

## 8th INTERNATIONAL FISHERIES OBSERVER & MONITORING CONFERENCE



*San Diego, California, USA*

*29 August – 2 September 2016*

# Proceedings of the 8th International Fisheries Observer and Monitoring Conference

Edited by

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**IC Independent Consulting**

with the assistance of the  
Conference Organising Committee

ISBN: 978-0-9924930-3-5

**Preferred citation:** Kennelly, S.J. (ed.) (2016). Proceedings of the 8th International Fisheries Observer and Monitoring Conference, San Diego, USA. ISBN: 978-0-9924930-3-5, 349 pages.

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## Acknowledgements

We would like to express our deepest appreciation to all those who participated in and supported the 8th International Fisheries Observer and Monitoring Conference. In particular we acknowledge the Conference Organising Committee, whose contributions over many months led to a very successful conference that resulted in tangible outcomes for the well-being of observers and the ongoing monitoring of fisheries throughout the world.

We thank especially our main hosts, NOAA Fisheries who funded a great deal of the conference and supplied all kinds of additional assistance and staff before, during and after the event.

Our conference sponsor CLS America and their new product Thorium X deserve special mention, for not just assisting the event financially but also for providing such fantastic display material and input into key sessions.

Our Friends of the Conference, the New England Fisheries Management Council, the North Pacific Fisheries Management Council and the International Halibut Commission also helped with sponsorship for the event.

In addition, our exhibitors, Archipelago Marine Research, AFMOS, AIS Inc, Ecotrust Canada, Marel, Marine Instruments and Satlink not only assisted the conference financially but provided an array of fantastic technical backdrops to the event with many varied and cutting edge displays of their latest equipment, software and other materials.

We also would like to thank our Conference Management, Arinex Pty Ltd, Australia, who ensured that all aspects of our conference ran smoothly and seamlessly.

But the greatest thanks must go to our delegates. Your collective experiences and expertise that was on display in the oral and poster sessions, the two workshops and the many discussion periods supplied the main intellectual substance of the conference and, as a result, these proceedings.

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## The 8th IFOMC International Steering Committee

The Steering Committee for the Conference was fundamental to the success of the event, organising many aspects of the meeting as well as individually taking charge of the 12 themes that ran throughout the meeting. As pictured below, the Steering Committee members are (left to right):

Dennis Hansford (Chairperson), NOAA/NMFS, USA

Amy Martens, NOAA/NMFS, USA

Chris Rilling, NOAA/NMFS, USA

Howard McElderry, Archipelago Marine Research Ltd., Canada

John Kelly, NOAA/NMFS, USA.

Judy Dwyer, Fisheries and Oceans, Canada

Lisa Borges, FISHFIX, Belgium

Steve Kennelly, IC Independent Consulting, Australia

Liz Scott-Denton, NOAA/NMFS, USA.

Andrew France, Ministry for Primary Industries, New Zealand

John LaFargue, NOAA/NMFS, USA.

Absent: Oscar Guzman, Instituto De Fomento Pesquero, Chile and Ryan Murphy, AFMA, Australia



## Executive Summary

The 8th International Fisheries Observer & Monitoring Conference took place in the Hotel Bahia Resort, San Diego, USA from 29<sup>th</sup> August to 2<sup>nd</sup> September, 2016.

The overarching Vision of this meeting was:

To develop, promote and enhance effective fishery monitoring programs to ensure sustainable resource management throughout the world's oceans;

The Mission Statement was:

To improve fishery monitoring programs worldwide through sharing of practices and development of new methods of data collection and analysis. To provide a forum for dialog between those responsible for monitoring fisheries and those who rely upon the data they collect.

The conference was an outstanding success involving 248 participants from 31 countries including representatives from many observer programs from around the world, fishing industry groups, and end-users of the data that these programs collect. The conference format included our distinguished keynote speakers, presented papers and posters, panel discussion sessions, workshops and less formal settings, such as trade exhibits, poster sessions and several social events.

The heart of this conference was with Keith Davis, other observers lost at sea, and their friends and families. Because of those losses and the International Fisheries Observer and Monitoring Conference's belief that the safety and security of observers is paramount, one of the recommendations from the conference was that all Regional Fisheries Management Organizations adopt best practices of health, safety, and welfare policies and tools, including the implementation of individual satellite-enabled safety beacons and communication devices.

Another major theme to emerge during the week was the increasing role that technology is playing in the monitoring of fisheries, through video, satellite and onboard tablets.

The conference consisted of 12 themes that were reflected in the various keynote addresses, oral and poster presentations, workshops and the many Open Discussion periods. The following pages provide significant detail about all these various formats in the form of extended (2-3 page) summaries of each presentation, the 2 workshops and detailed commentary obtained during the Open Discussion periods.

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## Opening Session – Keynote Addresses

The opening session of the 8th IFOMC saw the Conference Chair Dennis Hansford deliver a welcoming address that introduced the themes and format of the conference.



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Dennis' welcome was followed by two excellent addresses; our Guest Speaker William A Karp (NOAA Fisheries) and our Keynote Speaker Samuel D Rauch III (NOAA Fisheries).



### **Fisheries Monitoring – Looking Back and Looking Ahead**

**William A. Karp, Ph.D.**

**Science & Research Director, Northeast Fisheries Science Center, NOAA Fisheries**

From a historic perspective, the concept of public ownership of natural resources is well established. As early as 540 AD, this was articulated by the Byzantine Emperor Justinian the Great through the doctrine of public trust. In recent decades (or centuries!), this concept has evolved to recognize the importance of accountability related to harvest of public resources and, increasingly, this is seen as a shared obligation of management authorities and those that participate in the fisheries.

**As the accuracy of the scientific advice is directly related to the reliability of the original basic data, it is not only desirable for all countries to collect the necessary information but also their moral responsibility.**

*T. Williams in John Gulland "Fish Population Dynamics" 1977*

Modern stock assessment methods rely on accurate estimates of catch quantity and composition and, in many cases, size and age composition. Logbooks, delivery reports, and port sampling are the primary sources of this type of information but managers and scientists have often raised concerns about errors that are commonly encountered, and the challenges associated with verifying industry reports. Since assessments and many management programs rely on estimation of all sources of fishing mortality, the importance of properly accounting for discard has grown, and related to this, a realization that independent, at-sea monitoring of catch and bycatch is essential in many fisheries. Thus, in the 1970s and 1980s, we saw the emergence of observers as an essential component of monitoring and data collection programs. The need for observers has increased during the last 30 years and programs have grown worldwide. During the last decade we have seen increased emphasis of the role of industry in designing and implementing monitoring programs within a "co-management" framework.

**Estimates of total catch are an essential ingredient of stock production models, of VPA and all the techniques that depend on it.....No effort should be spared to acquire these data.**

*John Shepherd 1988*

So we monitor fisheries to ensure accountability, and to meet specific information needs for science, management, and compliance. Requirements or guidelines can be found in the conservation and resource management legislation of many countries as well as the FAO Code of Conduct for Responsible Fisheries.

Self reporting will continue to be an essential component of monitoring programs in the future. Concerns regarding accuracy and completeness will persist, but will be ameliorated through use of electronic data reporting technologies, and increasing collaboration between fishers and managers in support of a shared vision for sustainability. However, independent monitoring and/or verification needs will also grow, in support of management programs and public concerns regarding accountability. We will continue to rely heavily on observers to provide reliable and accurate reporting. Observer programs are particularly adaptable to changing information needs, through training and reprioritization of observer duties, and are uniquely able to support data collection with high temporal and spatial resolution, and collection of biological samples. Even though observer programs are generally quite expensive, they offer the best monitoring solution in many cases. In the future, we will learn to take better advantage of observers and observer programs to improve

communication and outreach with fishers and fishing communities, and we will continue to emphasize the importance of observer safety and observer professionalism.

Electronic reporting (i.e. electronic logbooks or vessel trip reports) are not new and are becoming increasingly important. Electronic monitoring (video monitoring, and related electronic systems; EM) has proved to be effective and efficient in many applications. Advances in EM and other technologies will continue and we must encourage innovation. Regardless of the approaches employed in a monitoring program, however, the necessary investment in IT infrastructure is lacking in many regions. This constrains the ability to integrate disparate data sets, address timeliness and quality requirements for research and management, and impedes our collective ability to allow full public access to the data.

To maintain or improve data quality, and encourage innovation, we should focus more on setting standards which meet information needs, rather than prescribing particular methods or approaches. This can be achieved through a regulatory framework, or through establishment of third-party certification standards for industry sectors. Examples where this approach already works, or could work include electronic reporting, observer and observer provider certification and establishment of observer safety standards, and management programs which require approval of industry-designed monitoring plans. Some general principles should apply, including a requirement that regulatory and monitoring systems should not degrade data quality and/or should incentivize accurate reporting, and that regulatory actions that require monitoring can only be implemented if information needs can be fully met.

Successful and cost effective monitoring requires a shared vision and commitment – trust and transparency are essential. Furthermore, well-designed monitoring programs address science, management as well as business information needs and this provides an added incentive for fishing companies to play an active role in system design. Collaboration encourages innovation and shared ownership and provides opportunities for engagement by a range of stakeholders including NGOs. In the future, we will see increased innovation and investment in IT systems which enable broader public access to fisheries data. We will also continue to depend on a professional and highly capable cadre of observers.

**Perhaps most valuable in reducing errors, however, is the attitude of the person in charge of the data collection.**

**John Pope 1988**





## **Keynote Address**

**Samuel D. Rauch III**

### **Deputy Assistant Administrator of Regulatory Programs, NOAA Fisheries**

NOAA Fisheries is responsible for the stewardship of the nation's ocean resources and their habitat. We provide vital services for the nation: productive and sustainable fisheries, safe sources of seafood, the recovery and conservation of protected resources, and healthy ecosystems – all backed by sound science and an ecosystem-based approach to management. Driven by the Magnuson-Stevens Act and in partnership with the Regional Fishery Management Councils we have one of the most dynamic management approaches in the world. A critical part of our approach to sustainability is the collection of data – using both new high-tech data collection and observer data collection.

The agency utilizes fishery observers to collect data from U.S. commercial fishing and processing vessels, as well as from some shore-side processing plants and motherships. Today, there are fisheries observer programs in all five NOAA Fisheries management regions (Alaska, West Coast, Pacific Islands, Northeast/Greater Atlantic, and Southeast). We tailor our programs to meet the diverse needs of our different regions.

Fishery observers and at-sea monitors are dedicated professional scientists. In addition to being scientists, they are also ambassadors. Observers collect catch and bycatch data from US commercial fishing and processing vessels, as well as shore-side processing facilities and motherships. This collection data supports a wide range of conservation and management activities. Observers also ensure compliance to regulations that keep stocks sustainable and resilient.

They may spend days, weeks, or months aboard commercial fishing and receiving vessels gathering first-hand information on what's caught and thrown back. The work is intense, and observers undergo a rigorous training program to be able to identify and take samples of the myriad ocean life that might come aboard. They make a valuable contribution to our knowledge of fisheries. Over time, in some fisheries, it becomes a collaborative working relationship. Fishermen get used to the observers, observers get used to the fishermen, and they view the observers as the true asset that they are. They realize that fisheries cannot operate at the high level that they are without the observers.

Commercial fishing, where our observers play a key role, is one of the most dangerous occupations in the U.S.. Boats are dangerous places and the observers are in vulnerable situations. We understand that safety is very important – even though they are not federal

employees we take the issue of unsafe observers very seriously. Observers are our partners and we couldn't do what we do without them.

We should never lose an observer, have observers who are harassed, who cannot get to shore, or who have bad working conditions. We understand that we are in a partnership with observer companies and fishermen, and it is up to us to work through these issues together.

As part of our ongoing efforts to increase safety, this comprehensive review will encompass all aspects of safety and health impacting observers and at-sea monitors in each region. The safety review will include gathering and assessing information from all key partners, including observer provider companies, and recommending improvements and developing continuing self-evaluation tools.

Specifically, the review will focus on seven areas related to safety and health:

- Safety reporting
- Communications
- Practices and Policies
- Training
- Regulations
- Equipment
- International

The review will begin as soon as a contract for a private sector company to conduct the safety review is put in place. A final report, to be delivered in 2017, will identify gaps in safety policies and practices; compile regional and national best practices; recommend improvements, and develop a regional and national self-evaluation tool. One of the most immediate noticeable changes moving forward will be that the agency will look at all facets of safety as a single safety program.

Observers can do almost anything on a boat, but we've seen in the U.S. an increasing demand for more monitoring and more data. NOAA Fisheries is expanding electronic monitoring capabilities for times when an observer is just not feasible. While we are not decreasing observers, we have to realize that the demand far outstrips our ability to place human observers on boats.

Given its potential utility in situations where human observers cannot be deployed, electronic monitoring (EM) has become an increasingly useful alternative tool for monitoring commercial fishing activities. Nationwide, NOAA Fisheries has invested approximately \$20 million since 2006 to develop and implement electronic technologies. In 2014, the Agency implemented regional electronic technology implementation plans to help move beyond pilot projects. Since release of the regional plans, NOAA Fisheries has allocated more than \$5 million to support the use of electronic technologies and in 2016,

Congress provided an additional \$6.7 million to support implementation of electronic technology programs.

So while NOAA Fisheries is moving methodically to implement new EM technologies more broadly, there are inherent growing pains and real-world practical challenges in moving from pilot projects to broader, fleet-wide implementation. The realities include complex hardware and software, varied boat sizes and designs, and the damage that can be done to electronics when exposed to saltwater and pounding waves. Another challenge is data storage and transmission.

Directly related to the expansion of electronic monitoring capabilities, NOAA Fisheries will be working with the Pacific Council to help implement an alternative approach to assist the Pacific Coast Groundfish Fishery fulfill its at-sea monitoring requirement. Over the past several years, in partnership with the fishing industry, the Pacific Fishery Management Council, the Pacific States Marine Fisheries Commission, state agencies, and environmental groups, we have been developing alternative Electronic Monitoring (EM) technologies to complement the work of onboard observers to enhance flexibility of the groundfish monitoring requirements.

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## Session 1. What can we learn from observer programs around the world?

**Leader: Chris Rilling**

In recent years, Observer Programs throughout the world are increasing in number, scale, diversity and sophistication due to their role in providing a major source of information underpinning all kinds of fisheries management policies and initiatives (such as rights-based management, EBFM, bycatch caps, fishing quotas, the European Discard Ban, catch trip limits, the Pacific Tuna days-at-sea restrictions, etc.). This session enabled new observer programs to take advantage and benefit from the “knowledge bank” available from established observer programs. Furthermore, established observer programs also learned from emerging programs – which are often at the “cutting edge” of innovation, new technologies and alternative management approaches. By sharing information about the lessons learned, and fostering increased collaboration among the world’s observer community, this key session introduced elements that permeated throughout the rest of the conference.

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### **Oral Presentations - Extended Abstracts**

#### **Strengthening the U.S. National Observer Program**

**Jane DiCosimo**

**National Marine Fisheries Service, Office of Science & Technology, National Observer Program, Silver Spring, MD, USA**

National Marine Fisheries Service (NMFS) has deployed human observers and at-sea monitors to collect fisheries-dependent data from U.S. commercial fishing and processing vessels since 1972. Fishery observers are deployed on commercial fishing vessels and in processing facilities to monitor fishing activities and collect data for use in stock assessments and fisheries management on all U.S. coasts. Approximately 70,000 days at sea by 867 observers in 53 fisheries occurred in 2015. The National Observer Program (NOP) coordinates nationally across 13 regional observer programs. It supports enhanced observer safety and training and improvements in data collection of fishing effort, biological samples, commercial fisheries catch, and bycatch of non-target fish, marine mammals, sea turtles and seabirds. Integration of these data with other research data into stock assessments provides fishery managers with the scientific information necessary to manage marine resources. The NOP initiated several projects in 2016 and beyond to improve observer safety and health, improve observer retention, implement electronic technologies, develop a tool to prioritize species for estimating release mortality, and optimize budgets to support regional observer programs.

Commercial fishing is one of the most dangerous jobs in the United States with a fatality rate 39 times higher than the national average. Recent observer fatalities prompted National Marine Fisheries Service (NMFS) to initiate a comprehensive review of all elements of observer safety at the national and regional observer programs. In August 2016, NMFS announced its Observer Safety Action Plan which includes: 1) an observer program safety review; 2) an observer survey; and 3) improvements to observer insurance coverage.

For its Observer Program Safety Review, NMFS contracted external observer safety experts in September 2016 to examine current policies and practices of NMFS regional, national, and international observer programs. They will identify best practices, gaps in safety practices and policies, and actions to improve safety and health standards. This evaluation will ensure that high quality and appropriate safety practices are being employed to effectively safeguard fisheries observers. The review will focus on seven core elements: safety reporting, communications, practices/policies, training, regulations, equipment, and international.

Second, the NOP is conducting an on-line survey of past and present observers to identify incentives and disincentives for remaining an observer. The survey includes questions relevant to regional observer programs. Approximately 350 survey responses were completed as of October 2016. Preliminary results show that working as an observer plays a positive role in their career paths, while pay and health insurance are among their major concerns.

Third, NMFS has acknowledged that federal regulations and observer provider contracts require some regional observer providers to carry insurance that are excessive or inapplicable and should be revised. The NOP is holding a public workshop in November 2016 to identify actions to ensure that observer providers carry insurance that is sufficient, but not overly burdensome, to cover claims by observers who are injured while on duty. Workshop participants will consider a national approach to types of insurance coverage requirements, including minimum thresholds, by observer providers. There currently is insufficient information to confirm that insurance gaps exist, or their extent. Participants will discuss: 1) coverage for observers under state workers compensation and the Federal Employee Compensation Act and 2) the types and amounts of insurance coverage that could cover such gaps.

In the short term, NMFS has authority to revise federal regulations to remove requirements for excessive insurance coverage in the Alaska and West Coast observer programs. A long-term objective could be adoption of a federal statute, such as the Fishery Observer Compensation Act (or FOCA). If adopted by Congress, it would: 1) replace a provision of the Magnuson-Stevens Act, 16 U.S.C. § 1881b(c) defining "Observer Status," 2) mirror compensation remedies of the Longshore and Harbor Worker's Act, and 3) provide liability coverage worldwide (including overtime in compensation calculations, waiving the rights of observers to bring legal action against a vessel owner or operator, and the option to have compensation adjudicated by a Judge Advocate if warranted).

Fourth, the NOP also has created a simple multi-attribute rating technique (SMART) tool to identify high-priority needs for estimating release mortality of discarded fish. The SMART tool can: 1) be customized based on regional needs; 2) be utilized by a wide group of

regional stakeholders; 3) and evaluate multi-species complexes, overlapping fishery sectors, and/or gear types to help address larger ecosystem-based factors.

A future initiative includes optimizing federal observer program budgets to support regional observer programs so that they meet their target observer coverage levels. A related effort is ongoing implementation of numerous electronic reporting and electronic monitoring programs in fishery-dependent data collections under regional observer programs around the U.S. In 2016, U.S. Congress augmented the Federal budget by \$7 million each year to facilitate implementation of these programs. NMFS is committed to using cost-effective and efficient methods for collecting fishery-dependent data.

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## **Pacific Islands Forum Fisheries Agency Observer Programme**

### **Philip Lens**

#### **Pacific Islands Forum Fisheries Agency**

The Pacific Islands FFA is an inter-government agency established in 1979 to facilitate regional co-operation and co-ordination on fisheries policies between its member(s) states. This is to achieve conservation and optimum utilization of living marine resources, in particular highly migratory fish stocks, for the benefit of the peoples of the region. The FFA member countries are: Australia, Cook Island, Federated States of Micronesia, Fiji, Kiribati, Marshal Island, Nauru, New Zealand, Niue, Palau, Papua New Guinea, Samoa, Solomon Island, Tokelau, Tonga, Tuvalu, and Vanuatu.

FFA observer programme role is to provide support to its member's national observer programmes in terms of national capacity building, observer administration strengthening, trainings as well as policy guidance.

The FFA Observer Programme ensure effective administering of the US treaty observer programme in coordinating and placement of observer on US purse seiners fishing in the region. The welfare of the pacific island observers who are placed on US fleets are also closely monitored as far as safety is concern. Observer are sourced from national programme around the region to be placed on US tuna purse seiners.

There are approximately 815 PIRFO trained and certified observers within all FFA members who are employed by their national governments, PNA Observer Agency and FFA US Treaty programmes. FFA members have, 14 PIRFO Observer Trainers, 104 PIRFO Observer Debriefers and 21 PIRFO certifies Observer Debriefers Assessors. The pacific islands observers are mostly deployed on Purse Seine and Longline tuna fleets in the Western and Central Pacific Fisheries Commission (WCPFC) convention area. Both FFA, SPC, PNA, WCPFC and some national programmes invested a lot of effort, time and money to continue training and upskilling of the observer personnel to be able to take on more senior roles in the observer work.

