come back and present a summary to all. All have to sign up for a group. Question period was cut too short. Did not include the audience much. Denied some people from asking questions.
- Continue work to fund developing countries with WFT and other groups. Have the conference in developing countries. Require posters/talks when possible. Provide hands on activities, like safety, especially related to sampling strategies and program development.
- Assistance with poster printing? Or translation of presentation (there are even some people from Quebec who don't feel confident enough to make oral presentations in English).
- Some panels with no Canadians or Americans – just the less represented countries (or only 1 Canadian or American).

Responses from males:

- No recommendations.
- No.
- To me the structure of the conference has been very well designed but I realise that for some participants, simultaneous translation could be very helpful to enhance full participation.
- More presentations from developing nations and/or panel/plenary focus on OP in developing countries/data deficient fisheries.
- Personally, I will ask you because I don't know.
- Ask for subjects of interest for agenda; fund attendance.
- Funding is the main issue, but also the quality of presentation should be evaluated.
- I think it would be good to promote the conference more to the Fisheries Administrations, NGOs and universities in developing countries.
- I like the format.
- Continue to approach NGOs and national governments' international office (State Dept) in "developed" countries to secure loans (in additional to any monies that IFOC can directly grant).

7. **What have you learned about overcoming barriers that women, ethnic minorities or local communities face in participating in fisheries observer/monitoring programs? Will these be applicable to your situation?**

Responses from females:

- Well, I saw that in many observer programs, the women have a good participation and we too, but we have to do better of the practice.
- I was pleasantly surprised at the number of female observers at the conference. I think that is a good sign. In my country, if females are made aware and educated about the observer programme, I am sure more female children will join.
- I'm not sure we've got detailed information on what the barriers are, let alone how to overcome them. I think we've barely touched the tip of the iceberg on this issue.
- None – no problem with that in my country.
- I got surprised about how many women work as observers in USA, Canada, etc. In my country, it is still pretty rare to have professional women observers. Yes, I think we can try to use female observers in our program.
- In my country, women becoming an observer is difficult due to condition of vessels are not appropriate.
- None.
- Barriers will be there for many more years and is in all countries. However, it's heartening to see so many women out there. A woman's group in future for safety/employment issues?
- Not much of that discussed.
- No bathrooms, concern from fishers' wives. I thought there might be superstition as a reason but that wasn't mentioned. I think the women/ethnic minorities and small communities would benefit from attending the conference. Not necessarily apply to me.
- Boats that won't take women.

Responses from males:

- Barriers concerning gender or minorities should be avoided. In my situation as coordinator of by-catch program, will try to propose to my bosses the use of female observers; if a man can, a woman can.
- No.
- Well, having a woman doing interviews has really good effects on the results you can get in a general way; however, female observers in our country is rather difficult because of some cultural barriers, but surely this can be done in the future.
- Some lessons with respect to community participation – very key to UN situation (i.e., community empowerment).
- In my country could be difficult at the beginning but I had learned from the conference that it could be applied with a successful end.
- Some participants told me that they agreed to look for opportunities to start placing women on boats.
- No. We have no support from member governments.
- For the moment, it is not applicable (women observers), but this is a theme that should be applicable.
- Yes, they are applicable, specially those barriers to women participation.
- Not much; n/a.

8. **Has the conference provided you with new knowledge on fisheries monitoring techniques or strategies? If so, will these be useful for the programs you represent? Which ones?**

Responses from females:

- Yes, we will do better training programs before sending the observers.
- Yes, though some were sophisticated. It would be helpful to have a statistical training program for observers from my country.

- Yes. Data handling and safety.
- Yes, for sure! It got very clear to me how important is the observer work to fisheries management and how by-catch is a very important issue.
- Yes, feedback for stakeholders for improving observer data quality.
- Yes, of course, especially on various electronic equipment.
- Exchange of ideas and experiences. Also shows that some large and long programs aren't developed. So areas not to go down.
- No.
- Yes.
- Yes. Yes. Communications, by-catch.
- Yes – I hope so; more technology – less paper; cooperating with other programs.

Responses from males:

- This conference has provided new examples of monitoring fisheries such as fleet self-sampling as a real tool, as well as estimates on discards.
- I noted that there is a lot of emphasis on EM; this could be complementary for an observer.
- Yes. Safety issues, electronic monitoring, and data verification/validation, and sampling techniques.
- Most of them will be useful as we are quite new on these issues. But what impressed more was the use of advanced technology to have all the data in real time.
- Yes. Sea turtle by-catch OP.
- Variability data base management; different ways to obtain harmful information from some fisheries.
- View of technologies available; quality control issues; safety.
- Yes, video tracking, electronic logbooks.
- Yes, there are some new methods for me, e.g., to see the coral taken in trawl nets like by-catch, or use of electronic devices.
- Definitely, I learned a lot about the benefits of having an observer program. I learned about training programs and technology (software, equipment).
- Covering rate, specificity of small scale fisheries for monitoring/observer programs implementation.
- I gathered a better understanding of how other observer programs are structured. That has been valuable for me.
- Yes; using electronic monitoring as an audit tool.

9. Do you think that the conference helped to facilitate learning and linkages between "developed" and "developing countries"? If so, how? How could this be improved?

Responses from females:

- Yes, we learn about what the first world countries do and we compare our working with theirs and we'll do things to get better works.
- Not really.
- Yes. More developing countries should attend if possible. We've got new ideas on safety.
- Yes, to be in contact with experiences of developed countries and realised that even they have things to work on with us. Lots of people talked to me about our Psychology Abusory Program. It was very interesting.
- Yes, I think so. By providing some guidance documentation.
- Yes
- Conference helped identify some differences and reinforced thoughts I've had at previous IFOCs that the "developing" programs have a whole different set of issues. How to improve? Separate sessions w/ focus on industrial vs. artesanal types of fisheries. Exchange program of staff and/or observers.

- Networking important. Yes. Very much so on a one-to-one basis as well. Less developed countries should write a wish list on how the more developed countries can bring to the table – one the smaller countries set.
- Seven minute talks are also difficult for 'foreign' speaking (i.e., English not as a first language).
- Yes, both awareness of the challenges faced by developing countries in monitoring programs and fisheries management among developed countries, fisheries managers, awareness for developed countries programs of future challenges they might face. Also, a sense of unity and a common goal during this time.
- Yes – through the nature of the conference (posters, panels, etc.); could be improved by more networking.

Responses from males:

- I don't think the linkage was possible. It could be improved by designing a special panel session for developing countries.
- I hope so. I work in a program that is completely composed of developing countries and our more valuable resources go to developed countries markets; so it is necessary for developed countries to remember that.
- Yes.
- With this kind of meeting, the exchange of experiences of every country can take place. Learning between each other is a great deal, but there is still a lot of things to do as every country has their own realities to establish observer programs.
- Yes. Sea turtle by-catch OP.
- I think that the experiences from developing countries would give us a different point of view re: fisheries.
- Networks, interactions, joint participation, i.e., sea turtle interactive session.
- Yes, provide a forum for developing countries to express ideas/needs and share with plenary.
- We are sharing our knowledge with people of both 'worlds', and of course, these kinds of links help.
- Yes, but specific session or WG on this topic may be useful.
- Yes, just by being in the same room and sharing/exchanging information.
- Yes, I've made a few contacts with "developing" country reps that I'll be sharing some detailed "lessons learned" with.

10. Other comments:

Responses from females:

- Well organised conference. The WFT organisers were very nice.
- As it was a very important opportunity to me and my staff, I wish to keep having chances to participate in future conferences. I'm sure for the next two years, our program will be improved. And I would like to share it with you in the future.
- I would be grateful if you could put all slides of presentations on the website. It would be very useful for non-English speakers.
- Program exchange ideas and international forums are some tools. Low cost and very effective is exchange observers themselves.
- Websearch – all good. Additional comments on conference evaluation.
- Not much veg food! Either don't feed us or provide full meals/more time at dinner. More hands on stuff (e.g., safety). People get tired after 3 days of straight being 'talked at'.
- The conference, in general, was cost prohibitive to most people in "developing" countries. This is true of most fisheries conferences as well. Maybe these conferences could be held at slightly less extravagant venues to reduce costs and make it more realistic for poorer nations to attend.

Responses from males:

- Thank you all WFT/CIDA and the other organisations involved in IFOC.
- Well, as I said before, you have been great and I hope the connections between countries can go on in the future for the benefit of our planet as the unique home we have in terms of our fishery resources.
- I think, from now on, the observers conferences will be divided historically – before Victoria and after Victoria.
- Excellent organisation; clear personal commitment of organisers.
- Some panels were overcrowded; focus of theme should be reviewed.
- I want to thank World Fisheries Trust for their support for my participation.
- I am glad that I attended. It was a very valuable experience.

APPENDIX 2

Observer Bill of Rights

– A discussion topic at the Observer Professionalism Working Group –

Moderator: **Teresa Turk** (U.S. Observer Program) gave introduction and led directed discussions *Panellists:* **Keith Davis** (U.S. Observer) presented Rights 1 and 2 **Reuben Beazley** (Canadian Observer) presented Right 3 **Scott Buchanan** (Canadian Observer Program) presented Rights 4 and 5 **Kimberly Dietrich** (U.S. Observer Program) presented Right 6

Introduction:

All programs should develop guidelines and incentives that encourage a significant retention rate of experienced observers. Such mechanisms to provide incentives to the contractors may be a performance-based contract that specifies an 80% retention rate and incorporates observers' assessments of their contractor's performance.

List of Observer Rights:

In order to guarantee an experienced corps of observers, the following basic rights must be protected for all observer programs:

1. **Observers have a right to a living wage, including but not limited to:**
   a) Health Insurance (Option for year-round coverage and consideration of a national pool to decrease cost).
   b) Disability insurance.
   c) Life Insurance.
   d) 401-K retirement plan.
   e) Paid vacations and holidays.
   f) Counselling (peer as well as professional).
   g) Personal and professional insurance.
   h) Transferability of observer credit for purposes of financial compensation from one program to another.

2. **Definition of "Observer work" for the purpose of compensation should include the following for each program:**
   a) Training.
   b) Debriefing.
   c) Deployment.
   d) Stand-by time (including time between deployments and briefing/debriefing).
   e) Step-based pay system that encourages experience and exceptional work.
   f) Travel.
   g) Searching for vessel.

3. **Observers have the right to a safe working environment**
   a) Right of refusal to any vessel without repercussions.
   b) No observer to be placed on a vessel that is considered unsafe.
   c) Define the procedure for what to do if a vessel is considered unsafe (A national protocol should be developed; information of the vessel's safety should be provided to observers).
   d) Increase minimum safety training standards for all programs and design training to be observer program-specific.
   e) Establish better communications between Coast Guard and fisheries agencies.
   f) Ensure reasonable accommodations and food.
   g) Provide observers with vessel's past safety records via web access.

4. **Observers have the right to be acknowledged for their contribution to science and resource management, encompassing the following:**
   a) Attendance at workshops.
   b) Credit in publications and other literature.