The other major initiative FFA is currently undertaking is the development of the PIRFO Front Line Management module, targeting observer coordinators and equivalent personal

to become competent observer coordinators and managers if they meet the specific management competencies. Two front-line management trainings were conducted in the last two years with observer coordinator participants from 15 FFA member countries attended, and are now undergoing assessment for PIRFO Front-Line Management certification.

FFA maintain close collaboration with the regional science providers, the Pacific Community (SPC) as far as observer data is concern. SPC plays that important role to process and analyze all FFA observer trip data, including national programmes trips and provide the scientific advice to FFA and the member states. The FFA observer programme in collaboration with the Pacific Community (SPC) provides trainings using the Pacific Island Regional Fisheries Observer (PIRFO) training standards.

The FFA Observer Programme is currently using an electronic observer programme management tool, called OPM – Observer Programme Management, The OPM is developed by FFA as a module within the National Information Management System (IMS) portal to manage the programme by moving away from paper trails to an electronic system of managing the core observer programme administration and operational functions.

The emerging technology has encouraged some national programmes in FFA region to start trailing out the electronic reporting using the android Tablet and Delorme device to collect and submit data near real time. Few national programmes such as Fiji, Solomon Island and PNG are also embarking on video monitoring trials on tuna longline fishing vessels.

FFA observer programme was audited and certified by the Western and Central Pacific Fisheries Commission Regional Observer Programme (WCPFC-ROP) after meeting the WCPFC-ROP minimum standards to provide observer service in the WCPFC conventional area.

FFA is committed and will continue to provide the regional support and strengthening to its member's national observer programmes through the Pacific Island Regional Fisheries Observer (PIRFO) platform,

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## **Broadening the Scope – challenges ahead for the New Zealand Ministry for Primary Industries observer programme**

**Alec Woods**

### **Pacific Networks Limited and contractor to Nelson Marlborough Institute of Technology**

New Zealand's Ministry for Primary Industries (MPI) is a "super ministry", with responsibility for agriculture, forestry, horticulture, aquaculture, biosecurity, food safety – and fishing. The New Zealand (NZ) observer programme is administered as part of government's responsibilities under the Fisheries Act and its amendments. Fisheries observers are selected, trained and deployed by the Observer Services division of MPI's Regulation and Assurance section.

This arrangement has remained largely unchanged since the observers programme began in 1986. Fisheries observers have been considered as an independent source of data in such areas as catch and effort, length frequencies, bycatch and discards, compliance and interactions with seabirds and marine mammals. Observer sea days can also be purchased by other government departments such as the Department of Conservation.

The New Zealand deep-water fishing fleet is comprised of a mix of domestic vessels crewed by New Zealanders and Foreign Charter Vessels (FCVs) crewed by a mix of nationalities. By 2011 it had become apparent that there were occurrences amongst some elements of the foreign charter fleet, of unsafe and, at times, inhumane labour practices, violations of the Fisheries Act and unsafe operating procedures. Such abuses seemed particularly prevalent amongst South Korean-flagged charter vessels with Korean officers and Indonesian/Filipino crew.

In August 2010, the 38-year-old Korean trawler Oyang 70 sank in calm conditions off the New Zealand coast when the captain attempted to bring a 120 tonne bag of fish on board. The marginally stable vessel rolled over and sank, killing the captain and five Indonesian crew members. In 2011, all 32 Indonesian crew on the Oyang 75 walked off the ship, alleging verbal, sexual and physical abuse. This vessel would later face 26 charges of dumping fish and its sister ship, Oyang 77, would later face eight charges for the same offence. This string of incidents and the attendant bad publicity prompted the Korean Government to send an interdepartmental delegation to New Zealand to investigate concerns with Korean-owned fishing vessels.

New Zealand has an international reputation for high quality, safe and sustainably produced food, a major advantage in a marketplace where consumer scrutiny is becoming commonplace. The Quota Management System is highly regarded as a sustainable fishing regime. New Zealand's food safety controls are internationally well-regarded and it holds itself up as a leader in the way it protects vulnerable workers. However, by 2010, these allegations of unsafe work practices, human rights violations and underpayment of crew had started to attract global attention. The New Zealand government reacted by establishing a Ministerial Inquiry to look into the allegations. Submissions were heard from August 2011 through to February 2012 and the Inquiry Panel presented its findings to Government in February 2012.

The main aim of the inquiry was to ensure that the operation of foreign owned and flagged vessels chartered by New Zealand companies supported the following government objectives:

- To protect New Zealand's international reputation and trade access
- To maximise the economic return to New Zealand from its fisheries resources
- To ensure acceptable and equitable New Zealand labour standards (including safe working environments) are applied on all fishing vessels operating in New Zealand's fisheries waters

[p.4, Report of the Ministerial Inquiry into the use and operation of Foreign Charter Vessels]



The Report made the comment that “where there are issues with vessel safety, there are often issues relating to labour standards and fisheries compliance [ibid. p.72]. It became clear during the Inquiry that inter-agency cooperation on the regulation of foreign charter vessels needed to be strengthened and that some form of on-board monitoring across the agencies be introduced. The Report also recommended that MPI continue its efforts to “strengthen monitoring and enforcement” of FCVs and to this end, recommended the placing of an observer on all FCVs fishing in the Exclusive Economic Zone.

Following the release of the Ministerial Inquiry’s report, the NZ Cabinet made the decision to require every foreign-owned fishing vessel to be flagged as a New Zealand ship. As a New Zealand ship, the FCV is subject to the same legislative and regulatory requirements and enforcement provisions as a domestically owned and flagged vessel. This decision kicked off a four-year transition period and by 22 May 2016, all foreign-owned fishing vessels had either reflagged or left the country and the number of foreign charter vessels fishing in the NZ EEZ had been reduced by approximately half.

For foreign crew, the benefits of reflagging are several. They are employed by a NZ-based party under a NZ employment agreement. NZ employment legislation, health and safety and criminal law automatically apply. In the case of underpayment of wages and illegal deductions, the NZ Department of Labour can investigate and take enforcement action if necessary.

Reflagging also required legislative changes to the Fisheries Act and in August 2014, the Fisheries (Foreign Charter Vessels and Other Matters) Amendment Act 2014 took effect, adding “conditions that relate to fisheries management, employment, vessel safety, or compliance with maritime rules relating to pollution and the discharge of waste material from vessels”.

Under Part 2 - Observers and other matters, the new Act requires observers to:

- Collect reliable and accurate information for fisheries research, fisheries management and fisheries enforcement
- Collect reliable and accurate information about vessel safety and employment on fishing vessels
- Collect reliable and accurate information about compliance with maritime rules relating to pollution and the discharge of waste material from vessels
- Have access to any safety equipment and to any document concerning the manufacturing or operation of the equipment
- Have access to any person engaged or employed to do work on the vessel so that, if the observer so wishes, the observer may discuss with that person any matter concerning his or her engagement or employment on the vessel

With the sweep of a pen, the new Act had considerably broadened the scope of an observer’s duties. Under the guidance of an inter-agency working group, observers are now tasked to carry out the extra observing and reporting tasks as outlined in the Act. Not

surprisingly, adjustments have had to be made in the recruitment and training of new observers while those while experienced observers have had to adapt to this new role.

The successful integration of these new duties into the tasks that observers already carry out will require careful management. The observer selection process in New Zealand has traditionally had a wide focus and has not been restricted to candidates with a bio-sciences background. The new role will favour a continuation of this policy and should attract people with specialised vessel knowledge and sea-going experience. Adjustments have been made in the training syllabus to reflect these new demands on observers, while recognising that these people are not generally maritime experts. Understanding workplace safety, particularly in a sea-going context, is a skill that is built up over time.

Industry acceptance of these new observer duties is most likely to occur if it can be shown that the changes have led to improved workplace safety. Maritime New Zealand will be looking for evidence that workplace safety has improved and food safety inspectors will expect to have a greater sense of confidence in the vessel's ability to process safe seafood. Likewise, the Ministry for Business, Innovation and Employment will need to be reassured that accusations of slave-like conditions no longer apply to the work environment on foreign charter vessels. These improvements will take time and are unlikely to happen unless observers have confidence in their judgements of what they see happening on the vessel.

This confidence will not be gained overnight. The processes will require continual refinement and good communication between all parties and the benefits gained will need to be measurable if our trading partners are to be assured that real gains have been made. There is no doubt that work at sea can be made safer and working conditions made more tolerable but care will need to be taken to ensure that the traditional benefits of having an observer on a fishing vessel are not compromised in any way.

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## **Has the future arrived yet for the Scottish Industry observer program.**

**K A Coull, J-F Birnie**

**Scottish Fishermen's Federation, Aberdeen, UK**

In 2008, Scotland embarked upon a new way of managing its fisheries within the context of the EU management regime. Under new EU regulation, Member States were given the opportunity to manage days at sea for their own vessels under a block allocation of kilowatt-days. Scotland as part of the UK chose to manage its fisheries in this way and in doing so was able to begin creating incentives for fishermen to engage in extra conservation measures.

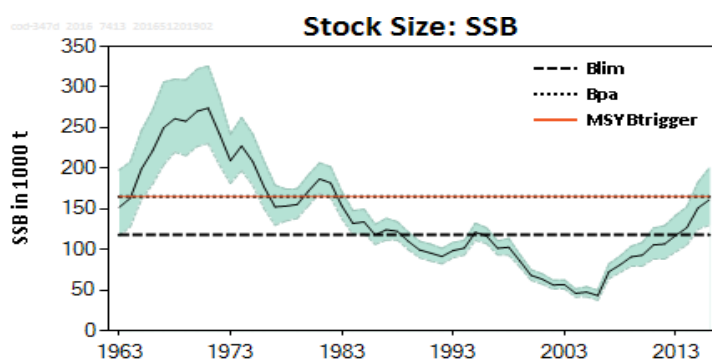
A cooperative management body was formed, known as the Conservation Credits Steering Group (CCSG) made up of government, scientists, environmental NGOs and industry. This group, along with sub-groups dealing with matters such as technical measures for more selective fishing gear, cooperated on the management of the Scottish fleet. The aim of the scheme is to make sure that stocks of valuable whitefish in Scottish waters, particularly cod,

are able to recover to sustainable levels, fulfilling Scotland's obligations under the EU's Cod Recovery Plan (CRP). Measures introduced by the CCSG include a programme of seasonal and real-time closed areas which help to protect aggregations of cod, various selective gear measures including the “Orkney trawl”, larger square mesh panels and larger mesh cod ends. In return for adopting selective gear methods, fishermen were rewarded with increases in the days at sea allocation. This led to the creation of an independent onboard observer scheme (IOOS) managed by the Scottish Fishermen’s Federation (SFF) to provide both policy and science managers with the degree of confidence required to support measures introduced.

SFF presented on the evolution of the Industry led Observer Programme to the International Fisheries Observer and Monitoring Conference (IFOMC) in Chile in 2013. In completing the presentation, reference was made to “The Future of the SFF Onboard Observer Scheme” and highlighted four specific aims; wider use of data in stock assessment, collection of biological data in support of the European Union Data Collection Regulation, provide information on data deficient stocks, training of fishermen in self-sampling techniques.

In 2016, SFF will take the opportunity to inform IFOMC on achievements against the stated aims and highlight the issues that arose and how they were addressed.

The Scottish Fishermen’s Federation is a trade organisation which represents 10 constituent associations covering over 500 vessels from the smallest under-10metere vessels to the largest most modern pelagic vessels. The constituent associations account for over 90% of the total Scottish quota (65% of the UK quota). The management initiatives pursued by of the Conservation Credit Steering Group, underpinned by the IOOS have contributed to the observed recovery of the cod stocks in the North Sea such that the most recent advice from the International Council for the Exploration of the Seas (ICES) shows the spawning stock biomass to be above management reference points.



Following the demonstrated increase in the cod spawning stock biomass European Member States pressed for the end of effort restrictions which had been imposed as part of the cod recovery plan. While the European Council adopted decisions which effectively ended the process of automatically increasing effort restrictions year on year, a legal wrangle between the European Council, Commission and Parliament ensued. The legal position has been

clarified but in the meantime, relaxation on specific measures in the CRP has eased pressure on sustainable activities on other species.

Following continued pressure from industry, the Fisheries Management and Conservation Group (FMAC) agreed to develop and operate a combined Marine Scotland Science and Scottish Fishermen's Federation Observer Sampling Scheme. This would make more efficient utilisation of the total resources expended on fisheries matters, delivering;

- A single, definitive source of Scottish discard data collected, store and analysed in a unified way.
- Statistically robust estimates of catch and discards for all required purposes (ICES and reporting to the Commission on measures adopted by the CCSG).
- A reduction in some of the variance associated with discard estimation.
- A larger pool of vessels sampled each year, providing greater coverage.

Although initiated in 2013, it was not until 2015 that a full programme was operational. While it had been clear that "policy" had accepted the case for a combined scheme utilising all available resources, resistance from individuals within the "science" element introduced difficulties that proved to introduce delays. However, these obstacles have generally been overcome and the contribution made by the Scottish Fishermen's Federation Observer Sampling Scheme currently amounts to approximately two thirds of the total observer data set feeding into the assessment for the main species relevant to the Scottish demersal fleet. Data from the combined scheme is now utilised in the stock assessment with data submitted to;

- Intercatch- a web-based system where National Institutes upload national fish catches per area per time period per fleet etc. Fish stock coordinators can allocate sampled catch data to unsampled catches and aggregate all catch data. The aggregated output files can then be downloaded to the stock coordinators workstation. The files will be used as input for the stock assessment models.
- Regional Database FishFrame- a regional data base for raw data – currently it is only national data submitters, stock coordinators and members of expert groups who can have access to the system.

Through wider cooperation between Industry and Science, data collected by industry observers also feeds into the revised National Program for the Data Collection Framework and also contribute to provision of data on some data deficient stocks,

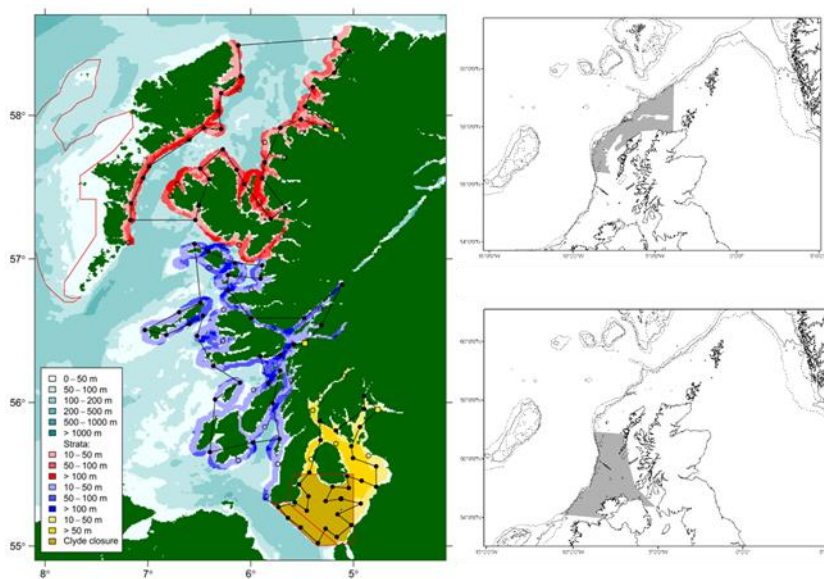
More recent workstreams undertaken by observers involved in the IOOS include;

- West of Scotland Demersal Fish Project
- Observer Scheme for Fishing Effort Exclusion
- Fisheries Innovation Scotland projects, including Post-catch survivability of under-sized Norway lobster (*Nephrops norvegicus*).

- Gear Innovation and Technology Advisory Group

### West of Scotland Demersal Fish Project

SFF undertook this EMFF project when it was realised that Marine Scotland did not have the capacity at that particular time to meet a commitment that had been made by the Scottish Government. Through the involvement of SFF, a series of quarterly surveys covering three inshore areas and four offshore areas was completed successfully with the outputs likely to inform on many fisheries matters, both inshore and offshore. This project dovetailed with the existing IOOS with observer playing a key role on all trips and contributing to the training of fishermen in self-sampling schemes. The areas covered by the West of Scotland Demersal Fish project is shown below.



### Observer Scheme for Fishing Effort Exclusion

Following representation from the Clyde Fishermen's Association, Marine Scotland recognised that there may be a case to set up an Observer Scheme to provide appropriate data on cod catches and discards relating to a group of vessels which may be excluded from the fishing effort regime laid down in chapter III of Regulation (EC) No 1342/2008.

- Approached by Marine Scotland in May 2013
- EFF Application submitted June 2013
- Interviews for Observers conducted – June 2013
- EFF Application approved July 2013
- Trips commenced July 2013
- 383 Trips covered
- Average of 0.43% cod in catch

- Application to Commission for STECF consideration – March 2014
- STECF Reported and supported the application (March 2014)
- MS applied to Commission for derogation (April 2014)

### **Fisheries Innovation Scotland**

Fisheries Innovation Scotland is an independent, non-profit-distributing organisation with the remit of bringing together government, scientists, industry and other key stakeholders to lead an on-going programme of research, knowledge exchange and education concerned with the management of Scotland's marine fisheries and related areas. The IOOS has agreement with Marine Scotland that support can be provided for various projects related to Scottish fisheries where the proposers may not have the resources to deal with the onerous commitments required for observer and practical coverage. IOOS observers are currently committed to a post-catch survivability project where they monitor damage and vitality of discarded *nephrops*.

### **Gear Innovation and Technology Advisory Group (GITAG)**

The IOOS offers observer support for the EMFF project GITAG which aims to:

- Assist the Scottish fishing industry's transition to the operational requirements of the phasing in of the Landing Obligation, whilst protecting economic viability.
- Stimulate innovation in the development of fishing gear technology.
- Foster flexible working partnerships between active fishermen, industry, public bodies, gear technologists and science, aimed at scoping and contracting targeted projects trialling innovations to existing gear categories, piloting new gear configurations and types with associated data collection and appropriate scientific analysis

The reality is that the IOOS is currently providing 80% of the observer support during phase I of the GITAG project.

### **Conclusion:**

In relation to the aims set out at IFOMC in Chile in 2013, SFF believes that they have indeed arrived at what they envisaged the future programme would look like. However, this was not achieved easily and it is clear that there were lessons learnt there which can be shared with others.

Briefly:

- Science institutes must recognise that in changing times where resources are restricted, they no longer have a monopoly on “fisheries observer” (science related) activities.
- While “policy” may be supportive, “science” tend to be rather protective (not conducive to successful partnership work)

- Flexibility within an industry led scheme ensures that observers can be deployed or allocated for pressing needs.
  - In seeking continuing EMFF support, adaptation, flexibility and innovation have been necessary
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## **Prerequisites matter: An examination of applicant qualifications and performance**

**Gwynne Schnaittacher**

### **NOAA/NMFS/AFSC/FMA**

Fisheries in Alaska are quota managed in near-real time as the result of the high quality data and timeliness by which data are collected and submitted to the National Marine Fisheries Service by fisheries observers. The North Pacific Observer Program (Observer Program) deploys 400 or more discrete observers annually, accomplishing over 44,000 deployment days on over 500 fishing vessel and shoreside processing plants. The majority of the North Pacific fleet has at sea communication allowing for observers to submit data daily. These electronic data undergo intensive quality assurance and control processes and are available to data users within two hours of upload. As these data are managed near real-time, any misidentification of fish or crab species has the potential to influence analytical work used in stock assessments, in-season quota management, and potential fisheries closures.

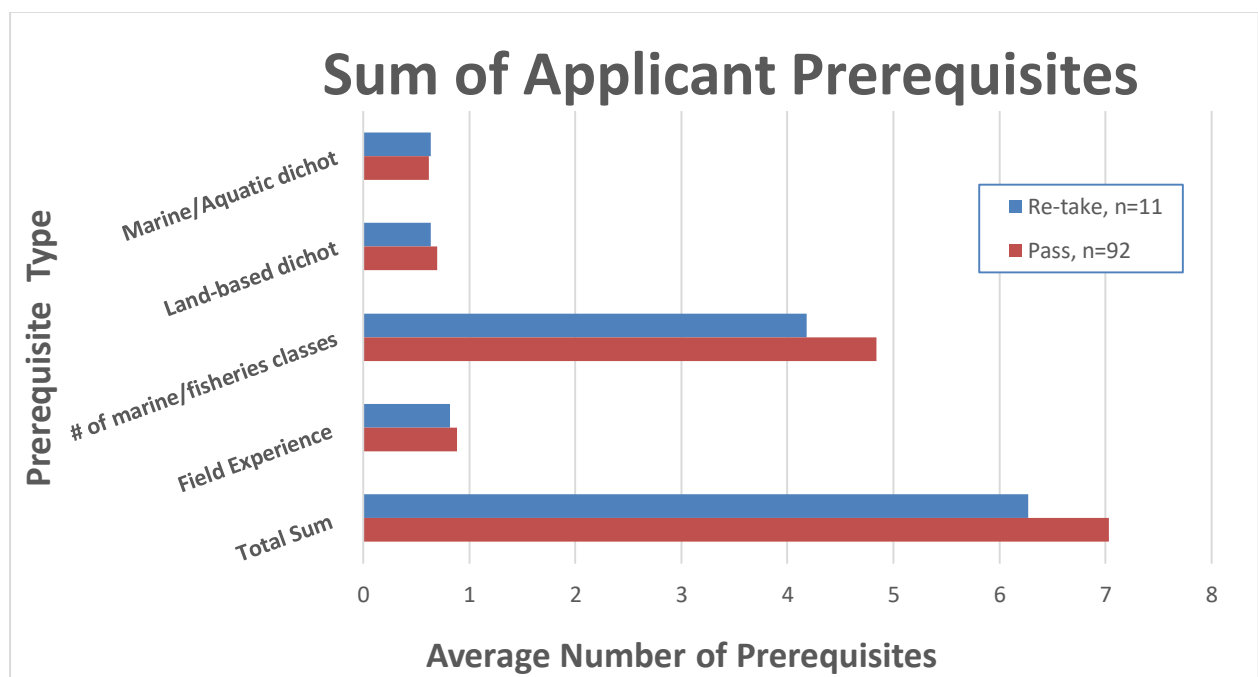
To be a marine fisheries observer in the United States there are national minimum eligibility standards established that require specific educational standards, allowing for a consistent baseline with robust scientific backgrounds across programs nationally. All candidates are required to have a Bachelor's degree in the natural sciences with at least 30 semester hours in the biological sciences, at least one math or statistics class, and experience with data entry. The North Pacific Observer Program has expanded national prerequisites to include extensive use of dichotomous keys in at least one of the biology courses and completion of at least one mathematics and one statistics course. The ability of observers to use dichotomous keys in the field, perform mathematical calculations, and apply appropriately randomized data strategies are essential to the successful performance of observers in the Observer Program.

To ensure a high standard of species identification and data collection in the field, the Observer Program requires annual fish and crab species identification testing for all observers. Fish exam performance results have been maintained and tracked for the last 11 years. Using these data and additional applicant information, this study examined if an individual's experience coming into the Observer Program can influence how they perform during their initial training and subsequent deployments. In the Program, rockfish, skates, salmon, flatfish, sculpins, sharks, and tanner and king crabs are all identified to species levels. In 2015, observers identified 89 commercially important groundfish taxa, 121 non-quota/non-target species and 15 prohibited species, totaling 225 taxa. With this diversity of species, it is imperative that observers have the ability to appropriately identify individual fish to a finite level, which necessitates the understanding and use of dichotomous keys.

The application packets, inclusive of transcripts and resumes, were evaluated for 103 observer candidates that attended and passed one of the three-week certification trainings in 2015. These data were then compared to their species ID performance during their 3-week training. These individuals' dichotomous keys were categorized as either marine/aquatic or land based, the number of marine/aquatic/fisheries classes, statistics classes, and math courses were tabulated, and if the individual had any field experience either through academic endeavors or work experience that was noted as presence or absence. The sum of the prerequisites were calculated for all individuals and a comparison was done between individuals that passed their fish identification exam on the first attempt and those individuals that required a retake of the species identification exam. Of the 103 application packets reviewed, there were 11 individuals that required a retake and 92 individuals that passed the fish identification exam on the first try. Alternatively, we examined the overall failure rate of fish exams in 2015 inclusive of individuals that did not eventually pass and deploy. There were 171 observer candidates that entered into a three-week certification training and 16 of those individuals failed the fish exam, resulting in a 9.8% failure rate.

Examination of applicant prerequisites as correlated to exam performance shows there is a general upward trend: those individuals that passed their fish exam on the first try had a higher number of prerequisites (Figure 1). The most notable differences could be seen in the number of marine/aquatic courses taken, field experience, and the total sum of prerequisites. Conversely, those individuals that failed the species identification exam on the first try had slightly more marine and aquatic dichotomous key courses on average than land-based courses. The failure rate is considered a low failure rate and could be the result of the stringent requirements the Observer Program has to allow entrance to participate in a three-week training

**Figure 1.** Applicant Prerequisites for Individuals Trained and Deployed in 2015





This study includes caveats, consisting of ambiguity around course use of dichotomous keys and whether it would be considered extensive use, a term not defined in the regulatory language. Additionally, some courses descriptions are not apparent if they used a dichotomous key or not, while others are well-defined such as dendrology, botany, ichthyology, phycology, and herpetology. If a course used them, but wasn't apparent that it would be indicative of this, then it may not have been part of the tabulation. Finally, the prerequisite requirements for the Program have been in place since the late 1990s. As we do not have applicant data to compare pre-implementation of the prerequisites, it is challenging to assess the direct impact of the prerequisites post-implementation.

Each program needs to tailor their prerequisites to meet their specific needs. It is important to recognize that it is imperative for observers to have a solid foundation of field skills coming into a program and that observer service providers must be able to identify the demands of the job and the requisite training or experience to complete the necessary tasks for their observer candidates. It was specifically noted in the regulatory implementation in 1997 that observers with previous course work using dichotomous keys are better able to apply that training" once they enter our program. Requiring applicants to enter the program with the appropriate experience and coursework ensures that training staff can focus on training them to complete their observer duties by applying the knowledge and skills they already have to meet the programmatic and regional management needs. Validation and consideration of the applicant prerequisites can have implications for new and emerging programs in regards to high quality in-season data collection and management, developing qualification metrics for applicants, and establishing efficiencies in recruitment and retention practices.

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## **Implementation of Discard Research Programs in Chilean Fisheries**

**Luis Cocas**

**Unidad de Biodiversidad y Patrimonio Acuático, Subsecretaría de Pesca y Acuicultura,  
Gobierno de Chile, Bellavista N° 168, piso 14, Valparaíso, Chile**

In alignment with recommendations of international fisheries forums and aware that increased levels of fishing mortality due to unaccounted discards and bycatch, threaten the long term sustainability of its fisheries, Chile amended its Fisheries Act in 2012, introducing new definitions on discarding: "*the action of returning to the sea hydro biological species captured*" and incidental catch (or bycatch): "*sea turtles, seabirds and marine mammals accidentally caught during fishing operations*", and also establishing sanctions and control measures for those incurring in such practices (Ministerior de Economía y Turismo, 2013).

Although the term discard was first introduced in Chilean legislation in 2001 (Ministerio de Economía y Turismo, 2011), that law's approach just banned and heavily sanctioned discarding, with no distinction between species and sizes, which added to challenging enforcement, made fishermen uncooperative and discards, while still occurring, became a taboo subject unknown in their magnitude to the fishing authorities and fisheries scientist.

To overcome those constraints, before penalizing discards or incidental catch, the 2012 amendment of the Fisheries Law, introduced exceptions to the discard ban, conditional on a

minimum two years monitoring program to quantify and identify the causes of these (until then) practices, and to develop and implement mitigation plans.

Further exemptions may apply as long as the following requirements are met: (i) monitoring programs are completed and discard and incidental catch mitigation plans are established, (ii) sufficient technical background has been collected according to the protocols established by the monitoring programs, (iii) the monitoring program continues to run, (iv) a global catch quota, which accounts for discards, has been set for the target species, (v) target and non-target species are subjected to a mitigation plan, and (vi) discarding does not affect the conservation of the target species. Finally, there are restrictions on the use of previously discarded catches for human consumption, such as under minimum landing sizes (MLS), but these may be lifted within the remits of the mitigation plans.

The development of the monitoring programs involved technical and cultural challenges because for a first time, discards and bycatch were going to be assessed with the consequent fears of fishing users on the outcome. Thus, to obtain (behaviorally) unbiased information, during the execution of these programs, sanctions on discards were suspended. However, all other fishing regulations had to be complied (*i.e.* closures, legal sizes, and gear restrictions). Originally, the information had to be collected exclusively by fisheries observers onboard, but because of coverage restrictions for a vast fleet, fishermen were also incorporated through self-reporting, contributing with their view and expertise.

This scenario required strengthening the observer programs as well, through improved regulation on working conditions, training, safety, infrastructure, and data collection. In addition, an intense socialization and communication work, led by observers, was deployed in the field to introduce these programs and achieve the fleet's commitment. Species identification guides for fishermen, posters, videos, workshops, and field meetings, along with a strong injection of budget for discard research, reaching US \$2 M in 2016, were also provided.

By 2016, out of a total of 30 discard research programs performed nationwide, two have been concluded in demersal fisheries, and the respective mitigation proposals will be discussed within specific Management Committees, which once approved will become binding through Mitigation Plans. These plans shall ensure the reduction of discards of both the target species and its accompanying fauna, as well as the incidental catch of seabirds, sea turtles, and marine mammals, and must contain at least: (i) management and conservation measures and the technological means necessary to reduce discards and incidental catch, (ii) a monitoring and surveillance program of the plan's functioning, (iii) an assessment of measures taken to reduce both discards and incidental catches, (iv) a training and dissemination program, (v) a code of good practices during fishing operations, and (vi) incentives for innovation in systems and fishing gears, with the objective of mitigating or reducing discarding of both the target species and the accompanying fauna as well as the incidental catches.

Observer programs, were extended with the new Fisheries Law, but will continue with the sole objective of collecting biological and fisheries data to be used in scientific advice for management, without any jurisdiction in compliance. Therefore Law compliance in terms of discard and incidental catch will be monitored by electronic monitoring systems (EMS) in all vessels of the industrial fleet as soon an EMS regulation is enacted (expected by first half of

2017), while artisanal boats longer than 15 m will be required to carry EMS three years after the EMS regulation is enacted. This regulation will distinguish by fishery and fishing gear and will consider the monitoring programs results.

After a complex beginning, the discard and incidental catch studies took force and acceptance between fishing users, and currently there is a huge interest from the industry in these non-sanction monitoring programs, as they perceive the resulting transparency of their fishing operations as an opportunity to change fishing regulations and match fishing opportunities with their real catches. At the same time, Chilean society is increasingly concerned about the profitability and environmental impacts of fishing activities, and open to sustainability certifications.

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## **Open Discussion Session**

This session was represented by a broad diversity of observer programs from around the world including the United States, Solomon Islands, New Zealand, United Kingdom, and Chile. Each of the presenters gave an overview of their respective programs followed by a question and answer session.

The session began with an overview by Jane DiCosimo of U.S. domestic observer programs, including current funding levels, how data are utilized, and what some of the current initiatives are to improve U.S. observer programs. These include a safety program review that will begin in 2016 and be completed in 2017.

Philip Lens discussed the Pacific Islands Fisheries Forum Agency (FFA), an inter-government agency established in 1979 to facilitate regional cooperation and coordination on fisheries

policies between its 17 member states and over 800 observers that are deployed annually, primarily on tuna purse seine vessels.

Alex Woods discussed the New Zealand observer program's initiative to broaden the scope of sea-going observation to include the working hours and living conditions of fishers, compliance with the new Health and Safety at Work Act of 2015, vessel safety and information related to food safety.

Kenny Coull discussed the impacts of a recent EU discard ban on Scottish Industry Observer Program and enhanced cooperation between government and industry that is necessary to successfully implement the program.

Gwynne Schnaittacher from the U.S. discussed the North Pacific Observer Program and how the ability of observers to use dichotomous keys in the field was essential to the successful performance of observers in the program.

Luis Cocas from Chile discussed a new law requiring the development of research programs to identify and quantify bycatch, recognize their causes, and propose mitigation measures.

## **Discussion**

There were many questions about the expanding role of observers in monitoring and compliance. For example, in New Zealand vessels are required to document food safety checks and present the records for quality assurance purposes. Some questioned whether this was an appropriate role for observers, and how observers are managing the increasing diversity of competing demands. There was also discussion about the increasing role of industry in self-monitoring and self-reporting. For example in Scotland fishermen are helping to fill gaps in data due to declining funds available for scientists to conduct studies. Stocks were being cut without sufficient data so the government was pressed for additional data to be collected, which allowed industry to play a larger role.

There were questions and discussion on the role of electronic monitoring (EM) and electronic reporting (ER) in conjunction with observer duties. Many program are developing EM/ER systems that provide an additional set of eyes for the observer to document activities on the vessel. In many programs there is dual interest in developing both EM and ER in the U.S. but that recently there has been greater focus on EM. Specific questions and comments follow.

### **Eric Brasseur (West Coast Observer Program) to Gwynne Schnaittacher**

Question/Comment

How do you keep the dichotomous keys up to date?

Response

Gwynne Schnaittacher: The program works with fishery biologists in Alaska to ensure that data are correct, especially for species that are difficult to identify like rockfish. Not certain how often they are reviewed but the dichotomous keys are made available to all to ensure data are current.

### **Isaac FORSTER (CCLMR) to Gwynne Schnaittacher**

Question/Comment

Are you able to evaluate observer performance and what metrics are you using?

Response

We have an intensive post deployment process that includes an observer interview and review of all of the data collected during the deployment. Specific to species ID there are several questions regarding species identification.

**Unidentified to Kenny Coull**

Question/Comment

Can you expand on the collaboration issues between science and industry?

Response

Kenny Coull: Stocks were being cut without data so the agency and industry were pressed for data and regulations. In the U.K. there have been reductions in staff among scientists thus allowing for a larger role by industry in monitoring fisheries.

**John McVeigh (West Coast Observer Program) to Panel**

Question/Comment

Landing obligations and discard bans. Electronic monitoring systems are being used for monitoring and fishermen are landing more catch which has resulted in difficulties and challenges. How have your programs dealt with this issue?

Response

Kenny Coull: Fishermen have had to adopt to a different business plan. Many are going after mixed catch.

Luis Cocas: Agency provides support for fishermen. Progressive process of developing new markets for new species.

**Dennis Hansford (National Observer Program) to Phillip Lens and Luis Cocas**

Question/Comment

Question for Phillip - IATTC cross arrangements and consequences for non-enforcement?

Response

Phillip Lens: Observers go through IATTC training before being placed on trips.

Question for Luis – How does voluntary gear become mandatory?

Luis Cocas: The program is an opportunity to reduce discards. Fishermen are eager to implement mandatory use of equipment. It is industry designed equipment and fishermen relish the opportunity to demonstrate to society the steps they've taken to reduce bycatch.

**John Carlson (Southeast Fisheries Science Center) to Kenny Coull**

Question/Comment

How do observers feel their new roles will affect their jobs and the jobs of the managers?

#### Response

Kenny Coull: There is a lot to learn and there are concerns about observers receiving adequate training. There is a short amount of time available to learn a great deal of material about regulations. Trainers show observers what to look for and identify common scenarios.

#### **Liz Mitchell (Association for Professional Observers) to Gwynne Schnaittacher**

##### Question/Comment

I understand that the North Pacific Observer Program has a coral ID pilot project, what is the status of project?

#### Response

Gwynne Schnaittacher: Not certain about the status but can find out about it and provide an update.

#### **Gill Silva (Oregon State University) to Alex Woods**

##### Question/Comment

Can you discuss the expanded role of observers in compliance? Is New Zealand unique in this regard?

#### Response

Alex Woods: We saw the expanded role coming about two years ago since regulators aren't on fishing boats and observers are. Since they are already on the vessel they can keep an eye out, but the question was how much should they be concentrating on compliance issues? It is difficult for observers to fit everything into their busy schedules.

#### **Josh (Hawaii) to Jane DiCosimo**

##### Question/Comment

Why is there greater emphasis on electronic monitoring than electronic reporting?

#### Response

Jane DiCosimo: The agency releases a request for proposals to all regions of the U.S. and the funds are allocated according to the needs of the regions. There has been greater emphasis on EM recently due to Congressional interest in expanding the role of EM in an effort to reduce costs. There has been less emphasis on ER because many solutions have been achieved in previous decades.

#### **Steve Kennelly (IC Independent Consulting) to Phillip Lens**

##### Question/Comment

Is the Forum Fisheries Agency implementing a Fisheries Information System?

#### Response

Phillip Lens: Not yet, but perhaps in the future. It has been tried in a few countries.  
Kenny Coull:

#### **Patrick Legion (MRAG) to Kenny Coull**

Question/Comment

Real time compliance monitoring has been successfully implemented in the Mediterranean.

Response

Kenny Coull: Similar in New Zealand. It is up to the Ministry to take concerns further.

**Bobby Buzzell (AIS Alaska) to Kenny Coull**

Question/Comment

Do you teach self-sampling to fishermen?

Response

Kenny Coull: There is a budget for industry to do data collection. There is a one day training (Species ID and sampling) with one observer present to assist. Since then there has been no follow up on routine self-reported data.

**Karl Staisch (Western Central Pacific Fisheries Commission)**

Comment

In the WCPFC observers have been trained since 1988 to collect compliance information.

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**Poster Presentations – Extended Abstracts**

**Meeting the Observer Training and Debriefing Challenges of the West Coast Groundfish Catch Share Program**

**Ryan Shama**

**NOAA Fisheries ▪ Northwest Fisheries Science Center ▪ Fisheries Resource Analysis & Monitoring Division, West Coast Groundfish Observer Program**

**INTRODUCTION**

The implementation of a Catch Share program in 2011 introduced Individual Fishing Quotas (IFQs) on the West Coast, along with a host of challenges for the West Coast Groundfish Observer Program (WCGOP). Paramount among these challenges was a need to increase the speed at which data could be made available to a central vessel account system, in order for fishers and managers to track quotas in near real-time. This required a significant decrease in data entry and finalization times. The WCGOP met this challenge by utilizing a number of techniques, including the creation of an offline database, expansion of automated trip error checks, an accelerated debriefing schedule, and data form scan and upload procedures.

This IFQ program also brought with it a significant increase in the demand for observers and a need for increased training frequency and flexibility. By working closely with observer

providers and creating a suite of new training/briefing options, the WCGOP has been able to meet the demand for certified Catch Share observers, while also providing opportunities for observers to move back and forth between the Catch Share and non-Catch Share programs. Crossover between programs has allowed for more observers to work year-round, potentially increasing observer retention. With greater retention, comes a reduction in the need for costly, time-consuming initial trainings. Having more experienced observers in the field also reduces the post-training burden on debriefing staff and improves data quality.

## DEBRIEFING/REPORTING PROCESS

The demands on the WCGOP Debriefing Team increased dramatically with the implementation of Catch Shares in 2011, due to the 100% observer coverage requirement. Prior to this, WCGOP observers covered an average of 1,259 trips per year (2002 through 2010). In 2011, WCGOP observers covered 3,530 trips and this became the new normal (See Figure 1). As a result, the debriefing staff nearly doubled, from 7 in 2010

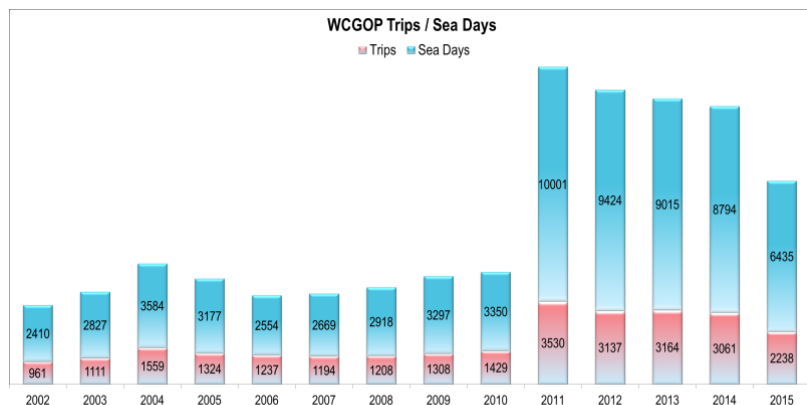


Fig. 1: WCGOP number of trips and sea days, 2002-2015.

to 12 in 2011, in order to maintain a high level of data quality and support to observers in the field. Several changes have also been made to the debriefing process.

## Data Entry

Timely data entry by observers is a challenge for any observer program; however, in a Catch Share program, timely data entry is essential. Starting in 2011, the WCGOP began to closely monitor the “days to entry” (DTE) for each trip. DTE is defined as the number of days between disembarkation and the completion of data entry. It was decided early on, that an average DTE of 3 days would provide fishers with sufficiently accurate, up-to-date estimates of their remaining quota. However, since WCGOP observers could not enter data at sea, achieving this goal required some drastic changes.

In 2012, the WCGOP introduced an offline database, which allowed observers to enter data, while at sea, and then upload their data, once an internet signal was available.