5. **Observers have the right to support from their program/agency**
   a) The program should develop support mechanisms for observers which cultivate a sense of belonging.
   b) Each program needs to develop protocols to improve communication, understanding, and support for observers.
   c) A grievance procedure should be established that encompasses the work performed by the contractor or government agency.

6. **Additional goals suggested for observer programs:**
   a) Standardise data forms and species/gear codes nationally or internationally (e.g., electronic logbook program).
   b) Creation of a clearinghouse on national/international level for certified observers who span various programs.
   c) Establishment of an electronic forum devoted to observer issues.
   d) Direct management staff (e.g., debriefers and trainers) should be required annually to serve at sea as observers, but not as a displacement for regular observers.

Some Panellist Suggestions:

- Safety is the first concern, with the observer on the wharf having the last call on accepting a position on any vessel.
- Asking observers to venture out in 18 foot speedboats hauling crab pots at 150 foot depths five miles from the nearest land is unacceptable. "When I have to place my own future and that of my family in the hands of a captain, it is not the (observer) company's call; it is mine." I have no desire to sail with anyone who does not show the sea respect," ***(Reuben Beazley***).
- A national protocol as to reporting, inspection and clearance must be developed and followed before another observer is deployed to a vessel not meeting safety requirements.
- A full report on each vessel's safety must be made available to observers.
- There is an obvious need for better communication between Coast Guard, the Department of Transport, and (observer programs).
- Along with safety concerns, comes the need for decent living conditions for observers. Cases of observers contracting scabies, scurvy, and lice infections on vessels were cited. Food and hygiene can vary from vessel to vessel, and unfortunately some vessels have low standards.
- Concerns were raised regarding observers living on sandwiches and canned goods, without benefit of showers, and then having to sail out again after a short stay on shore.
- Personal safety concerns were also raised, particularly in terms of confrontations with skippers and crews.

- In causing a fishing operation to stop because of violations, an observer effectively ceases the earning power not only of the crew but also his own. Working yourself out of a job is a "weird situation" in which to be placed.
- Observer Support and Acknowledgements should be classed together as fostering the professional development of observers.
- An advisory committee involving observers who are selected by their peers can be formed where data users are invited to present projects involving the use of observer data and biological catch.
- Observer participation in workshops (and conferences) is essential.
- Provide observers with scientific reports and management documents that use observer data. This provision will heighten observer awareness about their duties and why they are required in the fishery.
- Observer Programs should think about tying observer wage levels and development to data quality, involvement in peer debriefings, and helping with the development and training of new employees.
- A program of professional development of observers should be established similar to those in other professions with apprenticeship and progressive stages.
- A committee composed of people from observer groups, science, and management could set appropriate levels and criteria allowing for such a progression.

Discussion Points:

The Question and Answer session following the Observer's Bill of Rights presentation elicited a host of cogent observations. Following, are some of the main points raised during this discussion:

- Don't put all the information required for proper training at the front end. Early trips begin with simpler work; one moves from sampling to biological information to by-catching information, then to surveillance and navigation skills.
- There needs to be accreditation programs offered at appropriate institutions along with recognition of observers' current skills.
- There should be a training facility in a central location to cover all the training needs for observers in a particular region.
- Promote Observers who can act as instructors during observer training.
- There are many discrepancies between regions regarding a host of observer issues.
- Defining safety can be difficult – Observers' opinions come from having worked on many vessels while fishermen serve usually on only one.
- It can be difficult to define 'a living wage'. An observer can be on a factory freezer trawler with a comfortable cabin and state-of-the-art technology. Yet a fisherman on that same trawler can often earn three times the observer's salary doing an easier job. In other words, depending on the situation one is placed in, it is not easy to understand what is meant by "a day's pay for a day's work". Sometimes observers have to work on vessels which are "run by crazies with guns and booze". And yet, observers have made the industry rich by sending them out to rich fishing grounds. "Empires have been balanced on the tip of my knife." (David Benson)
- There should be information and data provided that would allow for comparisons across all regions with observer programs. Such data from operational observer programs would include the following:
  - The number of vessels and the number of observers utilised.
  - The average deployment length by vessel type and fishery.
  - The attrition rates; the number of violations reported and the number pursued from observer reports.
  - The estimated annual value of various target fisheries.
  - Are observer unionised in certain regions?
  - What are effective coverage rates?
  - What is the definition of a fishing day?

APPENDIX 3

Gender Equity Issues in Fishery Monitoring Programs

– A discussion topic at the Observer Professionalism Working Group –

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Working Group Leader:	Keith Davis, USA
Developing Country Liaison (WFT):	Joachim Carolsfeld, CA
Gender Specialist (WFT):	Elaine Ward, CA

Goal

To identify factors affecting participation of women in fisheries monitoring programs and to develop best practices that foster gender equity in these programs.

Background

Previous International Fisheries Observer Conferences have resulted in a ratio of female participants to male participants of 2:3 which was considered by organisers as a fair representation of people employed in this sector. The selection of participants from developing countries to the 2007 Conference includes a criterion to specifically foster gender parity amongst the CIDA-sponsored delegates. As a result, there are many women and men participating with the support of CIDA funds, coming from such countries as Argentina, Brazil, Ghana, India, Namibia, Nigeria, Pakistan, Peru, Philippines, Russia, and Sri Lanka.

Observer Professionalism Survey Results

Since the IFO Conference organisers did not screen participants along gender lines, the data obtained from the various surveys were not disaggregated by gender or other diversity categories (e.g., age, ethnicity, religion). However, the Fisheries Monitoring Program Overview questionnaire, under its Observer Program Management heading, included a question relating to the gender ratio of the respondent's observer corps. Also, the Safety Survey acknowledged 'His/Her Contact Information' via the e-mail; however, it will likely be unclear as to the sex of the respondent given only their e-mail address.