Unfortunately, due to a lack of adequate testing, this first attempt was deemed a failure. We learned the hard way, that thorough testing, conducted by multiple users is essential, when rolling out and making changes to database applications.

In 2014, the WCGOP rolled out a new version of the offline database, after collaborating with the Scientific Data Management Program (SDM) and taking the time for thorough testing by multiple users. This version perfectly mirrors the online database and has worked very well. The main challenge has been ensuring that each observer is running the necessary updates, regularly. This has been resolved, by requiring the entry of at least one trip per month via the offline application.



The WCGOP also expanded and cleaned up an existing Trip Error Reporting (TER) system within both the online and offline database applications. Common errors, questionable entries, and issues that result in delaying the reporting of data to the vessel account system are automatically identified and easily displayed, so that the observer can address these issues, immediately. Additional TER checks are easily added, fixed, and removed, as circumstances change. This has proven to be a highly effective way to quickly reduce the number of errors in observer data.

### **Data Submission**

Because of the nature of the West Coast fleet, WCGOP observers have historically collected and submitted data on a one month cycle, submitting all data collected in a given month by the 5th of the following month. In order to reduce the lag time between collection of data and submission to a debriefer, the WCGOP developed a new system, by which observers use compact, portable scanners to upload their raw data directly to the WCGOP database, as a PDF file. An email is automatically generated and sent to the associated debriefer, informing them of each newly uploaded trip. This allows debriefers access to their observers' raw data immediately after it is entered.

By using the tools available in Adobe Acrobat Pro, a debriefer can identify errors, make comments directly to the PDF, and upload an edited copy to the database, so the observer can begin making corrections. This process has proven particularly effective for reviewing data from new observers, observers in especially remote locations, as well as observers with performance issues. An additional advantage of this process is that a digital copy of the raw data from each trip is maintained, permanently in the database for future review. This can greatly reduce the need for retrieval of archived materials, a costly and time consuming process.

### **Vessel Account Reporting**

Observer data is debited from individual vessel quotas via the Vessel Accounts System (VAS). When the Catch Share program began, observer data was debited weekly. Changes were later made to provide vessels with more up-to-date quota information. Currently, observer data is uploaded to the VAS, daily, including any changes made to previously uploaded data.

### **TRAINING PROCESS**

Due to the 100% observer coverage requirements of the Catch Share program, the WCGOP Training Team was tasked with developing a training schedule to accommodate the increased need for observers. Prior to Catch Share implementation, the WCGOP held a single, 2.5-3 week training each March for new observers and two 4-day annual briefings for returning observers. The number of observers needed for the

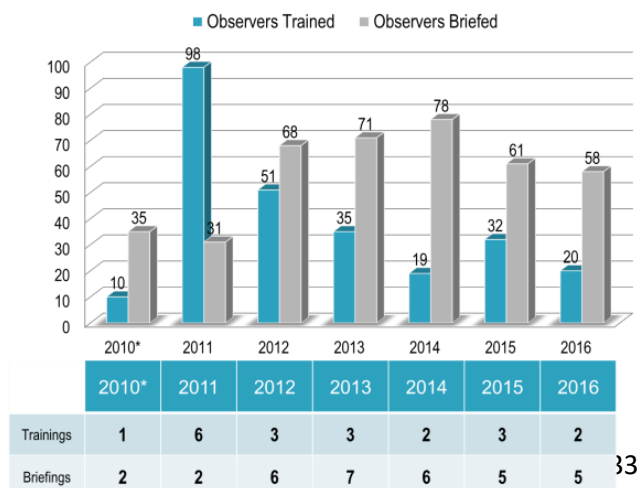


Fig. 2: Number of observers attending full trainings/briefings (top). Number of full trainings (3 weeks) and full briefings (4 days) held (bottom). \*2010 is fairly representative of years prior to Catch Share implementation.

year was decided well in advance of training. Once this training was completed, there were no further opportunities for training new observers, though attrition, fleet activity, etc. could mean too few or too many observers in the field. Catch Shares provided an entirely new model.

### ***Frequency***

Since providers coordinate Catch Share observer coverage, through contracts with individual vessels, the WCGOP is required to negotiate the number and type of observer trainings/briefings that will be held each year, based on the providers' predictions of vessel activity. Because the fleet reimburses these providers for observer pay, new observers must be trained as close to their first deployment date, as possible, to minimize the overall cost of observers to the fleet. The result is both multiple full trainings and annual briefings each year (See Figure 2).

Prior to Catch Share implementation, the WCGOP had little trouble finding space on-site to hold all trainings and briefings; however, the drastic increase in training/briefing events necessitated the use of rental space. Beyond the expense, it was difficult to find rental spaces that were flexible enough to accommodate our needs, since it was often difficult to schedule far in advance. To resolve this, the WCGOP invested in modifications to existing conference rooms, which currently allow us to hold all trainings and briefings on-site.

### ***Type***

In order to increase the efficiency of WCGOP training events and decrease costs to the program and observer providers, several alternative training and briefing types have been developed, without sacrificing efficacy. These include options for moving observers to and from the non-Catch Share and Catch Share programs, by focusing on the minimal differences between the two programs. Currently, the WCGOP has 3 additional training/briefing options, which can be performed within 1-2 days and at any time of the year, by multiple staff

## **ON THE HORIZON**

Despite our many successes, the WCGOP is not content to rest on its laurels. We continue to look for ways to improve upon the quality of our data, timeliness of reporting, and flexibility of observers to deploy in various fisheries. Additionally, the push for increased Electronic Monitoring/Reporting has left much uncertainty, regarding the role of observers, in the future. Therefore, we continue to look for ways to improve upon these processes and to demonstrate the value of observers for the collection of scientific data, much of which cannot be collected by other means.

### ***Debriefing***

Currently, the WCGOP is developing an electronic back-deck data collection system, which will revolutionize the way in which our observers collect, enter, and report data. This project also has the potential to virtually eliminate paper forms, along with the waste and printing costs associated with them. By moving away from paper, we will also eliminate the potential for transcription errors and the redundancy associated with copying raw data into the

database application. This will also greatly increase the efficiency of data collection and review, opening up opportunities for new and expanded sampling.

### ***Training***

For the first few years of the Catch Share program, Catch Share and non-Catch Share trainings and briefings were kept essentially separate, with several obstacles in place, preventing movement back and forth between the 2 programs. However, we are currently in the process of developing training materials, which will prepare and certify all WCGOP observers for deployment on both Catch Share and non-Catch Share vessels. This will result in a major reduction in the time and resources devoted, annually, to the preparation of training materials and lesson plans. It will also simplify training logistics.

### **THANKS!**

Special thanks to the 397 observers that have passed through our program, since it began in 2001. Your hard work, under difficult conditions, is greatly appreciated. Also, to my fellow WCGOP staff members, for continuing to explore new avenues for improving this program.

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## **Five years post rationalization: Fishing Behavior Changes Observed In Astoria's Groundfish Catch Share Fleet**

**Phillip Bizzell and Yong-Woo Lee**

**Fisheries Observation Science Program, Northwest Fisheries Science Center, NOAA**

**Goal:** To demonstrate fishing behavior adaptations following the transition to an IFQ fishery, by examining trends in fishing effort, catch rates, and revenue for the Groundfish Trawl fleet based in Astoria, Oregon.

### **Background:**

The transition from a Limited Entry, trip limit based fishery, to a Catch Share Individual Fishing Quotas (IFQ) system in 2011, was an important milestone in the management of the West Coast Groundfish Trawl sector and produced some immediate and notable changes in fishing practices. Since then, a few reports have demonstrated gains in vessel revenue and efficiency and have shown steep reductions in bycatch of certain commercially important or overfished species. In this study, we tested these patterns on a local scale, specifically for the Columbia River port of Astoria, Oregon. In the last decade Astoria has been one of the busiest ports for commercial fishing, and observer activity, on the West Coast. Annually about 1/3 of Catch Share trips in the entire U.S. West Coast are delivered to Astoria, OR and it's Groundfish trawl fleet appears to be thriving under the IFQ system. This poster showcases some of the changes observed by the West Coast Groundfish Observer Program (WCGOP) in the years leading up to and following IFQ rationalization.

### **Methods:**

To identify potential changes in fishing behavior in the five years post-implementation, we examined fishing effort and catch data collected by the WCGOP for all Non-Hake trawl trips landed in Astoria from 2006 to 2010 and 2011 to 2015. Mean trip length and mean trawl duration were the fishing unit-effort metrics considered. These metrics were chosen because they are related to overall efficiency of the fleet and give us some information about fishing strategies (depth and target), plus operating cost considerations. The accompanying graph was plotted with the most current landings data available from the Pacific Fisheries Information Network (PacFIN), and shows total revenue for 7 species groups, by year, for all Non-Hake trawl landings made in the Astoria Port Group. The division into species groupings easily allows us to see that the composition of landings has changed over time under IFQ management.

Overall retention and discard rates for 2 broad species groupings were also compared for the pre- and post-Catch Share periods. The IFQ and Non-IFQ groupings are intentionally broad to exhibit the larger trend in catch rates. The IFQ group contains most marketable species with IFQ designations, including all overfished/rebuilding species, most rockfish & flatfish, plus roundfish like Sablefish and Lingcod. The notable commercially important exception to the IFQ category are the skate species, which are part of the Non-IFQ category along with all other species that do not have allocated quota. Average discarded weight in pounds-per-trip of 9 priority species are also presented. Five of these species are currently overfished, or recently rebuilt. The other 4 are important to note because they are highly utilized (Sable, Thornyheads); signify a change in fishing practices (midwater targeting of Yellowtail rockfish); or in the case of Pacific halibut, prohibited with catch limited by the amount of individual bycatch quota (IBQ) available.

### Results and Discussion:

A permutation test was adopted to statistically compare the differences between pre- and post-Catch Share management (Fig. 1). The results indicate statistically significant decreases for both metrics of unit-fishing-effort, while retained catch rates significantly increased after Catch Share implementation. The average length of a trip was reduced under Catch Share management by 0.5 days (12 hours) and tow duration by 30 minutes. In the Post-Catch Share period, retention-per-trip of total catch and IFQ species catch increased by 46% and 42% respectively. Simultaneously, overall revenue increased (Fig. 2). This implies improvements in fishing efficiency, leading to economic gains for the Astoria fleet. Note that previously overfished Petrale sole (included in the

Species Discard	Before	After	Z-stat	P-value
Trip Days	4.8	4.3	-2.34	0.020
Trawl Hours	4.3	3.7	-2.44	0.015
Total Retained	31010.7	49313.6	2.75	0.006
Total Discards	12064.5	6743.3	-2.80	0.005
IFQ Retained	29014.5	44520.9	2.70	0.007
IFQ Discards	7576.5	2866.6	2.71	0.004
NIFQ Retained	1996.2	4792.7	-2.85	0.007
NIFQ Discards	4488.0	3876.8	-1.58	<b>0.114</b>
Darkblotched RF (DBRK)	183.3	20.0	-2.37	0.014
Pac. Halibut (PHLB)	415.8	232.7	-2.28	0.017
Pac. Ocean Perch (POP)	139.9	2.3	-2.15	0.007
Petrale Sole (PTRL)	171.4	73.8	-1.39	<b>0.147</b>
Sablefish (SABL)	519.6	18.9	-2.69	0.010
Thornyheads (THDS)	522.8	42.8	-1.86	0.008
Widow RF (WDOW)	38.7	0.1	-2.37	0.008
Yelloweye RF (YEYE)	0.5	0.0	-1.22	0.007
Yellowtail RF (YTRK)	29.4	0.1	-1.74	0.008

Fig. 1. Five year averages for each management system. Unit = average-pounds-per trip.

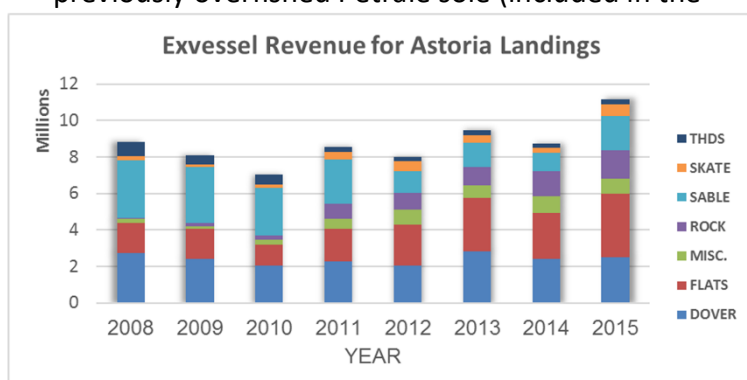


Fig. 2 – Non-Whiting Trawl Revenue for Astoria Port Group. Data Source: PacFIN, provided by Niels Leuthold

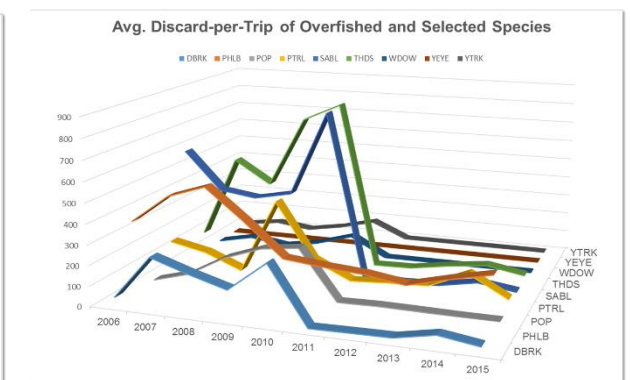


Fig. 3 – Pre/Post Catch Shares Avg. Discard in pounds-per-trip. Data Source: WCGOP

FLATS group), IFQ rockfish species group (ROCK), Skates and Misc. species are now constituting a larger percentage of deliveries, while Thornyhead (THDS) and Sablefish deliveries have decreased (Fig. 2).

Discard rates for most species fell precipitously in 2011 and have since remained at very low levels. There were significant reductions in the average pounds-per-trip discard of IFQ species as a group (Fig.1) and for our selected priority species following the IFQ program's implementation (Fig. 3). Among the species we selected, Sablefish and Thornyhead discards stand out, falling by greatest amount in terms of 5-year average pounds-per-trip at 500.7 lbs and 480 lbs respectively. Fishermen may not be targeting these 2 species as extensively as they were before, but now what is caught is generally retained and delivered. Just as impressive is the change in discarded weight of the selected IFQ rockfish, a group that includes overfished or recently rebuilt species. When taken together, the 5-year average discard for these rockfish species fell by 178% after 2011 and now averages only 4.49 lbs. per trip in the last five years.

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## **The Importance of Fishery-Dependent Biological Data Collection by the At-Sea Observer**

**Taylor Howe**

**West Coast Groundfish Observer Program, Pacific States Marine Fisheries Commission,  
NOAA Fisheries**

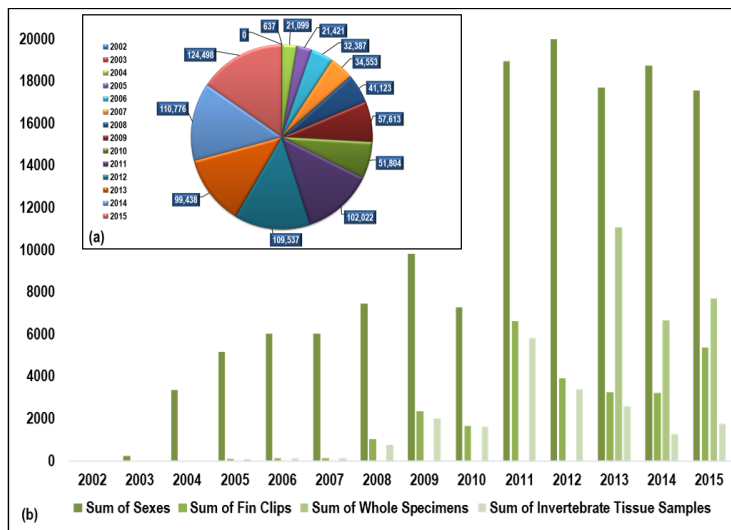
### Introduction

On January 19, 2000, the U.S. Department of Commerce declared the West Coast commercial groundfish fishery an economic failure following the dramatic decline in fish catch experienced over the previous decade. A direct cause for the collapse of the fishery was indeterminable. However, natural causes such as changes in ocean conditions, low productivity, and five El Nino events in an 18 year period, in addition to a lack of basic scientific information, were determined to be major contributing factors<sup>1</sup>. Furthermore, population recovery posed difficult, as many of the species impacted have long maturation and reproductive cycles. As part of a new fishery management strategy, NOAA Fisheries established the West Coast Groundfish Observer Program (WCGOP) in 2001 with the mission of collecting the basic fishery-dependent data which previously was lacking.

### WCGOP Observer Data Collection

In the fifteen years since the inception of the WCGOP, at-sea observers have proven to be an indispensable data collection resource and have amassed a robust fishery-dependent dataset with enormous potential for scientific use. The WCGOP observer dataset includes (1) detailed estimates of total discarded and retained catch; (2) weights, lengths, sex, age structure, and genetic information from numerous groundfish species, salmon, Eulachon, Green Sturgeon, and marine mammals; (3) invertebrate tissue samples; (4) viability estimates of Pacific Halibut; and (5) interaction information on marine mammals and seabirds.

## WCGOP Observer Data



**Figure 1. (a)** Total number of specimen lengths collected by WCGOP observers by year since 2002; **(b)** Total number of sexes, fin clips, whole specimens, and invertebrate tissue samples collected by WCGOP observers by year since 2002.

## WCGOP Observer Data Uses

Detailed biological sample information such as lengths, sex, genetic material, and viabilities are used by stock assessors and other scientists to study population structure and the overall impact of fishing activity on this important natural resource. Having at-sea human observers on board commercial fishing vessels to collect this important fishery-dependent biological data is an essential part of doing the true science required for developing a better understanding of the marine environment and its inhabitants.

## Conclusion

Collecting large biological datasets using human observers does have constraints and there are both monetary and spatial costs to consider. With recent improvements in video quality, Global Positioning Systems (GPS), and electronic logbook technologies, alternative methods to carrying a human observer on board are being worked on to account for catch estimation and monitoring regulation compliance. However, these new technologies remain limited in their capabilities to collect the important fishery-dependent biological information necessary for proper fishery management.

## Citations

1. "Commerce Secretary Daley Announces West Coast Groundfish Fishery Failure." United States Department of Commerce News, no. 377, 2000, pp. 2-3.

## Acknowledgements

Thanks to all of the WCGOP observers that have worked tirelessly to collect data over the last fifteen years. Thanks to Jim Benante, Phillip Bizzell, Vanessa Fleming, Jon McVeigh, Neil Riley, and Ryan Shama for their assistance and guidance in putting this poster together.

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## **Implementation of a Discards and Bycatch research program in Chile.**

**San Martín M., C. Román, J.C. Saavedra**

**Instituto De Fomento Pesquero, Chile**

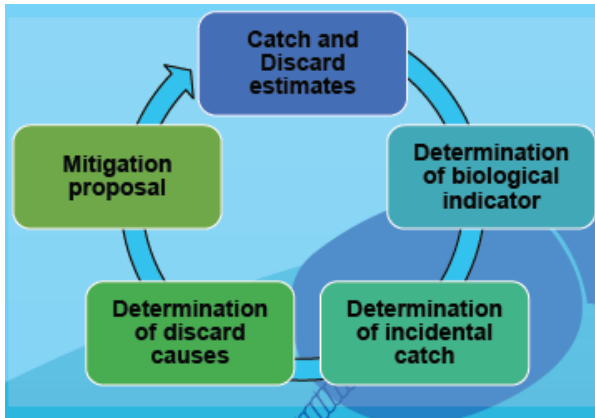
Discards represent a common issue for fisheries sustainability around the world (Alverson et al., 1994), and their negative effects in marine ecosystems must be acknowledged. A recent review of discards in the world's marine fisheries have estimated that around 7.3 million tonnes per year were discarded globally for the period 1991-2001 (Kelleher, 2005). However the information used to estimate discards in different fisheries, largely has a great uncertainty. In general, it has been seen that fishing gears like demersal trawl nets, catches different species including target and non-target (bycatch) as well as specimens of sizes or qualities not desired. These unwanted specimens are often discarded producing unknown mortalities (Nikolic et al., 2015). The insufficient data on discard rates can lead to biased estimates of fishing effort and mortality, causing inaccurate estimates of stock status and ecosystem.

The discard term was first introduced in Chilean Legislation with the Fisheries Law amendment of 2001. Although strong sanctions were established, the insufficient control and lack of cooperation of fishermen, provoked that discards practice continued as normal. In recognition of these issues, the revision of the Fisheries Law during 2012, modified some legal aspect about this topic, and established control rules and sanctions. In addition, this amendment considered the development of research programs through fisheries observers on board in order to quantify and identify the causes of discards, to later develop and implement a mitigation plan. These research programs, of a minimum 2-year, were first developed in the main bottom trawl fisheries in Chile and then extended to pelagic fisheries along the country.

In this work, we show the background and development of Discard and Bycatch Research Programs in Chile carried out by Institute for Fisheries Development (Instituto de Fomento Pesquero, IFOP), in addition to methodological aspects, where the role of fisheries observer work on board is essential.

### **Objectives of the Discards and Bycatch Research Programs**

The Discards and Bycatch Research Programs are focused in five main objectives which aims are presented in **Figure 1**.



**Figure 1.** Objectives of Discard and Bycatch Research Programs.

## Methodology

### Implementation

The Research Programs developed in demersal fisheries considered eleven fisheries, both industrial and artisanal, distributed between 26°00' and 57°00' S (**Figure 2**).



**Figure 2.** Demersal fisheries monitored by Discard and Bycatch Research Programs.

The Discard and Bycatch Research Programs was implemented as an observational study, where the data survey was a critical stage. Thus, **at a first step**, the implementation of this program required the collaboration of all stakeholders, especially the fishermen and fishing companies. To achieve this, meetings were held at the beginning of the implementation which contributed to raise awareness about the main aspects of the discard law and the research program, in addition to inductee continued support from stakeholders.



The **second step** was oriented to develop, test and validate the methodologies used for data collection, learn the fishing operation and identify workplaces where sampling could be possible for fisheries observers in each fisheries. This step enables a defined **sampling designed**.

### Sampling design

Generally, the sampling design considered the estimator for each indicator proposed in this study (total catch, discarded catch, biological indicators, inter alia), and the mean and variance for these estimators. In addition, causes of discard were assessed. Sampling was based on stratified cluster sampling divided into two stages (trip and hauls). Temporal and spatial stratification were also considered. The sampling units were selected either randomly or through systematic selection frame with a random start.

The **third step** was oriented to data collection and information analysis. The data collection arise from two sources; fisheries observers onboard and self-report logbook filled by fishermen.

### **Expected Results**

The expected results include, an assessment of discard levels and total catch, species composition of discards, biological condition of discards, and spatial and temporal variations of these variables. Also assessments of incidental of seabirds, marine mammals and reptiles. On the other hand, identification of the causes of the discards and incidental catches is another primary objective to develop mitigation measures.

At present the program has been completed in two demersal industrial fisheries; crustacean (Shrimp, red squab lobster and yellow squab lobster) and Chilean hake. In both fleets rates of discards and the underlying causes were determined, allowing the establishment of the first proposals of mitigation measures. Now, a mitigation plans shall be developed by the Undersecretary for Fisheries

The results in these fisheries showed a progressive reduction of discards along the studied period. The main causes of discards for target species were legal and administrative problems, while non target species are discarded principally by economic reasons (no current economic value).

Despite the presence of bycatch, it is required a great sampling efforts to determine more accurately the real impact for these fisheries.

Results for other fisheries are expected once they have completed at least two years of effective monitoring, hoping to complete the whole study during 2017-2018. This information will allow the development and implementation of mitigation plans for each one of them.

### **Discussion**

The discards and bycatch monitoring are generally complexed and difficult to implement. The main difficult are associated principally to the lack of cooperation of fishermen, and the absence of adequate regulation frames and management measures.

Chilean fisheries were not the exception, however the Chilean Government, aware of the problem, modified the Chilean Fisheries Law, setting clear rules about the discards and bycatch and additionally incorporated the implemented of a research monitoring program.

The discards and bycatch research monitoring program, carried out by IFOP, has been a great challenge. However, and thanks to the work of the fisheries observer and collaboration of the fishermen and fisheries companies, it has been possible the development of adequate and standardized program.

The information generated by the research program will allow the implementation of efficient mitigation measures, discussed jointly by all stakeholders and accompanied by a permanent monitoring by fisheries observer aboard.

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## **Abstracts of presentations that did not provide Extended Abstracts**

### **OBSERVERS - THE FACE OF FISHERIES MANAGEMENT**

**David Schubert**

#### **Australian Fisheries Management Authority, ACT, Australia**

The Australian Fisheries Management Authority (AFMA) has long running internal observer program tasked to independently monitor commercial fishing operations in Australia. Observers are commonly referred to as the face of AFMA and are recognised as a conduit between fisheries management and the fishing industry. This gives observers unique insight into the mindset of industry and an understanding of the most effective ways for management to deliver important information.

To utilise this valuable knowledge a project was developed to use a visual multimedia package to educate fishers to the role of compliance officers and what to expect in the event of an inspection. This communication strategy relied on clear and concise language paired with an easily related visual demonstration of a routine compliance inspection. Although the dissemination of the video is still in early stages initial responses indicate industry is appreciative of the approach and find it very beneficial.

Visual multimedia has been identified for use in a range of applications including an observer training tool for observers and an effective way to convey changes to fishing regulations. The success of the project has paved the way for observers to be involved in future, similar communication strategies. The project has also highlighted the unique and varied skill set that observers have to offer fisheries management as well as the importance of retaining face-to-face interaction with industry.

## **40 Years of Observer Data in the At-Sea Hake Fishery**

**Vanessa Tuttle**

**NOAA Fisheries, WA, United States**

An analysis of all things "40" reveals the long, rich history of observer data in the at-sea Pacific hake fishery off the U.S. West Coast. From 1975-2014, data collected by the At-Sea Hake Observer Program (A-SHOP) has served for the successful management of a MSC-certified, sustainably managed fishery. To celebrate this long history, and focus on the number 40, a list of impressive statistics about the program has been compiled. The A-SHOP has changed greatly over the last 4 decades, but the core responsibilities of determining total catch, collecting species composition samples, and biological data on protected species has never wavered.

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## **Six Basic Questions for Building an Observer Program**

**Stuart Arceneaux**

**NOAA/NMFS, HI, United States**

Six Basic Questions: Developing a solid foundation for a fishery observer program.

Developing and implementing an at-sea fishery observer program can be confusing. This short presentation will address six (6) basic or foundational questions that should be answered by emerging programs, or those in development. There are no "right answers" to the questions. It is hoped that by developing the answers to these questions, programs can avoid many pitfalls to have impacted other observer programs.

Each answer will have its pros and cons. It is up to individual programs to determine their best solution.

The list is not intended to be restrictive. As things progress, additional questions will very likely arise.

## **Session 2. How do we train and prepare observers, provide opportunities for professional growth and reward performance?**

**Leader: Amy Martins**

In this session, we explored proven methods to train, inspire, support and invest in a strong and committed work force for observer and monitoring programs. We examined where, and how, you find and keep good observers, and the benefits for doing so. We also heard about new ways to drive high performance, a strong work ethic, effective communication and reliability throughout the observer community.

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### **Oral Presentations - Extended Abstracts**

#### **Preparing for Life on the High Seas...In a classroom**

**Benjamin Duffin**

##### **Southeast Shrimp and Reef Fish Observer Program**

For many aspiring biologists, fisheries observing is an irreplaceable boon providing an opportunity to learn about a new job and create life experiences not common elsewhere. But some of these experiences can be a real shock to the uninitiated. Entering a career that may require long deployments offshore in a confined and hazardous setting can take a large amount of acclimation. To confound things further, many observer trainees have limited or no prior marine safety training, are faced with learning new sampling protocols, and may not be familiar with identification of species found in diverse fisheries. To best prepare observers for life in the field, the Galveston Observer Program employs an intensive course that keys in on instruction, simulation, and testing.

The first week of our training is entirely devoted to safety, starting with the introduction to the seven steps to survival that are emphasized continually. Each subject is presented in a way that will prompt a group activity or mock emergency that must be handled. Take for instance flare training: general safety and use will be covered in the classroom initially. Then, using dummy flares, observers will have a chance to showcase the proper maneuvers to deploy a flare safely. Any errors can then be corrected in a controlled environment. After each trainee has shown proper handling skills, they have a chance to deploy a live flare under supervision of coordinating staff and local Coast Guard guidance.

Similar exercises are completed for all required safety skills. Once protocols have been established for reacting to fire, flooding, man overboard, and abandon ship emergencies; this week culminates in drills run on a shrimp fishing vessel followed by a comprehensive test. Safety training is paramount, and as such all trainees must pass with a minimum score in order to proceed in training.

After completing safety training, observer protocol training begins. Covering multiple fisheries translates to learning five distinct sampling protocols, and there is a huge amount of material that must be digested within a three week training period. After the forms and technical aspects of a particular fishery are covered, group simulations are used to exhibit the real-life application. Observer candidates are required to properly record fishing effort that is simulated by instructors. Artificial catch is used so everyone has a chance to sort, weigh, measure, and record data just as they would in the field. Real fishing gear is used so that you can show just how exactly to measure the leading edge or flap overlap on a turtle excluder device. These simulations are followed by several paper and pencil “trips” and a practical exam that once again must be passed in order successfully complete training. This cycle of introduction, in class activities and simulations and finally testing is carried out for each protocol in series.

In Galveston, there is a unique opportunity to carry out interactive protect species training. We are able to work with a sea turtle rearing facility so students have a chances to practice several skills. Not only are they taught proper sea turtle handling techniques and identification, but also instructed on proper hook removal and tissue sample collections. This has been a huge boon, as it can be nerve racking the first time an observer collects crucial protected species data in the field.

Another hurdle that must be jumped is the intensive species identification portion of the program, wherein trainees are exposed to hundreds of frozen specimens. During the last two weeks of training, time is put aside each day to cover species identification. Initially, families of fish and their common constituents in our area are introduced. Distinctive characteristics are pointed out and keys are walked through. As training progresses, more and more fresh frozen specimens are prepared for observers to identify on their own, culminating in a final hands on test where observers must identify thirty to forty fish and invertebrates to the species level.

Given the small amount of time available to train observers, hands on learning and running simulations followed by knowledge tests has proven to produce field ready observers.

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## **How the Pacific Community trains and prepares observers, providing opportunities for professional growth**

### **Siosifa Fukofuka**

#### **The Pacific Community**

The Pacific Community is the principal scientific and technical organisation in the Pacific region, supporting development since 1947. It is an international development organisation owned and governed by its 26 country and territory members. The Oceanic Fisheries Programme (OFP) is part of the Fisheries, Aquaculture and Marine Ecosystems (FAME) division of SPC, and is a regional centre for tuna fisheries research, fishery monitoring, stock assessment and data management.

The Pacific Community (SPC) and the Pacific Islands Forum Fisheries Agency (FFA) are the two regional bodies responsible for overseeing and providing technical assistance and training opportunities in the Pacific region.

Fisheries observers are the eyes and ears of fisheries science and management. They are responsible for observing, recording, and reporting on the fishing situation in Pacific Island Exclusive Economic Zones (EEZs). This fishery-independent data is imperative, as it serves as the baseline for key policy- and decision-makers.

### **History of the Pacific Islands Regional Fisheries Observer (PIRFO) certification and training**

Dating back to 20 years ago, a handful of fisheries observers attended one or two training courses conducted each year by SPC and the FFA.

It all started in 1995, when the FFA, under the Pacific Islands-US Treaty (US Treaty), employed an Observer Manager who had trained observers from Pacific Island countries. SPC had employed a Coordinator and four scientific observers to conduct observer trips in the Pacific Island waters. These four observers were deployed at sea with the primary objective of collecting baseline observer data. Simultaneously, national programmes were established to train and recruit new observers.

The Pacific Islands Regional Fisheries Observer (PIRFO) Certification and Training Standards were endorsed by the Pacific Island states during the 2008 FFA Forum Fisheries Committee 68. PIRFO uses competency-based training and assessment methods, universally recognised as the best method for vocational training. It was noted at the time that observers working on tuna vessels in Pacific Island waters had to be PIRFO-certified.

The Western and Central Pacific Fisheries Commission (WCPFC) Conservation and Management Measures (CMMs) relevant to observer duties require 100 per cent observer coverage on all tuna purse seiners, 5 per cent observer coverage for tuna longliners, and 100 per cent high seas transshipment; based on these requirements, more observers are needed to meet the demand.

### **Stages and levels of PIRFO certification**

The certification and training of PIRFO observers, debriefers and trainers is guided by the *PIRFO Certification and Training Policy Manual*. The PIRFO Certification Management Committee (CMC) is tasked with developing training programs, formal certification procedures, and effective quality assurance processes with regard to the competencies and specific tasks of regional fisheries observers.

The typical track in this field is to start as an observer, and over the years acquire the skill set and gain experience from sea days, to become eligible to be trained as observer debriefers and later observer trainers. The processes for acquiring different levels of training and certification are described below.

#### *Observers*

Observer trainings consist of two-to-four weeks of generic training (sea safety, firefighting, basic first aid, radio communication and occupational health and safety training) delivered by the Maritime College in the host country. The second part of the observer training

comprises observer specialist training, which covers fishing gear and operations, species identification, report and journal writing, monitoring and compliance issues, sampling protocols and operations, observer forms, and accurate data recording.

### *Debriefers & assessors*

There are two levels of debriefer certification: debriefers and debriefer assessors. The prerequisites for taking part in the debriefing trainings include PIRFO experience, excellent communication skills, national programme support, references, and a set number of logged sea days.

Becoming a certified PIRFO debriefer is a three-part process: Part A comprises a two-week introductory workshop; Part B involves on-the-job training; and Part C is the final workshop. The time it takes to complete all three stages depends on the availability of certified debriefers, and the availability of observers with data to complete the tasks in the required activity book and other resources.

To advance to debriefer assessor requires full certification as a PIRFO debriefer; the latter requires completing at least five full debriefings, and attending the debriefer assessment training. The role of the debriefer assessor is to carry out the required assessments before signing off on the debriefer assessment record book (DAR), attesting to the debriefer's competency.

### *Trainers*

A prerequisite of becoming a PIRFO trainer is certification as a PIRFO debriefer, which encompasses experience, teaching aptitude, national programme support and references.

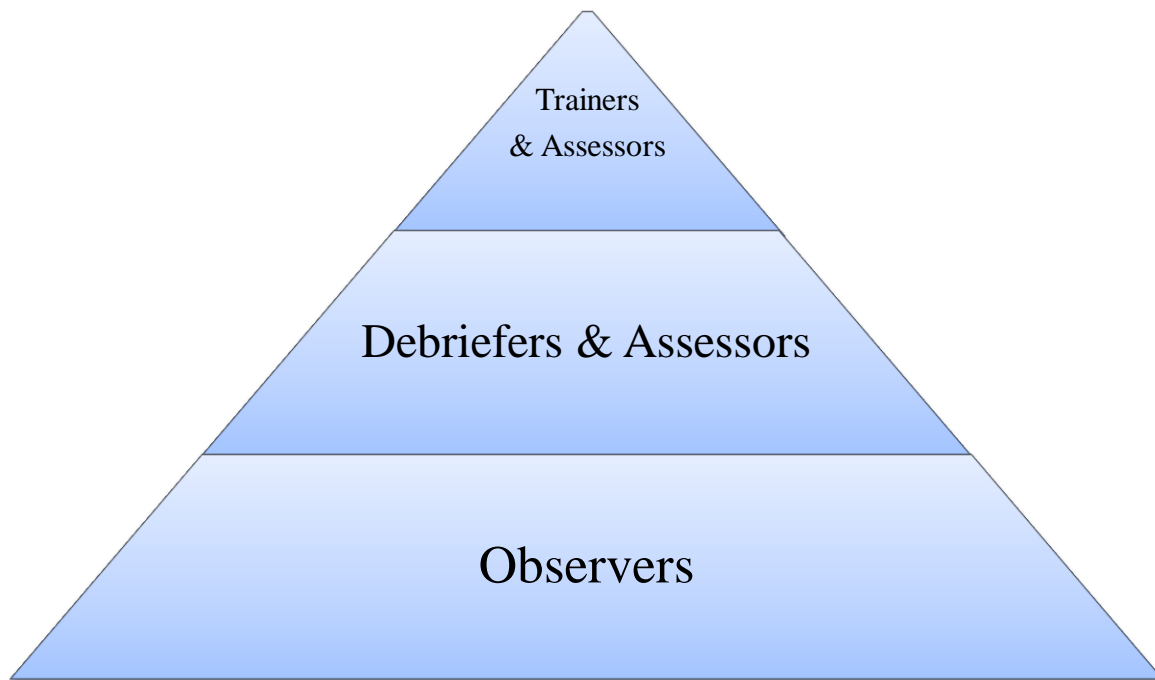
The training entails an on-the-job attachment, and the completion of a minimum of six attachments coinciding with the observer courses. A level IV certification in the 'Train the Trainer' course is also required at the end of the attachments.

In order to become certified as a trainer and assessor, the individual must complete training and a supervised assessment, and achieve a level IV certificate in training and assessment.

### **Looking ahead: PIRFO's growth and impact potential in the Pacific**

The endorsement of PIRFO training and certification in 2008, and the development of observer training over the years, have created opportunities for further growth across the Pacific Islands. As a result of developments in the field and capacity building efforts at the national level since 2008 and at present, there are now around 815 observers, 105 debriefers and 14 trainers from 15 national observer programmes across the region.

PIRFO has become required training and certification for an observer career path, which opens up employment opportunities for young men and women throughout the Pacific. Experienced observers are now also moving into roles, such as office observers for electronic monitoring data review.



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## **Resolve This! Skills to Train Observers in Conflict Negotiation**

**Christa Colway**

**NOAA Fisheries, NWFSC**

Conflict is unavoidable; this is particularly the case for fisheries observers who face constantly changing work environments and situations. The National Observer Program has provided a broad standard for training observers which includes identifying the dominant personality types and the conflict resolution techniques that work best with each. However, there are no standardized, uniform conflict resolution techniques or training materials. Fisheries observers face difficulties at sea beyond those typically covered in training materials for workers in an office setting. They work independently on other people's vessels, often in tight quarters for days, weeks, or months at a time. Knowledge of personality types and communication styles are useful to help prevent conflicts, but may offer little help to the observers finding themselves offshore and alone in a confrontation.

Observers need specific conflict management skills that they can draw on to quickly de-escalate a tense situation, take control of the conversation, and lead to a successful negotiation. I've combed through a sea of materials and will share in this presentation the skills I've found in my search which may be the most useful.

We approach safety training as providing information and checklists to help increase awareness, and hopefully the safety of the individual, but we also teach them how to use tools (e.g., survival suits, EPIRBs, life rafts) in case an emergency occurs. Conflict resolution can be approached in the same manner. Knowing your personality type, and recognizing those of other's is useful to keep a misunderstanding from escalating. It's also important to



understand how your audience may interpret your communication technique. However, neither of those things are skills that will help you end a conflict. And conflict is unavoidable because human beings interpret the world around them differently and have emotions. Add to the mix varying degrees of emotional intelligence, maturity, and communication skills and you have the elements for a conflict. This audience also knows that the environment in which observers work is uniquely challenging. It's isolating, stressful, and can be intense.

Because the challenges are so specific for observers, I recommend they receive training that gives them skills to handle a conflict as it occurs and to negotiate their way out of it. Conflicts should be addressed as a response, not a reaction. A natural reaction to a conflict is rarely a constructive one. The goal should be to *respond*, which is a diplomatic, deliberate skill. But this can be hard to do when feeling an emotional response; it takes skill to control your stress.

People react differently under stress. It's common to feel the effects of the flight or fight reaction; pulse and blood pressure increase, muscles tense, vascular constriction occurs, and as it escalates it clouds our thinking. Therefore, it's critical to recognize these reactions in yourself and know how to deflect them. A quick stress relief technique involves using one of your senses to remind yourself of being in a relaxed state. Call on one, or a combination of your senses, to remind you of when you were relaxed and happy. The sense you call on such as a picture that relaxes you, music, the taste of your favorite dessert, the smell of a campfire, the feel of your pet's fur, or deep breathing, act as a trigger to calm yourself down and center you. If practiced regularly, such as when in traffic, the faster and easier it becomes to control your physiological response using this mental technique. Being able to calm your stress reaction will allow you to *respond* to the conflict.

People generally don't say what they mean in a conflict. What they claim to be angry about may only be a symptom of something much larger. Dr. George Thompson, author of, *Verbal Judo* describes an angry person as being "under the influence" and uses the image of a box. The corners of the box represent the underlying influences of the emotional reaction; such as fatigue, drugs, ego, or financial pressure. As a listener, you're trying to find out what these issues are, which is complicated because people don't say what they mean. This is why paraphrasing is a powerful skill to master.