In the OPWG survey, specific gender-related questions were not asked; however, there were opportunities within the Short Answer and Additional Comments sections to address matters otherwise not explicitly covered in the Definitions and Multiple Choice sections. Therefore, if a survey respondent wished to elaborate on gender-sensitive issues with respect to wages and benefits, support and opportunities, or employment standards and definitions, they could do so. One factor which may affect the results is that even though respondents were given the opportunity to remain anonymous, they might not have felt comfortable being candid around gender issues since they would likely submit their results electronically, and thereby leave an e-trail.

Gender Analysis

Based on CEDAW, numerous OECD Gender Equality Tipsheets touching on gender relations, CIDA's gender equality policy and guide to gender-sensitive indicators, as well as a number of documents relating to women in the fisheries sector, the following represents a preliminary gender analysis based on the literature alone. Once the survey results are in, a deeper gender analysis can be conducted prior to the conference.

OECD and its Committee for Fisheries:

OECD Employment Outlook 2002: Chapter 2: Women at Work: Who are they and how are they faring?

re: gender wage gap
OECD Gender Equality Tipsheets (particularly two on Coastal Zone Management and on Labour Standards) (www.oecd.org/document/34/0,2340,en_2649_34541_1896290_1_1_1_1,00.html)

Query:

How do these documents relate to the observer and the fishery situations?

Answer:

OECD Gender Equality Tipsheet:
Labour standards and equality between women and men – concerns include minimum wages, equal pay for work of equal value, maternity leave and parental/family leave provisions, protective legislation (e.g., doing certain kinds of tasks during pregnancy), non-standard work for temporary workers (e.g., hours of work and rights to unionise), non-discrimination (recruitment, contracts, training, promotion, conditions of work and remuneration), means of redress (e.g., sexual harassment complaints), and uneven implementation and enforcement of labour standards.

OECD Gender Equality Tipsheet:
Coastal zone management – concerns include **participation and consultation strategies** (Have the **constraints to women's and men's equal participation** in fisheries monitoring program activities with respect to---program objectives and target group; gender division of labour; access and control of resources; access and control of the benefits and fisheries monitoring program impact; social, cultural, religious, economic and demographic factors and trends---and have **gender strategies** been identified to overcome these constraints? Do women and men have equal access to fisheries monitoring program planning and decision-making? Will any separate activities be needed for female fisheries observers to ensure that they participate, and that they are not disadvantaged by the fisheries monitoring program? Are women trained and supported to engage in research and documentation on fisheries monitoring issues, and to set priorities for fisheries research? Are fisheries monitoring program communication channels equally accessible to both women and men?). Other concerns include **women's social status and equal role as decision makers** (Are women consulted and involved in decision-making about changes to fisheries resource use and management? What practical needs and strategic interests of women are addressed in the fisheries monitoring program?), **capacity of partner agencies** (Are there national/international policies or other statements promoting the importance of women and girls in fisheries management and environmental conservation? Has a sex disaggregated employment profile in the fisheries sector been undertaken? Has an affirmative action plan been developed to support and resource female fisheries observers? How does the fisheries monitoring program plan to increase counterpart capacity for gender-sensitive environmental planning and implementation?), fisheries **program monitoring** (Have targets been set for male and female equal participation and benefits? Have gender-sensitive indicators been identified? Will all data collected be disaggregated by sex? Will there be on-going consultation with community groups, including women's groups, directly or indirectly affected by the fisheries monitoring program?), and **program resources** (Are program resources adequate to ensure that males and females participate and benefit from the fisheries monitoring program? Is gender expertise available throughout the program?).

ILO:

International Labour Conference, Committee on the Fisheries Sector, excerpts of references to gender and women, June 2004, as reported in YEMAYA, No. 16, August 2004. (http://www.icsf.net/jsp/publication/yemaya/pdf/english/issue_16/art01.pdf)

ILO instruments relating to fishing sector: 5 Conventions and 2 Recommendations (1920, 1959, 1966).

Part I. Definitions and scope (Clause 5(c)):
*"Following this, the Government member of **Argentina** submitted an amendment, seconded by the government member of Brazil, to insert the words "man or woman" after the word "person" in clause c) on definition of "fisher". This was done because the concept of gender did not appear anywhere, and they felt it important for issues such as **accommodation**, to consider that the vessel could be carrying women as well as men"* (para 161).
*"The Government member of **Brazil** added that, besides the question of arrangements on board, very real problems, such as **sexual harassment** on board fishing vessels, needed to be addressed"* (para 162).

Part III. Minimum requirements for work on board fishing vessels:
*"…provisions on **medical examinations** should take into account gender issues." "….it was up to the doctor to check the **aptitude for work** of both men and women"*. Government of **Chile**, Brazil and Argentina.

Part IV. Conditions of service – Manning and hours of rest:
"Crewing" vs. "manning" (para 459) to provide a more **gender-neutral terminology**.

Part V. Health protection, medical care and social security – medical care:
….supplies *"including women's sanitary protection and discreet and environmentally friendly disposal units"* re: voyage and applicable international standards with a view to being *"proactive in protecting the health of women fishers"* (para 610). …adding *"taking into account the number and gender of fishers on board"*.