Paraphrasing is an excellent skill that serves multiple roles. Saying, "You feel (\_\_\_\_) because of (\_\_\_\_), correct?" makes the other person become a listener because they are hearing how you have heard their words. This creates a natural break in the tension. Wanting to be heard and understood is universal and we feel frustrated when we aren't. Paraphrasing is the attempt by the listener to reach this level of understanding. People don't mean what they say when they are upset, so it's unlikely that the first time you paraphrase you will be correct. You can paraphrase back as many times as you need to. This also accomplishes another critical element; it separates the person from the problem. Approaching a conflict as "us versus the problem" instead of "me versus you" will maintain the relationship between the people involved. Maintaining that relationship, and enhancing it by resolving a conflict together, will reward the observer a million times over not only on that vessel but within the industry.

Paraphrasing back also creates empathy, which is essential for negotiating conflict. Empathy towards another is respectful and shows that you are trying to work on the problem by

understanding it. Empathy does not mean agreement; it simply shows understanding. We're much more likely to work with someone who has empathized with our position. Without empathy, conflicts can continue to escalate and be very repetitive as the same feelings are repeatedly expressed.

Remaining calm and paraphrasing back will usually resolve the problem at this point because misunderstanding causes most conflicts. However, there are times a furious person may confront you. Perhaps they are even throwing insults. This situation requires a different skill to keep things from escalating. In *Verbal Judo*, Dr. Thompson describes a technique he developed, called "Deflect and Redirect." If someone is hurling insults at you, they have lost control and are trying to push you to be in the same place. You can throw them off by agreeing with them.

We're wired to listen for points to argue against, but if you agree with someone it gives you an opportunity to change the conversation. Deflector phrases acknowledge the insult, such as "I appreciate that" or "I understand that". The deflector is followed up by a conjunction such as 'but' or 'and.' However, I recommend using 'and' as it's an agreement term rather than a contentious word. After the conjunction comes redirection of the conversation to where you want it to go, such as towards troubleshooting for solutions.

We're human. We have emotions and can be under the influence of something that hinders our ability to handle conflict constructively. I've presented several skills that I feel are trainable to help observers negotiate their way out of a conflict. Remaining calm so the conflict can be responded to, rather than reacted to, is the first step. Then paraphrasing can be used to determine what the issues are. If there are influences like exhaustion, hunger, stress, drugs, ego they will start to be chipped away by using paraphrasing. Hearing our words spoken back to us helps us see them from a different perspective. Sometimes, that's not enough. In those rare situations where things have escalated deflect and redirect can be employed. Ultimately, we are trying to help the upset party think the way they would in 24 hours when they have calmed down.

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## **Establishing Reliable And Well Trained Former Longliners To Increase Survival Rate of *Chelonia Mydas*, *Lepidochelys olivacea*, *Eretmochelys imbricata*, *Dermochelys coriacea*, *Natator depressus*, and *Caretta caretta* In Indian and Pacific Oceans**

**Wahyu Teguh Prawira**

**WWF-Indonesia**

### **Abstract:**

The issue of Endangered, Threatened, and Protected (ETP) marine animals (Sea Turtles, Sharks, Marine Mammals, and Sea Birds) bycatch in fishing activities becomes a significant global concern. The presence of on-board observers as mandated by Food and Agriculture Organization (FAO) of the United Nations and Indonesian government is considerably needed, aside from the efforts to change the fallacious image of the observers among the

observed parties, primarily to cooperatively solve bycatch issues. There were at least 17.61% ETP marine animals; sea turtles and sharks, during 2006 – 2014 which were unintentionally in tuna fisheries activities and later as a result of improper post-caught treatment. Creating qualified and well-trained observers genuinely aims to reduce the mortality rate of the animals and improve the quality of the tuna longline fisheries data. To attain a qualified observer, the candidate must be reliable and certified. In its practice, some approaching strategies is principally needed to engage the candidate especially who has graduated from marine and fisheries vocational school or those who has a background in operating longline vessel such as captain and deck crew. Selected candidate will participate in a week training to build their capacity in collecting data and treating bycaught animals on longline vessels which are based in Benoa Harbour.

During 2006-2014, there were at least 61 observers who was placed in 75 longline vessels from three major fishing port in Indonesia; Benoa, Bitung, and Muara Baru joined 218 fishing trips with total 5717 *setting* number. The efforts of treating sea turtle by catch which is done by the on-board observers by using steps as directed in the Better Management Practices for sea turtle handling, has been proven to improve life release of sea turtles until 96.57%.

**Keyword:** *Bycatch, Observer, Tuna Longline, Survival Rate*

## INTRODUCTION

The issue of Endangered, Threatened, and Protected (ETP) marine animals (Sea Turtles, Sharks, Marine Mammals, and Sea Birds) bycatch in fishing activities becomes a significant global concern. The presence of on-board observers as mandated by Food and Agriculture Organization (FAO) of the United Nations and Indonesian government is considerably needed, aside from the efforts to change the fallacious image of the observers among the observed parties, primarily to cooperatively solve bycatch issues. In Indonesia, there are 1600 number of longline vessel with 3 major of tuna port located in Benoa, Bitung, and Muara Baru (Musthofa Zainudin, Imam 2014). These port are biggest tuna landing in Indonesia. The major of main target catch in there are Yellow Fin Tuna, Big Eye Tuna, Albacore Tuna, and also Blue Fin Tuna. The fishing ground of longline vessel which base on these port are around Pacific and Hindia Ocean. Usually, they spent 3-7 months for each fishing trips. The problem is, fishing ground of tuna longline in Indonesia was overlay with migration and feeding ground of sea turtle. Both in Pacific and Hindia ocean, there are olive ridley (*Lepidochelys olivacea*), green turtle (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*), leather-back (*Dermochelys coriacea*), logger head (*Natator depressus*), and flat-back (*Caretta caretta*) estimated caught 4920-4980 every year (Wiadnyana et al. 2006). There were also at least 17.61% ETP marine animals; sea turtles and sharks, during 2006 – 2014 which were unintentionally in tuna fisheries activities and later as a result of improper post-caught treatment (WW-Indonesia, 2014). In the present of bycatch handling by onboard observer, we prepare and train onboard observers as well to increase survival rate (life release) of ETP species bycatch.

## METHODS

Creating qualified and well-trained observers genuinely aims to reduce the mortality rate of the animals and improve the quality of the tuna longline fisheries data. To attain a qualified

observer, the candidate must be reliable and certified. In its practice, some approaching strategies is principally needed to engage the candidate especially who has graduated from marine and fisheries vocational school or those who has a background in operating longline vessel such as captain and deck crew. Selected candidate will participate in a week training to build their capacity in collecting data and treating bycaught animals on longline vessels which are based in Benoa Harbour.



Fig. 1. (A) Onboard training before trip. (B) Class training about sea turtle bycatch handling in Turtle Conservation and Education Center (TCEC)

Using former longliner and or graduated from marine and fisheries vocational school is much better than the other to be an onboard observer. The most important thing is, they can survive over sea for a long time with very good bycatch handling even the weather is bad. And in this study, the methods for data Collecting is directly doing by Onboard Observer in Longline tuna in 3 Major Tuna Port in Indonesia ; Benoa, Bitung, and Muara Baru.

## RESULTS

### OBSERVER TRAINING

Before the onboard observer will be deployed, they have to get some trainings about how to collecting the data and bycatch handling on board. Usually, there are 2-3 observers get training for each season (recruitment). We were hiring observer 6-11 months and if the data result is good, the contract period will be extended continuously. First day of training, we give understanding about the main responsibility of observer, how to approach to the fishermen, and how to be survive at the sea. Mostly, they have good experience as a vessel crew or cadet, but they don't understand how to be an observer its also good for another crew. At the second day, the onboard observers get the theory of bycatch handling, especially sea turtle and sharks. We give theory about biology and morfology of sea turtle, sharks, and the other species. This session will be take 2-3 days training. After they get the theory, each observers must be try (practice) how to handling sea turtle. Start from what should they do since they know they caught sea turtle, how to pick to the board up, and how to handling if the bycatch is unconscious. All these practice still in the class. When

observers already understand all of the class training, we bring them to the Turtle Education Center (TEEC) for more detail about sea turtle identification. They can learn everything detail about sea turtle over there. After that, they still have to field trip (onboard training) at the longline vessel which base on Bena. Before continue to the next training (photograph), the most important training is about data management and analyse. Usually we inviting resource person from the other NGO's and or MMAF to get data management and analyse training. And the last day training, we give them the theory of photography, so they are not only good for data collecting and handling sea turtle bycatch, but also have good capacity in documentary using camera.

### **DEPLOYING OBSERVER AND THE CHALLENGING**

The next thing to do after observer training is deploying onboard observers at the longline vessel from 3 major of tuna port. We put at least 1-2 observers in each port. But, there is big problem in Indonesia to deploying observer. . During 2006-2011, we could deploying observers easily in each port. But, by mid of 2012 until 2014 due to some regulations about transshipment and delimitation of ex. foreign vessel, the condition going to be bad. Most of tuna longline companies are disagree and give resistance to put observer on their vessel. Very difficult to put observers anywhere. That's all the government regulation impacts. For us, to solve that problem, we were doing approachment to the senior longline crew or captain (we called as champion) to get opportunity in deploying observer. These champion, will be coordinate the observer after training until onboard. Sometimes, we use captain or bossman (crew work leader) to collect the data and monitor what happen on the vessel. That's all because of the resistance from the companies for deploying observers. So, the best solution tha we were done right now is train the captain and or bossman, or maybe chief engineer to be onboard observer.

### **ON THE VESSEL**

Nowadays, there are very far longline fishing ground in Indonesia. For each trip, will be take on minimum 3 days and maximum 14 days to go to longline fishing ground. In Bitung, each trip is about 3 months, Bena is about 3-8 months, and Muara Baru is about 8-12 months. When they have arrived at the fishing ground, they usually dircetly start from 1<sup>st</sup> setting. If there is dark time (no moon), usually they sets the line using life bait (milk fish). And when there is full moon, the use dead fish we called "layang" (*decapterus sp.*) for the bait. The moon face condition is also impactful to the sea turtle bycatch.

<b>Hindia Ocean</b>	<b>No. of Hook</b>	<b>Hook rate</b>	<b>Hook rater/ 1000</b>	<b>No. of Setting</b>	<b>No. of Vessel</b>	<b>No. Individu</b>
Leather-back	1,184.62	0.0913	0.0770	8	6	8
Olive ridley	2,128.82	0.0747	0.0351	78	28	82

Green turtle	1,484.67	0.0883	0.0595	6	3	6
Hawksbill	1,498.50	0.0677	0.0452	2	2	2
Logger head	1,439.23	0.0766	0.0532	7	2	7
Flat-back	1,213.11	0.0942	0.0776	7	3	7

Table 1. Sea Turtle Hook Rate in Hindia Ocean

<b>Pacific ocean</b>	<b>No. of Hook</b>	<b>Hook rate</b>	<b>Hook rater/ 1000</b>	<b>No. of Setting</b>	<b>No. of Vessel</b>	<b>No. Individu</b>
Leather-back	1,309.23	0.0825	0.0630	7	6	7
Olive ridley	2,176.06	0.0702	0.0322	317	24	469
Green turtle	1,544.79	0.0877	0.0567	33	8	43
Hawksbill	1,535.70	0.0695	0.0453	2	7	3
Logger head	1,480.53	0.0761	0.0514	23	10	26
Flat-back	1,360.05	0.0849	0.0625	15	5	17

Table 2. Sea Turtle Hook Rate in Pacific Ocean

Because of the fishing ground is also overlay with the migration and feeding ground for sea turtle, in every trip, at least 1 sea turtle caught as bycatch. It's only the data from vessel which observer onboard there, so the another vessels are definitely caught sea turtle bycatch.

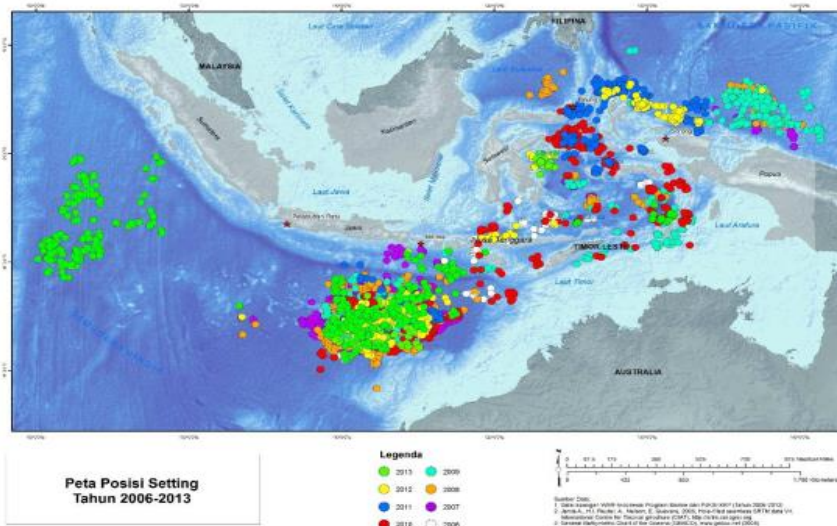


Fig. 2. Setting and Hauling location 2006-2013

### SEA TURTLE CATCH COMPOTITION

During 2006-2014, there were at least 61 observers who was placed in 75 longline vessels from three major fishing port in Indonesia; Bena, Bitung, and Muara Baru joined 218 fishing trips with total 5717 *setting* number.

Well trained onboard observers in sea turtle bycatch handling as long as fiishing trip in 3 major tuna port identificated as 14,29% sea turtle catch in unconcious condition, 68,11% in life condition, and 17,61% in dead condition before take to the onboard. The efforts of treating sea turtle by catch which is done by the on-board observers by using steps as directed in the Better Management Practices for sea turtle handling, has been proven to improve life release of sea turtles until 96.57%.

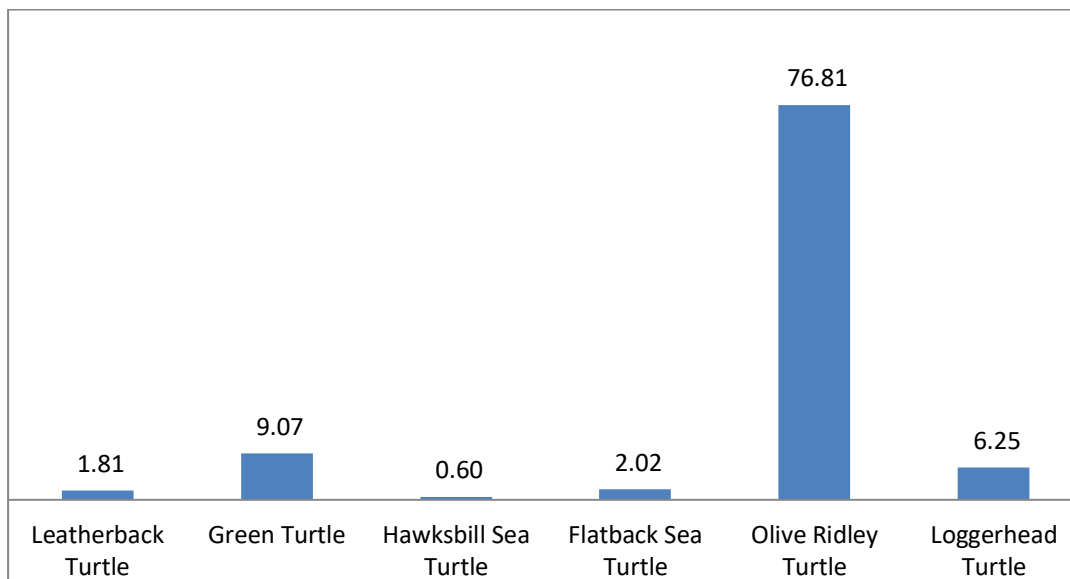


Fig. 2. Handling Success (%) for Sea Turtle 2006-2014

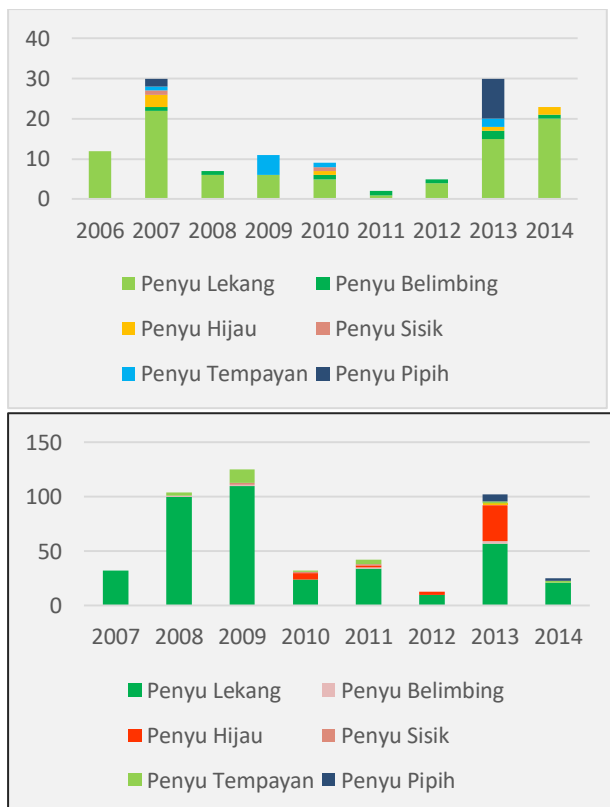


Fig. 3. (A) Sea Turtle catch in Hindia Ocean 2006-2014. (B) Sea Turtle catch in Pacific Ocean 2006-2014

Sea turtle bycatch in both of Hindia and Pacific ocean is dominated by olive ridley. The highest number of olive ridley bycatch is on 2007 and 2013. Generally, 53,26% sea turtle bycatch is male, 42,53% is female, and 4,21% unidentified.

The lesson learn of this study is, Onboard observer can increasing the survival rate and life release of ETP bycatch, especially sea turtle. And the big problem in Indonesia are very difficult to deploying observer and get the good data management from observer its self. In the future, we hopefully could join to observer training involving people who works for onboard observer program around the world.

*Acknowledgements.* Thank the following field asistants who participated in data collection ; Dwi Ariyogagautama, Soehartoyo, Samsul Anwar, Deny Arwan, and La Ode Sidiq. We also thank to the fishermen and their families at Denpasar (Bali), Jakarta, Bitung, for their support on every fishing trips. This study and work was supported by WWF-Indonesia, Minister of Marine Affairs and Fisheries, National Marine Fisheries Service of the National Oceanic and Atmospheric Administration, and the Fisheries University of Jakarta.

## From Decksheets to Spreadsheets: Integrating Observers Beyond Data Collection

Lindsey Nelson



## North Pacific Observer

Observers are highly trained college graduates who possess an array of qualities such as creativity, adaptability, physical stamina, and diligence. Their role as data collectors is the foundation for fisheries management decisions that have economic, biological, and political consequences. Yet despite the rewards of the job, it is not a lifetime career. For most it's a stepping stone or a springboard. A few observers choose to work for a period of time before returning to school to pursue a Master's or PH.D. The rest, who have no interest in academia or debt, are struggling to move forward and land a biologist position. Mainly because they're considered "Biological Technicians" and not "Biologists." In order for observers to take pride in their work and exhibit their best, it is important for the observer programs and fisheries agencies they participate in help bridge the gap between these two concepts. This presentation explores: How agencies can provide opportunities for observer inclusion; tips to build resume and CV; and increasing awareness of observer presence on vessels.

### Integration and Utilization

Observer data collection is the foundation for the rest of the work performed at our fisheries agencies. It influences population structure, ecosystem management, endangered species, and management implementation. And for all of the responsibility and the number of times they have proven themselves, they don't necessarily get the recognition or opportunity for further involvement. Our agencies should reward high observer performance though **integration in a number of projects**, including but not limited to: data analysis and manipulation, report writing and publication, grant proposal writing, presentations of preliminary findings, and examining specimens returned to the lab. Because job listings often require either specialized experience or a higher degree in addition to the minimum required 4-year degree, participation will provide an edge when competing against applicants with an M.S. The agencies and departments also benefit by including fresh minds and being able to hand duties off to an assistant to focus on other tasks.

Implementation of new ideas isn't without challenges. In this case, and for both parties, time and money are difficult to sort out. Observers would rather spend their free time at home, travelling, or pursuing other seasonal work instead of being stuck in the office. The agency might be working under strict deadlines or might have work that requires a longer commitment than an observer is willing to agree to. In addition, our agencies might not have money to bring on extra workers, and many observers are past their volunteering days.

### Drab to Fab; Resume and CV Building

First impressions count, right? Potential employers will be reading through numerous resumes and CVs to quickly weed out the less qualified candidates. Below are some tips for current and former observers to use to boost the attractiveness of their qualifications.

**Quantify:** Add numbers wherever possible. They are definitive and they stand out strongly against the sea of words. Examples for places to include numbers include: Length of observing career (sea days, contracts, years), number of vessels assigned, number of

difference fisheries involved in, number of companies, number of observer programs, and species encountered or verified.