Part D (Proposed Conclusions with a view to a Recommendation, Part III. Health protection, medical care and social security), para 60 thus states that *"The competent authority should establish the list of medical supplies, including **women's sanitary protection and discreet environmentally friendly disposal units**, and equipment to be carried on fishing vessels appropriate to the risks concerned."*

The following comes from **ILO Safety and Health in the Fishing Industry**, December 1999 http://www.ilo.org/public/english/dialogue/sector/techmeet/tmfi99/tmfir1.htm#N_1_36_

Woment and fishing

Sea fishing has, at least in many countries, traditionally been carried out by men,[35] while women have been much more active in fish processing and marketing. The advent of factory trawlers led to a greater number of women on vessels at sea, with the majority of workers on the processing lines of some vessels being women. However, women are also becoming more active in fish catching. Some countries, such as Norway, have made determined efforts not simply to eliminate discrimination but to actively recruit women. Yet, in many places in the world old stereotypes and even superstitions remain.[36]

Women have also become more politically active in fishing issues at the local, regional and national level,[37] whether as fishermen or shoreworkers or as wifes or mothers of fishermen. Wives and mothers can maintain a continuing presence in shoreside fisheries management and safety forums while their husbands or sons are on the water.[38] A workshop on gender perspectives in fisheries, held in Senegal in 1996, discussed various strategies and organizational forms that have been adopted by women fishworkers to address their concerns in different countries. In India, for example, women fishworkers are seeking a place within mainstream fishworker organizations to address issues of concern to them. In Canada, the wives of fishermen organize as autonomous groups, join fishworker organizations and get together at the community level to protect the interests of coastal communities. In other Northern countries, women are working to protect smaller operators as well as to improve conditions on board distant-water vessels. In some Southern countries, women fishworkers are struggling to retain their place within the fisheries sector, in the face of globalization and trade liberalization.[39]

35. Although there are notable examples of fisheries, particularly inland fishing in many African countries, where women constitute the majority of fishermen or "fishers".

36. For a discussion of gender and fishing, see E. Munk-Madsen: "Psychosocial characteristics of the workforce at sea", in ILO: *Encyclopaedia of Occupational Health and Safety* (Geneva, 4th edition, 1998), Vol. 3, Ch. 66: "Fishing".
37. See the discussion of the Commercial Fishing Industry Vessel Advisory Committee (CFIVAC) under "United States" in Annex 1.
38. The Gloucester Fishermen's Wives Association, in Massachusetts, United States, for example, participates not only in local forums but is also represented on the national advisory committee concerned with fishing safety.
39. This workshop, organized with the International Collective in Support of Fishworkers (ICSF), was reported in "Different voices, similar concerns", in *Samudra Report* (Madras, ICSF), No. 15, Aug. 1996.

Other Relevant ILO Conventions (relatively recent):

Maritime Labour Convention, 2006
Maternity Protection Convention, 2000
Worst Forms of Child Labour Convention, 1999 (including girl-child)
Seafarers' Identity Documents Convention (Revised) 2003
Seafarers' Hours of Work and the Manning of Ships Convention, 1996
Recruitment and Placement of Seafarers Convention
Labour Inspection (Seafarers) Convention, 1996

On the prevalence of **HIV/AIDS** in deep-sea fishing boat crews:
(www.ilo.org/public/english/protection/trav/aids/publ/globalizing.pdf)

CEDAW – Convention on the Elimination of All Forms of Discrimination Against Women

(entered into force 1981):

Article 11

1. *States Parties shall take all appropriate measures to eliminate discrimination against women in the field of employment in order to ensure, on a basis of equality of men and women, the same rights, in particular:*
   - *(a) The right to work as an inalienable right of all human beings;*
   - *(b) The right to the same employment opportunities, including the application of the same criteria for selection in matters of employment;*
   - *(c) The right to free choice of profession and employment, the right to promotion, job security and all benefits and conditions of service and the right to receive vocational training and retraining, including apprenticeships, advanced vocational training and recurrent training;*
   - *(d) The right to equal remuneration, including benefits, and to equal treatment in respect of work of equal value, as well as equality of treatment in the evaluation of the quality of work;*
   - *(e) The right to social security, particularly in cases of retirement, unemployment, sickness, invalidity and old age and other incapacity to work, as well as the right to paid leave;*
   - *(f) The right to protection of health and to safety in working conditions, including the safeguarding of the function of reproduction.*
2. *In order to prevent discrimination against women on the grounds of marriage or maternity and to ensure their effective right to work, States Parties shall take appropriate measures:*
   - *(a) To prohibit, subject to the imposition of sanctions, dismissal on the grounds of pregnancy or of maternity leave and discrimination in dismissals on the basis of marital status;*
   - *(b) To introduce maternity leave with pay or with comparable social benefits without loss of former employment, seniority or social allowances;*
   - *(c) To encourage the provision of the necessary supporting social services to enable parents to combine family obligations with work responsibilities and participation in public life, in particular through promoting the establishment and development of a network of child-care facilities;*
   - *(d) To provide special protection to women during pregnancy in types of work proved to be harmful to them.*
3. *Protective legislation relating to matters covered in this article shall be reviewed periodically in the light of scientific and technological knowledge and shall be revised, repealed or extended as necessary.*

CIDA

CIDA's Policy on Gender Equality (1999), including "Good Practices to Promote Gender Equality" (www.acdi-cida.gc.ca/INET/IMAGES.NSF/vLUImages/Policy/$file/GENDER-E.pdf)

and CIDA's Guide to Gender Sensitive Indicators (www.acdi-cida.gc.ca/INET/IMAGES.NSF/vLUImages/Policy/$file/WID-GUID-E.pdf)

ICSF

International Collective in Support of Fishworkers (www.icsf.net), Gender Relations in Fisheries (http://wif.icsf.net/jsp/wif/english/home.jsp) and Excerpts from the report on women in fishing sector (http://www.icsf.net/jsp/conference/labour/labour_icsf_committee_women.jsp)

Workshop on Gender and Coastal Fishing Communities in Latin America, 2000 (http://www.icsf.net/jsp/publication/reports/Workshop-withmap.pdf)

FAO

922103626X: Fisherwomen on the Kerala Coast: Demographic and Socio ... 9251024618: Observer Program Operations Manual FAO Fisheries Technical Paper
Socio-economic and gender sensitive indicators in the management of natural resources, 2003 (www.fao.org/sd/2003/PE09023a2_en.htm)

IDRC

Gender, Globalization and Fisheries in the New Millennium Project
The IDRC Library Catalogue (on Gender Analysis, Women Workers, Gender Relations)

UNEP

Mainstreaming Gender Equality in Environmental Impact Assessments, 2005.
www.unep.org/DEWA/products/publications/2005/Mainstreaming_**Gender**.pdf

APPENDIX 4

List of Exhibitors

The committee gratefully acknowledges the participation and support of the following sponsors and companies in the conference exhibit program.

National Organization of Oceanic and Atmospheric Administration National Marine Service

www.nmfs.noaa.gov/

This U.S. federal agency is responsible for stewardship of the nation's living marine resources. NOAA Fisheries Service's goal is to protect, restore, and manage the use of coastal and ocean resources through an ecosystem approach to management. Under the authority of the Magnuson-Stevens Fishery Conservation and Management Act, NOAA Fisheries Service works to assess stocks, eliminate overfishing, rebuild overfished stocks, protect essential fish habitat, improve monitoring and compliance, and minimise by-catch. Under the Marine Mammal Protection Act and the Endangered Species Act, NOAA Fisheries Service strives to monitor fisheries and reduce by-catch of protected marine species (including whales, dolphins, seals, sea lions, and sea turtles), so that they may recover to their optimum sustainable population levels.

Department of Fisheries and Oceans Canada

www.pac.dfo-mpo.gc.ca/pages/default_e.htm

DFO is responsible for developing and implementing policies and programs in support of Canada's scientific, ecological, social and economic interests in oceans and fresh waters. DFO is a national and international leader in marine safety and in the management of oceans and freshwater resources. Departmental activities and presence on Canadian waters help to ensure the safe movement of people and goods. As a sustainable development department, DFO will integrate environment, economic and social perspectives to ensure Canada's oceans and freshwater resources benefit this generation and those to come. This mandate includes responsibility for the conservation and sustainable use of Canada's fisheries resources while continuing to provide safe, effective and environmentally sound marine services that are responsive to the needs of Canadians in a global economy.

Ministry of Environment, Province of British Columbia

www.env.gov.bc.ca/omfd/

The ministry is responsible for the overall leadership of provincial government strategies and initiatives related to ocean resources and marine fisheries. The key goal of the division is to ensure the sustainable management and development of British Columbia's ocean resources and marine fisheries while protecting the environment, and supporting a thriving economy and healthy communities through collaborative federal-provincial decision - making processes. British Columbia is determined to achieve the "best fisheries management system, bar none". This supports a seafood sector that offers strong competition in global markets, based on world-wide acknowledgement of quality and sustainability.

Australian Fisheries Management Authority and the Australian Government

www.afma.gov.au/default.htm

The Australian Fisheries Management Authority (AFMA) is the statutory authority responsible for the efficient management and sustainable use of Commonwealth fish resources on behalf of the Australian community. The authority ensures that fishing is conducted in a sustainable way so as to provide the benefits we get today such as healthy seafood and employment, while also making sure that there will be fish around for future generations to enjoy.

AFMA manages fisheries within the 200 nautical mile Australian Fishing Zone (AFZ), on the high seas, and, in some cases, by agreement with the States to the low water mark. As a general rule of thumb, AFMA looks after commercial fisheries from three nautical miles out to the extent of the AFZ. The states and the Northern Territory generally look after recreational fishing, commercial coastal and inland fishing and aquaculture.

Archipelago Marine Research Limited

www.archipelago.ca

Archipelago is based in Victoria, British Columbia and is a major supplier of fishery monitoring services to local fisheries as well as more distant Pacific fisheries. The firm has a large staff, providing at-sea observing, video-based electronic monitoring, and landings monitoring services for a wide variety of commercial fin fish and shellfish fisheries.

A.I.S. Incorporated

www.aisobservers.com/

AIS is dedicated to the collection of accurate, complete, and reliable marine and ecological data. We supply observers for the collection of catch data on commercial fishing vessels; we also supply observers for deployment on scows and hopper dredges for monitoring endangered species, and we supply inspectors for the recording of disposal data on harbour and waterway dredging operations.

Juniper Systems

www.junipersys.com/company/index.cfm

Juniper Systems, Inc. provides high-quality rugged field computing products for natural resource, agriculture, and other rugged markets. These products result in superior customer satisfaction while providing growth and prosperity for employees, investors, and our community.

Lat 37

www.lat37.co.nz/aboutus.htm

Lat 37 offers natural resource solutions for electronic data collection in the field to other people and organisations through the experience we've accumulated. Lat 37 provides a prompt, personal and cost effective service for clients working with electronic data collection in the field. We understand the environmental conditions and exposure that the equipment will be used in and are experienced in developing programmes with which your technicians and operators will quickly become proficient.

OLRAC

www.olrac.com/index.html

OLRAC CC (OLRAC) provides a consulting service to the international fishing industry in the basic area of quantitative assessment and management. OLRAC presently consults to most of the major fishing groups in South Africa and has in the past consulted extensively in Namibia. OLRAC is continuously involved in critical management issues across a broad spectrum of fish resources and other marine topics. OLRAC specialises in the implementation of sophisticated quantitative tools in fisheries science and management using a highly critical and pragmatic approach.