**Field Specifics:** Any duties that you have performed or have learned to do regarding observing or biology should be listed out. This can include: Random sampling design and implementation, specimen collection, enforcement duties, safety training, gear types, fishery types, and locations.

**Practical Skills:** These are skills or experience you gained while observing but aren't necessarily biology or fisheries related. Do not underestimate this! They can be applied to any job anywhere, and show you're more than a one-trick biology-pony. Some examples are: knowledge of power tools, communication and language skills, conflict resolution, teamwork and leadership and independence, exposure to the elements, working in factories, safety awareness, vehicle and boat licenses, time management, documentation, and organization.

Remember to be concise when creating your CV and don't feel obligated to cram everything on the pages if it won't fit. Carefully read the job announcement and list the most relevant information that they are looking for. If a letter of interest is required, use that space to expand and describe your qualification and experiences.

### Unknown to Renown

In order for observers to move forward in their careers, it is imperative that our fisheries agencies state and restate who we are, what we do, and why we do it. But understand, this idea is not meant to conflict with confidentiality agreements, which are designed to protect our identity and ensure safety. There are a number of ways to accomplish this. First, **printed materials** such as trifold pamphlets, seafood safety cards, public notices, newsletters, fliers, and books are easy to design, print, and distribute without much effort. They can include information regarding observed fisheries, federally mandated observers, or descriptions of duties along with other data. Second, though **online** resources exist, it takes a high level of familiarity of the field in order to navigate there without typing "observer" into the search bar. Websites are dynamic engaging, so why isn't this the case for federal web pages?

Educating the public through **personal communications** might reach fewer people but will have a resonating effect. Whenever an agency sends representatives to public events such as job fairs, science and seafood festivals, or Earth Day, where they set up a table and have a physical presence, this creates an opportunity to converse with people about observers. Or better yet, invite an observer to come along and speak about their own experience and answer questions that visitors may have, without taking away from the purpose of other volunteers. Spreading the word about fisheries observers increases name recognition everywhere. That recognition creates an edge when observers navigate the job market and compete for positions.

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### Open Discussion Session

### **Bubba Cook (WWF)**

#### *Question/Comment*

How can we incentivize observers? For example pay, authorship on papers, recognition?

#### *Response*

**Amy Martins:** One suggestion would be to reward observers with conference attendance, and we have had an “Observer Seminar Day” for collaboration between observers and scientist. At NEFSC FSB, we have established an observer of the month program. In our program, every month, an observer is recognized for outstanding work and a certificate is sent to the individual and their provider highlighting the outstanding work. Monthly recognitions are published in our observer newsletter.

**Christina Colway:** Highlight observers who do a good job. Financial rewards depend on the program/company etc. Acknowledge that observing is/can be a career.

### **Miguel (Azores Research Program)**

#### *Question/Comment*

How can we provide motivational support for observers/know who will succeed at observing?

Metrics for judging interpersonal skills?

#### *Response*

**Panel:** In person interviews are very helpful to have a clear description of what the job will entail and how they feel that they will handle the challenges. Try to set up interviews with potential observers.

### **Jason (NWFSC – data scientist)**

#### *Question/Comment*

How can observers contribute to scientific studies/particular projects?

#### *Response*

**Panel:** It depends on the scientific study or project. Observers can and should be included if possible.

### **(Inaudible) (Indonesia Observers)**

#### *Question/Comment*

Question unintelligible: Asked about how fisheries are monitored in Solomon Islands

#### *Response*

She did not have a response written down?

**Matt Kemp (NPOP)**

*Question/Comment*

Conflict Resolution: How much time is adequate to cover the topic? There is a lot to cover. What is the most important to cover? De-escalation techniques? Etiquette? Real world examples? Shouldn't mission focus?

*Response*

**Christa Colway:** Yearly briefings can also help with conflict resolution training. Include fisherman in trainings. Provide real world examples in training.

**Emma Fowler (NE Observer)**

*Question/Comment*

How do we retain observers? Incentives? Allow more flexible deployment options.

*Response*

Panel: "Observer Culture" – retention really depends on companies

Unknown: Give observers official letters with achievements that can go in their files

**Kit VanMeter (Dispute Resolution Coordinator, NE U.S.)**

Based on the talks and interactions with participants, the same seems to be true of observers worldwide. Observers are fisherman with on-the-job training; university graduates with marine science concentrations; only men; full time employees; temporary employees and maybe volunteers. They deploy for less than a day or months—Alaska, 3 months at a time. There is only one or there are hundreds by area. The information they collect varies greatly from country to country. They work for private companies, governments, communities, industries, and groups. Some have enforcement roles and some do not. Regulations and legal obligations vary greatly between countries.

Training situations ranged from classroom, to experiential, to on-the-job. Some programs require refreshers, every year, two years, or never.

One person spoke on the need to select and evaluate for observers who are strong emotionally and psychologically stable. Hard to do from resume with limited selection time.

Have more control of who passes training. It is hard to judge interpersonal skills and ability to get along with crew from an interview.

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**Poster Presentations – Extended Abstracts**

## Training Strategies for Retaining Observers And Minimizing Turnover

Matthew S. Kemp

### NOAA Fisheries

**Abstract.** Development of a robust observer training environment is contingent upon the success and professional growth of the observer as well as the program that supports them. This unification between observers and the program plays a vital role in establishing a lasting working rapport, thus better ensuring observers have a fulfilling experience, return for subsequent contracts, and have the opportunity to grow professionally. In the North Pacific Observer Program constructive feedback is imperative to stimulating said growth of the individual observer and moreover promotes the continual improvement and evolution of the program. This in part is due to the challenging work environment the observer faces throughout their deployment. This environment requires observers to adapt to the commercial fishing vessel platform, interpret multiple gear types over several distinct vessel configurations (i.e. catcher-only vessels, processing vessels etc.) and develop equitable working relationships with difficult crew. Often, these tasks can be uniquely arduous as each experience differs in many ways. Each successful deployment also requires a high level of integrity and determination from the observer in both making safe and suitable decisions as well as knowing when to ask for help before, during and after each cruise. This is where providing modes for feedback and communication come into play.

From the observer's initial training forward, multiple channels for providing feedback (e.g. "Training Evaluation Form", "Pre-Deployment Reflection" etc.) are supplied to ensure the materials being used in trainings/briefings are current and tailored to address the specific challenges that observers may face over the course of deployment. With these forms, Observers determine topics they wish to examine and discuss, identify areas of personal improvement and personally evaluate the effectiveness of the class environment and provided instruction. This allows program information to be delivered in a way that will benefit the class as a whole, in addition to addressing the information needs of the individual. In 2013 when the North Pacific Observer Program was restructured and the Full Coverage Sector (i.e. vessels required to carry an observer for 100% of their fishing activity) and Partial Coverage Sectors (i.e. vessels who are only required to carry observers on randomly assigned trips) were formed, observer feedback later led to a revamp of training/briefing formatting to allow for the division of class time to address topics pertinent to each sector individually. This has helped minimize the delivery of irrelevant content to the unintended audience, and allows the trainer(s) involved to focus on sector-specific information. The end result was well received and has greatly benefitted the effectiveness of training classes. This in part has helped to shed light on the importance of this method of observer input.

This process of contributing feedback is carried from the training environment into the field via in-season management where near real-time communication allows the observer to enquire about sampling questions, receive constructive feedback about current data collections, and address pressing safety concerns. In season staff review sampling designs outlined in messages sent by the observer and work to revise a sampling strategy to best suit each individual scenario presented. Additionally, the observer and associated staff work to refine the methods being implemented to better ensure the data being collected is of the

highest quality possible. Furthermore, the advisor can provide advice to aid the observer in overcoming known challenges specific to the vessel based on previously identified challenges. Lastly, in season communication provides a crucial avenue for the dissemination of time sensitive safety concerns occurring onboard, and provide documentation to catalog for the cooperative effort between the program and U.S. Coast Guard to better ensure the vessel is safe as possible for the assigned observer.

Following their deployment, observers are provided an opportunity to sit down with an observer program staff member, all of which have previously observed, and get a chance review their methodologies and catalog the challenges they faced during the course of their contract through a standardized debriefing process. Throughout this process, the observer reviews their deployment and discusses individual, documented challenges faced throughout their contract. By further dissecting these challenges, the observer receives appraisal based on the methods they employed and important constructive feedback on areas to improve upon for future deployments. The debriefing progression allows for current information about yearly changes to be gathered and simultaneously evaluated ensuring it can be incorporated into program updates to promote an effective flow of information. This information provided by observers is compiled and dispersed via the "Updates and Reminders" document, and upon their return the observer can observe the provided information being incorporated and broadcast to benefit all others observers deploying thereafter. The purpose of this poster is to provide further insight on the outlined fundamental practices of the North Pacific Observer Program that have proven to increase transparency throughout all program processes. This limpidity allows the program to foster trust and bestow confidence in the observers being trained. When observers play an active role in this process they are far more inclined to complete multiple deployments, exhibit strong work ethic, and continue to grow professionally throughout their career. By doing so, the observer remains connected to their cause, and as a result, helps promote their own success as well as the success of the program.

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## **The Evolution of Effective Training Techniques in the At-Sea Hake Observer Program (A-SHOP)**

**Cassandra Donovan,**

**Pacific States Marine Fisheries Commission**

### **Goal**

To provide observers with the best training and resources available to collect the highest quality data to manage sustainable fisheries resources.

### **Questions**

What makes an observer training effective? How do trainers keep the observers engaged in learning the WHY of their job, as well as the HOW to do it? How do we make the training as interactive and informative as possible?

## **Background**

In the beginning, the At-Sea Hake Observer Program (A-SHOP) training was three days long. Topics covered included safety at-sea, catch estimation, species composition sampling, and biological specimen collection. As time went on, we expanded our sampling protocols. Our sampling manual increased in length. We wanted to add more engaging and interactive training methods. But we were constrained by our three-day training length.

## **Evolution**

In discussions about how to make our training more effective, we kept coming up against time as the constraining factor. When we realized time was what was limiting us from improving our trainings, we made the big step of expanding our training from 3 days to 4 days.

Expanding our training to 4 days has allowed us to incorporate more interactive training activities, as well as expand training on health and safety topics. Developing hands-on training exercises simulating real-life sampling scenarios and using actual gear gives the observers a clearer picture of what they will encounter and allows the trainers to clear up confusion before data even begins to be collected. Communicating the WHY is also critical, to give observers a vested interest in collecting the highest quality data. Having guest speakers who are the actual data users serves the dual purpose of demonstrating the WHY, as well as breaking up some of the requisite sitting and listening portions of training. An effective observer training is the vital first step towards our end goal of sustainable fisheries management. It is our responsibility as trainers to continually strive towards providing observers with the best information and tools to meet that goal.

## **Benefits**

- More health and safety training
- Interactive and engaging class exercises
- Communicating the WHY aka guest speakers are actual data users
- Opportunities for observers to address and correct misconceptions prior to deployment

## **Suggestions?**

What training methods has your program found effective?

Let me know: [Cassandra.Donovan@noaa.gov](mailto:Cassandra.Donovan@noaa.gov)

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## **Building Community in the West Coast Observer Program Through Outreach**

**Rebecca Hoch and Jon McVeigh**

## NOAA Fisheries Northwest Fisheries Science Center, Fisheries Resource and Monitoring Division ☐ West Coast Groundfish Observer Program

### Introduction

With the implementation of the Catch Share program in 2010, the total number of observers in the field went from 40 to 100+ in less than six months. This increase altered the dynamic between West Coast Fisheries Observer Program (WCGOP) staff and observers. What had been a small, close-knit community allowing WCGOP staff and observers to know each other one-on-one, became an impersonal collection of email addresses and names on a spreadsheet. We went from knowing each other to knowing *of* each other.

As both the WCGOP staff and the observers adapted to the changes Catch Share implementation brought, this subtle difference in our relationship became a challenge. Observer survey feedback indicated observers did not feel as connected to the WCGOP as before, which went against one of the goals of the program; to have a strong observer-program relationship.

Recognizing this as not only a challenge to be addressed, but also an opportunity, we developed *Word on the Waves*. This is a quarterly newsletter directed to the active observers working in the West Coast Observer Program. It's used to keep them informed of program happenings, current events in fisheries, and breaking NOAA research. We also focus on them, their activities and accomplishments and their contributions to the Program.

### Why a newsletter?

**It's controllable.** We wanted to ensure the publication went to active observers and a limited industry/NOAA audience only. This was not possible with Facebook or an online website/publication. A newsletter in PDF format distributed via email solved this problem.

**It fits the observer lifestyle.** On average, observers are in their twenties and early thirties. That generation is device-oriented and highly mobile. Observing puts observers in small, remote ports with limited/sporadic internet connections. The PDF format allows them to download the newsletter to their device to read later as well as ensuring a quick upload if they read it online.

**It's sustainable.** Unlike a website or electronically hosted publication, a newsletter does not require constant maintenance to achieve optimal effectiveness. The time investment to produce it is easily shared among the WCGOP staff and is not overwhelming for any one person. Its compatibility with our regular work load making it sustainable long-term.

**It promotes collaboration.** Each *Word on the Waves* is a group project. Observers and staff submit content, produce visuals (photos), perform editorial tasks, i.e. edit and proofread. The interaction this requires strengthens our connections and improves our relationships; we get to know each other. This improves our communication and ability to work together overall.

### Content

- Observer Spotlight: front page article showcasing a recent outstanding observer.



- From the Program: message from Jon McVeigh, Program Manager
- From the Galley: recipe developed by John LaFargue, California Coordinator featuring seasonal seafood
- Program Snapshot: Quarterly summary of how many trips and sea days have occurred.
- Fisheries News: A compilation of links to current events and news we think observers would find interesting.

### **Bonuses**

- Observer get the opportunity to expand their scientific efforts beyond their observing responsibilities. They get to create research-based content, investigate and report on current industry events, share their skill set and knowledge base with each other.
- Their outstanding achievements and efforts are regularly acknowledged to their peers, employers and NOAA management.
- Observers' contribution and efforts to fisheries management are raised and highlighted to upper management.
- Observers are kept abreast of how the data they collect are used through links to current products (Groundfish Mortality report, Protected species bycatch reports, etc.) and articles by our analysts and researchers.
- Current industry topics and events are made available to them encouraging their ongoing professional development.
- It's an effective method in helping observers get to know each other. For a group that spans the entire west coast of the US and is so highly mobile, learning who's who is critical to helping them develop their own community.

### **Achievements**

- In March 2016, we issued our 11<sup>th</sup> issue to over 200 recipients. This includes Catch Share observers, Non-Catch share observers, At-Sea Hake observers, observer providers, WCGOP staff, NOAA management and friends of the program.
- The 2016 winter issue had a record number of observers contributing to the newsletter. Their articles constituted over half the publication and included a link to an observer-produced film on observing.

### **Into the Future**

We plan to continue publishing the newsletter on a quarterly basis. We'd like to see a continued increased in observer participation. We're considering using information from the Observer Spotlight and From the Galley sections to create an annual calendar we can distribute as a means of furthering our outreach efforts.

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## **Exploring the relationship between the long-time prior and the newer observer: How can we make the most of experience?**

**Dennis Jaszka**

### **North Pacific Groundfish Observer**

Throughout his or her career, an observer will venture through a rigorous evaluation process – beginning with an intensive training class, then resuming in the field through a mid-cruise debriefing and inseason advisement. The process will end with a debriefing interview, then resume when the observer returns and takes an annual briefing class. These evaluation methods represent the formal channels for observer development. An observer will also seek informal channels for development through a well-experienced prior observer.

These informal development opportunities are worth exploring, especially the unheralded role of the long-term prior within an observer program. Newer observers may find training materials too broad, dry, or simply not detailed enough to be of much comfort in a specific situation. The amount of exposure newer observers may have to well-experienced priors throughout their careers may very well prove to be the difference in whether they feel confident as professional fisheries observers collecting data and monitoring compliance. In the long run, this exposure may help decrease turnover rates and improve data quality for observer programs worldwide. Long-term priors can help newer observers in three areas: sampling/data management, professionalism, and the overall lifestyle of observing.

#### *Sampling/Data Management:*

Collecting data on fishing vessels can be a difficult and demanding job. Newer observers often have difficulty managing the variety of small daily tasks. Over the course of the season the observer may become overwhelmed as he/she falls behind. Under these conditions, it will be difficult for an observer to prove his or her competence to a debriefer as well as to vessel crew. Working with an experienced lead, an observer has a proven example available to show how to streamline a sampling workload, clearly and efficiently record data, identify fish, and check data for errors. These things show staff that you are a competent, prepared, and effective observer; most of all these are the foundations of high quality data collection.

#### *Professionalism:*

It can be difficult for a new observer to fathom that he has entered a professional world. Industry, program staff, and providers expect you to be a professional. Observing, however, presents a unique environment where you live and work on fishing vessels and other communal living environments. It may be difficult to maintain a professional decorum at all times. There may be, at times, a lot of freedom available to an observer to push those boundaries. It is important for observers to be accountable, be an effective communicator, and have the maturity to meet the demands of such a unique work environment.

#### *Lifestyle:*

A former North Pacific Observer Program trainer once said that you are very rarely 100% in the job of observing. In other words, each day will present new difficulties in physical health, mental strain, and emotional well-being. How to stay healthy, aware, and effective in a job that often has you awake for long, odd hours is a task in itself. At the same time, too much downtime may have an observer mentally strained under the restless sensation of boredom. How do you balance this within a ninety day contract?

The North Pacific Observer Program has 24 observers with at least 10 years of experience. In playing an informal guidance role within an observer program or an observer provider's corps, it is important to note that the long-term prior may find it more beneficial to play a mentoring role rather than a management role in working with less experienced observers. The difference is setting a good example for the long-term prospects of the observer profession. Long-term priors can help foster an atmosphere that allows younger observers to embrace the job/lifestyle of observing and become a more mature, professional, and effective observer – teaching not only the job but a love for the job.

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## **Observers as the At-Sea Scientist: Our Experiences with Fisheries Research**

**Jennifer Cahalan**

### **Pacific States Marine Fisheries Commission**

Fisheries observers and the data they collect play a crucial role in fisheries management. These data feed directly into catch estimation, support quota management of fisheries, are a key component of stock assessments, and support ecosystem studies and other research efforts. Observers in the North Pacific Observer Program (Observer Program; NOAA Fisheries, Alaska Fishery Science Center) are trained not only in data collection but in the fundamentals of sample design. They know how to accomplish the difficult tasks of assessing and sampling catch on a vessel that is actively engaged in fishing. Observers bring a unique perspective to the research environment due to their involvement with the industry and their knowledge of vessel operations. Observers understand how to communicate with the captain and crews of fishing vessels so data collection goals can be achieved and they understand the importance of documenting their monitoring activities. Because of their skill set, experience, and unique perspective, observers can be an important component of research projects that are conducted on commercial fishing vessels.

The Observer Program is often involved in fisheries research activities, conducted by Observer Program staff as well as research sponsored by outside scientists. Each year the Observer Program receives requests from researchers and stock assessors for additional data collections and assistance with research projects. Since observers are already deployed into the fisheries and have the right skillset, combining research activities with their standard data collection activities can be an effective method of meeting research goals with minimal additional funding.

The research studies that utilize observers cover a broad range of topics. These topics include: studies focused on conservation efforts of individual species, increased performance of stock assessments, and basic life history research. For example, in 2012 and 2013 observers were involved in research evaluating the potential for observers to identify

coral species (Stone et al., 2015). Results from this study were used to document the rarity of coral in the catches and the difficulties associated with identification of coral to the species level. Based on these results, observers have been tasked with identifying coral to the taxonomic order. In another ongoing research project, observers identify skate egg cases belonging to a variety of species and assess their viability. This information is being used to map the distribution of new and existing skate nursery areas and the impact fishing activities may have on these species. In 2015, observers on factory trawlers were asked to participate in project where the recapture of mackerel tagged on deck and recovered in the factory by vessel crew was documented by the observer. This tag recovery rate was used in conjunction with the tag-recapture data to assess Atka mackerel population size. All of these studies are examples of projects the Observer Program has been able to accommodate without additional funding. As such, the incorporation of additional research duties must be as seamless as possible, allowing research activities to be conducted without negatively impacting observer's regular duties. It is important that the observer's regular work duties take precedence since those data are required by in-season quota managers and stock assessors.