R. White Woods Inc

www.whitewoods.com/welcome_page.htm

Established in 1986, R. White Woods Inc. is an independent company based in Victoria, British Columbia, Canada. Our primary activities include forest consulting, software development for various industries and the sales and service of rugged outdoor computers.

Catch Log

www.fishinglines.com/software/fishbase/htmls/catch_log.html

FISHbase Catch Log provides a powerful yet easy to use interface for recording catches. You can record catches at whatever level of detail you prefer, ranging from a very basic record of Species, Date, and Time, to fully detailed catch records consisting of over 50 individual data items. You define all the data elements during the setup process, so you are never searching through lists of unnecessary items. The program is configured to *your* style of fishing.

NSW Department of Primary Industries

www.dpi.nsw.gov.au

The New South Wales Department of Primary Industries, Australia is responsible for the conservation, development and sharing of the State's living aquatic resources. Our objectives include the research and monitoring necessary to underpin the sustainable management of the State's fisheries resources for the benefit of present and future generations. We work to promote viable commercial fishing and aquaculture industries, promote quality recreational fishing opportunities and share fisheries resources appropriately among users of those resources, whilst ensuring their conservation for future generations. The Department works in close partnership with other government agencies, universities, recreational fishers, commercial fishers, indigenous people, fish farmers and the broader community. We are the main agency responsible for monitoring fish stocks in the State, and the impacts of commercial and recreational fisheries on those stocks. This involves targeted observer programs in key fisheries, locations and times.

APPENDIX 5

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APPENDIX 6

Commonly Used Abbreviations

AA	Aves Argentinas
ABARE	Australian Bureau of Agricultural and Resource Economics
ACP	African, Caribbean and Pacific Group of States
ADFG	Alaska Department of Fish & Game
AFA	*American Fisheries Act*
AFMA	Australian Fisheries Management Authority
AFSC	Alaska Fisheries Science Center
AHP	Analytic Hierarchy Process
AIC	Akaike Information Criteria
AIDCP	Agreement on the International Dolphin Conservation Program
AMR	Archipelago Marine Research Ltd.
AMSEA	Alaska Marine Safety Education Association
APO	Association for Professional Observers
ASHOP	At-Sea Hake Observer Program
ASOP	American Samoa Observer Program
ASOP	At-sea observer program
BC	British Columbia
BRTs	By-catch Reduction Technologies
BSAI	Bering Sea / Aleutian Islands
CCAMLR	Commission for the Conservation of Antarctic Marine Living Resources
CCCHFA	Cape Cod Commercial Hook Fishermen's Association
CCSBT	Commission for the Conservation of Southern Bluefin Tuna
CECAF	Committee for the Eastern Central Atlantic
CENDEPESCA	Centro de Desarrollo de la Pesca y la Aculcultura (El Salvador)
CFP	Common Fisheries Policy
CFVS	Commercial Fishing Vessel Safety
CI	Confidence Interval
CIDA	Canadian International Development Agency
CoML	Census of Marine Life
CPUE	Catch Per Unit Effort
CSIRO	Commonwealth Scientific & Industrial Research Organisation (Australia)
CSP	Conservation Services Programme
CV	Coefficient of Variation
DAS	Days-at-Sea
DCR	Data Collection Regulation
DFO	(Department of) Fisheries & Oceans Canada
DINARA	Área de Recursos Pelágicos of the Dirección Nacional de Recursos Acuáticos (Uruguay)
DMS	Data Management Systems
DoFi	Department of Fisheries (Vietnam)
DWLLF	Distant water long-line fleet
EA	Ecosystems Approach
EAF	Ecosystem Approach in Fishing
EBM	Ecosystem-based management
EEZ	Exclusive Economic Zone
EIS	Enterprise Information System
ELB	Electronic Logbook
E-Logs	Electronic Fishing Logbooks

EM	Electronic Monitoring
EMS	Electronic Monitoring System
ENGO	Environmental Non-Governmental Organisation
EPIRBs	Emergency Position Indicating Radio Beacon
EPO	Eastern Pacific Ocean
EU	European Union
FAD	Fishery Attraction Device
FAO	Food and Agriculture Organisation
FERF	Fishery Enhancement and Research Foundation
FFA	Forum Fisheries Agency
FFDA's	Fish Farmer's Development Agencies
FIMP	Fisheries Information Management Program
FIT	Fisheries Interaction Team
FLDRS	Fisheries Logbook Data Recording Software
FMA	Fisheries Monitoring and Analysis (AFSC)
FMP	Fisheries Management Plan
FOS	Fisheries Operating System
FoS	Friend of the Sea
FPN	Fundación Patagonia Natural
FRS	Fisheries Research Services
ft	Feet
FUNDATUN-PNOV	Programa Nacional de Observadores de Venezuela de FUNDATUN
FVSA	Fundación Vida Silvestre Argentina
GCMD	Global Change Master Directory
GDP	Gross Domestic Product
GIS	Geographic Information System
GPS	Global Positioning System
H&G	head and gut
HCE	Humboldt Current Ecosystem
HTB	High-opening trawl
IATTC	Inter-American Tropical Tuna Commission
ICCAT	International Commission for the Conservation of Atlantic Tuna
ICES	International Council for the Exploration of the Sea
ICZM	Integrated Coastal Zone Management
IDCP	International Dolphin Conservation Program
IEZ	Inshore Exclusive Zone
IFMP	Integrated Fishery Management Plans
IFOC	International Fisheries Observer Conference
IFQ	Individual Fishing Quota
IMARES	Institute for Marine Resources & Ecosystem Studies (The Netherlands)
IMARPE	Instituto del Mar del Perú
INP	National Fisheries Institute of Ecuador
IOTC	Indian Ocean Tuna Commission
IPHC	International Pacific Halibut Commission
IREPA	Istituto Ricerche Economiche per la Pesca e l'Acquacoltura (Italy)
ITBP	Innovative Technology and Business Process Program (DFO)
ITQ	Individual Transferable Quota
IUCN	International Union for Conservation of Nature & Natural Resources
IUU	Illegal, Unreported and Unregulated
IVR	Interactive Voice Response
IW	Integrated weight longlines
IWPS	Integrated weight longlines with paired streamer lines
kg	Kilogram
LMRs	Living Marine Resources
LOOP	Logbook-Onboard Observers Program
MCS	Monitoring, Compliance and Surveillance

MFish	Ministry of Fisheries (NZ)
MFMR	Ministry of Fisheries & Marine Resources (Namibia)
MMPA	*Marine Mammal Protection Act (U.S.)*
MOU	Memorandum of Understanding
MPAs	Marine Protected Areas
MSA	*Magnuson Stevens Act*
MSC	Marine Stewardship Council
mt	Metric ton
m	Metre
MUN	Memorial University
NAFO RA	Northwest Atlantic Fisheries Organisation Regulatory Area
NBR	National By-catch Report
NEFOP	Northeast Fisheries Observer Program (NMFS)
NEFSC	Northeast Fisheries Science Center (NMFS)
NERO	Northeast Fisheries Regional Office
NGOs	Non-government organisation
NIWA	National Institute for Water and Atmospheric Research (New Zealand)
NLMA	Nantucket Lightship Management Area
NMFS	National Marine Fisheries Service
NOAA	National Ocean and Atmospheric Administration (USA)
NOP	National Observer Program (NMFS)
NOPAT	National Observer Program Advisory Team
NPFMC	North Pacific Fisheries Management Council
NPGOP	North Pacific Groundfish Observer Program
NSW	New South Wales
NWFSC	Northwest Fisheries Science Center
NZ	New Zealand
NZ RLIC	New Zealand Rock Lobster Industry Council
NZFIB	New Zealand Fishing Industry Board
OBIS	Ocean Biogeographic Information System
OBR	*Observer Bill of Rights*
OBSCON	Observer Contract database
ODA	Official Development Assistance
ODS	Operational Data Store
OFCF	Overseas Fishery Cooperation Foundation
OLE	Office of Law Enforcement
OP	Observer program
OPWG	Observer Professionalism Working Group
OTBs	Bottom trawl
OTIS	Observer Trip Information System
OTL	Ocean Trap and Line (NSW)
OY	Optimum yield
PA	Precautionary Approach
PBR	Potential biological removal
PBS	Pacific Biological Station (Nanaimo, BC)
PCR	Polymerase chain reaction
PDA	Personal Digital Assistant
pdf	probability density functions
PFD	Personal Flotation Device
PIFSC	Pacific Islands Fisheries Science Center
PIRO	Pacific Islands Regional Office
PIROP	Pacific Islands Regional Observer Program
PNOFA	Programa Nacional de Observadores a Bordo de la Flota Atunera Uruguaya
POP	Pelagic Observer Program
POPA	Azores Fisheries Observer Program
Project GloBAL	Global By-catch Assessment of Long-lived Species

PSC	Prohibited Species Catch
PTB	Paired bottom trawl
QAC	Quality Assurance & Control
QMS	Quota Management System
QSR	Quota Status Report
RCMP	Royal Canadian Mounted Police
RFMOs	Regional Fisheries Management Organisations
RFOs	Regional Fisheries Organisations
RIMF	Research Institute for Marine Fisheries (Vietnam)
RONS	Regional OBIS Nodes
ROP	Regional Observer Program
SAPs	Special Access Programs
SARA	*Species at Risk Act*
SBT	Southern Bluefin Tuna
SCL	Steering Committee Liaison
SEAFDEC	Southeast Asian Fisheries Development Centre
SEDAR 10	Southeast Data Assessment and Review stock assessment number ten
SEFSC	Southeast Fisheries Science Center
SET	South-east trawl
SG	Sea Grant
SP	Service Providers
SPC	Secretariat of the Pacific Community
STB	Single bottom trawl
T	tonnes
TAC	Total Allowable Catch
TD	temperature-depth
TEDs	Trawl efficiency devices OR Turtle Excluder Devices
TFP	Total Fish Production
TRN	Net Register Tonnage
TTS	Text to Speech
U.S.	United States
USA	United States of America
UIW	United Industrial Workers (Alaska Fisheries Division)
U.K.	United Kingdom
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNIPESCA	Unión Nacional de Pescadores Conservacionista (Guatemala)
UNIVALI University	Universidade do Vale do Itajaí
USB cable	Universal Serial Bus
USCG	United States Coast Guard
UW	Unweighted longlines
UWPS	Unweighted longlines with paired streamer lines
VMS	Vessel Monitoring System
VTR	Vessel Trip Report
WCGOP	West Coast Groundfish Observer Program
WCPFC	Western and Central Pacific Fisheries Commission
WFT	World Fisheries Trust
WGL	Working Group Leader
WKDRP	Workshop on Discard Raising Procedures
WKDSMRP	Workshop on Discard Sampling Methodology & Raising Procedure
WTO	World Trade Organisation
WWF	World Wildlife Fund

APPENDIX 7

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