In addition to integrated research projects, the Observer Program occasionally receives additional funding to conduct research that is not tied to regular monitoring duties. These are research studies that either require additional observers in order to be implemented or where sampling logistics otherwise prevent collection of regular observer data- this type of research generally cannot be conducted without additional observers and funding. For example, the effectiveness of electronic monitoring to collect data to be used in catch estimation (scientific monitoring) has been an ongoing research interest. Starting with a small study several years ago the Observer Program was able to use grant funds to simultaneously deploy observers and camera systems in a side-by-side comparison (Cahalan et al., 2010). Currently we are developing Electronic Monitoring (EM) systems with increased capabilities that include potentially automating species recognition and data collections. Other research has focused on observer sampling methods on-deck of trawl catcher vessels where observers face some of their most difficult sampling challenges. Here the Observer Program was able to deploy two observers in side-by-side comparison of standard and alternative sampling methods (Cahalan et al., 2016) and to evaluate a potential sampling method for monitoring shoreside processing facilities (Faunce et al., 2015). In these cases the tested methods are not small adjustments to sampling, but rather these are tests of novel methods that represent complete shifts in how observers sample and are major changes to their work flow. For these studies, we required that at-sea scientific staff be currently certified North Pacific Observers precisely because observers are familiar with the vessels and vessel operations, and because they know the fisheries and already understand how data is normally collected.

In 2016, a focus of observer research in the North Pacific has been on Pacific halibut which supports an important fishery and is caught incidentally as bycatch in a number of fisheries in Alaska. It is regulated under individual fishing quota (IFQ) regulations and in the absence of available quota, halibut are required to be discarded. As part of their regular duties, observers assess the condition of halibut (e.g., excellent, poor, dead) as they are being discarded. Discard condition data are used to assign post-capture mortality rates necessary to estimate the total halibut mortality. The assessment of the halibut condition is a time consuming task. The condition of discarded halibut is affected by factors that could be easily

and quickly measured by an observer such as time out of water, and how the halibut is removed from a longline hook. In our current research project, observers are asked to record the amount of time halibut are out of the water before being discarded on trawlers, and the type of halibut release methods on hook-and-line vessels. Our purpose of this work is to see whether collected data can be used to predict the condition of discarded halibut with the ultimate intent of streamlining our data collections.

Another 2016 study that involves North Pacific observers is being conducted and funded by industry under an Exempted Fishing Permit (EFP), and again the focus is on changing observer sampling methods. Current regulations prohibit sorting of halibut on-deck before the observer has an opportunity to sample the catch. On catcher processor vessels, observers sample below deck in the processing factory, and consequently all halibut are discarded from the factory. If methods could be developed where observers are able to sample the discarded halibut on-deck, the halibut could be returned to the water faster and survival would increase.

Research activities provide benefits to the Observer Program and its trained observers. The Observer Program gains the ability to conduct research that otherwise would not be achievable. In cases where additional research funds are used, the hiring of certified observers and using them as the at-sea scientists assures the highest quality data is obtained. Vessels that are actively engaged in commercial fishing activities are not the perfect sampling or research platforms and conducting rigorous sampling onboard is difficult. The scientists best suited to complete research activities in this environment are the observers who know sampling, vessel operations, and need for high quality data. For the observer, these research opportunities provide them with training and experience beyond standard data collection activities that can further enhance their knowledge and background. The sampling skills, documentation, and communication skills that observers have are highly portable and are valuable in any number of research situations beyond conducting at-sea monitoring of fisheries. Research activities can provide a break from the monotony of observer's regular sampling duties, increasing their level of involvement and interest. Research provides new and engaging accomplishments for the observer, hopefully increasing their engagement with the program. Observers who are more engaged, have a greater depth of knowledge and experience are in a position to make informed sampling decisions. By increasing the diversity of duties and providing additional opportunities for observers to gain experience, observer retention may be increased, increasing the strength of the Observer Program overall.

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## **Increasing observer job satisfaction through career services**

**Stewart DESMEULES**

### **NOAA Fisheries**

For many people, the observer job is a stepping-stone, a way to gain valuable field experience and build their resume. After fulfilling their contracts with their observer provider company, many observers begin to think about potential next steps in their careers. Observers are supported on many levels, including training, incident support, debriefs, mentoring, and data quality. There is an opportunity to support observers as they decide to transition out of the program to further their careers/schooling.

The Career Counseling Resource will be accessible via web portal, and will include features on former observers and the career paths they have taken, and how they have utilized their experiences and skills gained from observing. Observers will be provided with a network of former Observers who they can contact to discuss career planning, job opportunities, and exchange advice. Observers will have access to a list of positions that former Observers have taken, and the means to get in touch with them. In addition to this, the resource will include employment websites, listservs, path finding resources, state and government job resources, information on other observer programs, and non-profit job boards. There will be a section with a list of graduate programs that former observers have gone through, as well as other fisheries/marine/environmental based graduate programs and GRE prep resources. Information about programs like AmeriCorps, Peace Corps, semester at sea, and volunteer-abroad experiences will be included as 'grad-school alternatives'. In an effort to build the observer network, the resource will include information on how to contact Observer Program staff and other NOAA employees. At times it can be difficult to make connections as an observer, given the independent nature of the job, so the career counseling resource will also include a schedule of fisheries council meetings, PDT meetings, outreach events, and other opportunities for professional growth.

To recognize the opportunity that observers time on land offers, a list of free and paid online software classes (SAS, R, Matlab, SQL, GIS, etc), as well as a list of nearby schools/organizations that offer classes in subjects like aquaculture, scuba certifications, statistics, and other specialized skills. Another goal of the resource it to provide connections to other observer programs: Australia, Indian Ocean, New Zealand, Portugal, United States, Western, Central and South Pacific Ocean, and West Africa. Building the network globally will increase the number of opportunities available to current and former observers significantly.

The career counseling resource also seeks to highlight the unique skills that observers learn on the job. Observers are widely regarded as excellent field biologists. The observing job establishes a strong fieldwork skill set, and presents one of the most difficult fieldwork

environments in biology. In addition to fieldwork skills, observing provides real people skills. The ability to deal with a range of personalities, and to communicate effectively is something that's applicable to many positions. Conflict resolution skills come with the territory as well. In addition to getting trained in conflict resolution, observers are expected to resolve conflicts on the job. Other skills like time management (juggling multiple duties while at sea), a strong independent work ethic, at sea experience, boat safety, marine mammal and fish sampling, and language skills are some of the things that observers come away with at the conclusion of their contract.

Job satisfaction is significant to both the Observer and the Observer Program. By connecting Observers and their skill sets with job opportunities and helping them with the next step in their careers, it is possible to highlight the value of Observing and increase overall satisfaction within the program. Creating a professional network can serve to improve the program overall, injecting it with new ideas, especially when former Observers stay working in the fisheries field.

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## **Survey design to identify incentives and disincentives to continue as U.S. fishery observers**

**Yuntao Wang, Jane DiCosimo**

### **NOAA Fisheries Office of Science and Technology**

NOAA Fisheries utilizes observers to collect information on catch, bycatch, fishing efforts, biological characteristics, interactions with protected species, and socioeconomic information from U.S. commercial fishing and processing vessels. Observers are usually the only independent data collection source for fishery-dependent data and are crucial in fishery management.

The National Observer Program (NOP) is conducting a survey of past and present fishery observers in order to investigate incentives and disincentives for remaining an observer and to identify their subsequent career choices. The survey will collect background of observers, including their demographic information, educational level, history of observing and their plan for future career path. This information is important to classify perceptions of observers with different gender, age and educational degree. And it could offer a quantitative estimate of the importance working as an observer to their career path. The major component of survey is intended to identify the level of satisfaction working as observers relating with observer program, provider company, and captain/crew. More information regarding their experience towards international fishery and regional program will be included to provide a comprehensive understanding of observers' experience.

Currently, there are roughly 400 observers took the survey. The preliminary result shows pay rate and safety are two major concerns they have. The survey results will be used by national and regional program managers to evaluate current observer provider contract requirements with an aim to increase observer retention. This information is needed to support the Agency's conservation and management goals, to strengthen and improve fishery management decision-making, and to satisfy legal mandates under Federal laws.

Improved retention of qualified and experienced observers is expected to reduce training efforts and costs, and improve data quality. During the conference, observers will be encouraged to register to receive an internet link to the survey.

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## **Abstracts of presentations that did not provide Extended Abstracts**

### **Strengthening capabilities and encouraging on board observers of the programme “Programa Bitacoras de Pesca (PBP)” of Perú**

**Marilú Bouchon, Julio Limache, Gersson Roman, Cecilia Peña, Sofia Rivadeneyra and Manuel Ochoa**

**Instituto del Mar del Perú (IMARPE), Peru**

Currently the on board Observer Programme PBP of the Instituto del Mar del Peru (IMARPE) has 40 professionals, including biologists, fisheries Engineers, Technologists and Technicians who has years of experience in the field. The number of on board observers over time has varied mainly for budgetary reasons.

In the beginning the PBP had a main goal that was collecting information on different measures of effective effort to estimate relative abundance indices of Peruvian anchovy. Later, new objectives were added to convert the program into a medium capable of monitoring both biological, population and behavior of pelagic fish and top predators as the dynamics of the fishing fleet, becoming a scientific platform of Peru for ecosystem management. To achieve this new goal was necessary a hard work bringing training and incentives to the observers, which generates valuable information for the decision making in the scope of the fisheries management and many other studies. Our goal is to inform the international scientific community about the observers continuous training in favor of their personal and professional development.

They acquire knowledge of biology (reproductive and biometrical sampling), fisheries (echo sounder lectures), fishing effort, ecology, sightings of top predators and oceanography (temperatures and water sampling), and also about the input of the obtained information into a scientific communication system through a mobile device and on the IMARPE's database called IMARSIS. The best observers are encouraged to participate in other scientific activities: Research Cruises, Eurekas, Surveys, etc., where they learn about the design and methodology of each activity. Thanks to this training and experience in fisheries, observers have been able to move into other jobs either in fishing companies, Ministerio de la Produccion (PRODUCE) or IMARPE for their good performance.

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**Observers as the At-Sea Scientist: Our Experiences with Fisheries Research**



**Jennifer Cahalan**

**Pacific States Marine Fisheries Commission, WA, United States**

The North Pacific Observer Program (Observer Program) is often involved in fisheries research activities, studies that are conducted within the Observer Program as well as research sponsored by outside scientists. As a result, our observers are regularly asked to conduct research data collection activities in conjunction with their regular catch sampling duties. Because of their experience as fisheries monitors collecting scientific data onboard commercial fishing vessels actively engaged in fishing, observers 1) have a distinctive skill set that includes knowledge of sampling, fisheries, and vessel operations, 2) are well trained to evaluate situations and determine the best methods to achieve data collection goals, and 3) bring a unique perspective to the research environment due to their involvement with the industry and their knowledge of vessel operations. Precisely because of their skill set and because of their unique perspective, observers can be an important component of research projects that are conducted on commercial fishing vessels.

Involving observers in research activities benefits the Observer Program beyond simply completing the research project. By increasing the diversity of duties and providing additional opportunities for observers to gain experience, observer retention may be increased, increasing the strength of the Observer Program overall.

For the observer, these research opportunities provide them with training and experience beyond standard data collection activities that can further enhance their knowledge and background. Not only does this increased depth of experience enhance their potential for other professional opportunities should they choose to leave observing, it keeps the observer involved in the growth of the Observer Program as it constantly adapts sampling methods to changes in fisheries operations and management.

In this presentation we will discuss our experiences conducting fisheries research studies on fishing vessels actively engaged in commercial fishing.

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**A career in observing**

**Matthew Cunningham**

**NEFSC/NPGOP/APO, VA, United States**

Observing has long been thought of as temporary position for new college graduates. Most contractors request a one-year commitment, yet due to high rates of attrition, many new hires do not fulfill this commitment. As an observer with 13 years of experience I have seen various reasons observers leave the position. Many stem from the notion that observing is not a viable career path. In the United States, there are various contracted observer providers, each competing for contracts every few years. Contract instability trickles down to job instability for observers in terms of work availability, benefits packages, and pay scales. Observers are not permitted to work for multiple contractors concurrently. In regions like the Northeast this results in limited work opportunities seasonally. In the scallop fishery

there are multiple providers all competing for the same trips, leaving observers with less opportunity for work, or requiring contractors to reduce their employed observers. There is no system in place to protect observers from contract fluctuations, making it difficult to commit to the position long-term. Rapid observer turnover has many negative consequences for overarching goals of observer programs due to higher training costs, loss of rapport with industry, and potential reductions in data quality. If observing could be presented more as a career path, rather than a temporary position, retention of professional observers would not be as formidable a challenge as it is now. Establishing a cadre of professional observers will prove beneficial to fishermen, managers, end-users, as well as observers. The creation of federal observer positions will remove much of the uncertainty I have described, providing continuity for observers across the board, and providing a more established career path.

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### **Investment Opportunities: Determining Factors Which Result in the Long-Term Retention of Fisheries Observers**

**Jessica Miller**

#### **North Pacific Groundfish Observer Program/Saltwater Inc., LA, United States**

Fisheries observers play an integral part in the collection of real-time field data used by thousands of people in both industry and research alike, but are often relegated to the outskirts of both the scientific and the fishing communities. At the best of times, they are seen as the future of the fisheries science world - each putting in their time in the field before moving up into more scientifically rigorous programs and careers. At the worst, they are considered easily-replaceable, "dime a dozen" employees with little impact on the fisheries world at large. This second mode of thinking is very damaging to both the regulatory programs and the industry that rely on the observers whom are on the front lines of fisheries management. As observer programs recruit, the view of the position as impermanent is inevitably communicated to prospective observers, creating a self-fulfilling prophecy of temporariness. With such high turnover rates, training must be provided again and again for new observers, wasting money, time, and resources that could be allocated to other areas. In addition, observer programs continually lose a valuable accumulated wealth of experience and knowledge, as well as the higher quality data that follows. In order to determine a way to mitigate this seemingly unavoidable observer attrition rate, a series of questions pertaining to observer job satisfaction, hiring practices, performance, compensation, contractor support, and other professional opportunities was developed and disseminated among current and prior observers of different levels of experience. The anticipated results of these interviews will be a comprehensive list of reasons that observers continue in the field or retire, and insight into the potential aspects of an observer program that would successfully create a communicative support system for long term observers.

## Session 3. How can fisheries observers improve the quality, diversity and use of fisheries dependent information?

### Leader John Kelly

The “quality” of scientific data has several dimensions including its relevance, accuracy, credibility, timeliness, accessibility, interpretability and coherence. And as fisheries observers attempt to gather their data in accordance with these principles, they must work in situations that vary greatly with regard: the type and quantity of data being collected, the methods used to collect it, legal requirements, safety considerations, confidentiality issues, different vessels, deck spaces and working environments, the behaviours of captains and crews, language barriers, data capture and transmission protocols, etc. etc. This session explored the range of knowledge, personality and skills that observers must have in order to accomplish their tasks to the highest quality possible under such a myriad of conditions.

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### Oral Presentations - Extended Abstracts

#### Scientific Data Collection in a Fishery Dependent World: Have Your Hake and Eat it Too

Vanessa J. Tuttle

NOAA Fisheries

Everybody knows that if you don't collect a piece of data while you have a fish in hand, the chance will pass, never to be had again. Observers provide fisheries managers with the necessary data to manage fisheries, including who, what, where, when, how, and how much. But there is also great opportunity for observers to contribute to science. The At-Sea Hake Observer Program (A-SHOP) and the West Coast Groundfish Observer Program (WCGOP), which operate off the U.S. West Coast, are testing the limits, collecting as much data as possible, from as many different aspects of fishing as possible.

The at-sea hake fishery targets Pacific hake (*Merluccius productus*) and is characterized by large catcher processors, which both catch and process at sea; and motherships, which receive un-sorted catch delivered at-sea from smaller catcher vessels. The fishery uses large, pelagic nets to fish for hake off the Washington and Oregon coasts, seasonally from May-November. The fishery is a large volume fishery, and by total weight, has low bycatch levels. Two NMFS observers are deployed on each vessel, for every fishing day.

Recent additions to data collection protocols include expanded genetic sampling at the species level. Currently we're collecting tissue samples for genetic analysis from Chinook salmon (*Oncorhynchus tshawytscha*), Rougheye and Blackspotted rockfish (*Sebastes aleutianus* and *S. melanostictus*), Darkblotched rockfish (*S. crameri*), Canary rockfish (*S. pinniger*) and Pacific hake. These are being used for stock structure studies and cryptic species identification.

Observers are currently collecting water samples from the fish holds for environmental DNA sampling. This project is considered “proof of principle” for future work on detection and species identification in water samples from the wash down of decks or tanks, with the idea of using these techniques to combat Illegal, Unreported and Unregulated (or IUU) fishing. The hake fishery has no issues with IUU, but the fishery presents ideal conditions for this experiment because the observers have easy access to the fish tanks and the observer’s species composition samples will serve to validate the results from the DNA sequencing.

Cephalopod specimen collections for the National Marine Mammal Lab have been on-going for several years. These are used for marine mammal diet studies, including squid beak collections for scat studies and squid life history studies. The program also passes along fish specimens to add to the fish bone collection which are used in the marine mammal scat studies.

The A-SHOP also collaborates with the University of Washington to collect and donate fish for research, and rare and unusual fish specimens for preservation and storage.

Current protocols included collecting ovaries for a maturity study of P. hake, but were recently expanded to include ovary collections from Jack mackerel (*Trachurus symmetricus*) for a fecundity study, and age structure collections for J. mackerel and Pacific mackerel (*Scomber japonicus*). This is in collaboration with the Southwest Fisheries Science Center and the data will be used for life history studies and in the stock assessments for these two data-poor species.

Blackfooted albatross bycatch numbers indicated there may be more interactions with trawl cables than was previously thought. This year, the program embarked on research which is studying how seabirds interact with the trawl warps and other cables, which break the surface of the water while the nets are being towed. The observers are on the front-line, collecting these observations each day and recording data about the vessel setup, the discharge plume and the wind and weather conditions at the time.

This is all in addition to the typical species composition samples, routine biological sampling, and enhanced data collection on protected species, which make up the core data collections for the A-SHOP. Harnessing the opportunity that is presented from having a human at sea to collect data is our goal, all the while remaining cognizant to not overburden the observers in the process. Time management training, use of priority lists, and occasionally even just saying no to requests for data collections are several of the tactics we use to ensure a successful and happy observer cadre.

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**Using observer data to quantify the effectiveness of eulachon smelt bycatch reduction devices in the U.S. West Coast pink shrimp fishery.**

**Bo Whiteside, Jason Jannot, and Ryan Shama**

**Northwest Fisheries Science Center ▪ West Coast Groundfish Observer Program**

In 2015, the U.S. West Coast pink shrimp (*Pandalus jordani*) fishery landed a record breaking 46,667 metric tons of shrimp, generating over \$110 million in revenue for the U.S. states of Washington, Oregon, and California (PacFIN 2016). However, with all fisheries comes the potential for bycatch, and one particular bycatch species of concern in the pink shrimp fishery is the southern Distinct Population Segment (DPS) of eulachon smelt (*Thaleichthys pacificus*), which was listed as threatened under the Endangered Species Act (ESA) in 2010.

In addition to record breaking pink shrimp landings in 2015, a large number of vessels in the pink shrimp fleet also adopted the use of a new bycatch reduction device (BRD), aimed at reducing the amount of eulachon smelt bycatch. Developed by the Oregon Department of Fish and Wildlife (ODFW), in conjunction with the Pacific States Marine Fisheries Commission (PSMFC), this BRD consists of a series of light-emitting diodes (LED) secured along the main fishing line, above the ground line (see Figure 1). These lights are believed to illuminate escape routes for smelt (Hannah & Jones 2015).

Results from the testing of this BRD, conducted by ODFW, suggest that their use substantially reduces the overall weight of eulachon (90.4%), juvenile rockfish (78%), and juvenile flatfish (68.8%) bycatch, with only a .7% loss in shrimp. (Hannah and Jones 2014). These tests were controlled scientific experiments and the news of their initial findings spread quickly throughout the fleet. As a consequence, most vessels participating in the pink shrimp fishery implemented the use of light BRDs in 2015. At the same time, the West Coast Groundfish Observer Program (WCGOP) began collecting data on the use of light BRDs in the pink shrimp fleet. In 2015, approximately 200 trips were observed with this BRD in place.

Analysis of 2014/2015 WCGOP pink shrimp data, also suggests a reduction in eulachon bycatch, as a result of light BRD use. Figure 2 shows the results from a generalized linear model used to test the effectiveness of light BRDs on eulachon catch per haul. The presence of a LED BRD appears to reduce the observed number of eulachon per haul by about 23% (left) which agrees well with the model prediction of a 34% reduction. Given the complexity of shrimp trawling behavior, these data suggest that LED BRD can reduce eulachon bycatch in realistic fishing scenarios.

Understanding how light BRDs reduce bycatch in this fishery will provide managers with insight into how best to incorporate their use into management measures. It will also act as an example for other programs in the U.S. and around the globe. The WCGOP will continue to collect this valuable information, while also attempting to characterize the many other types of BRDs, currently being used in West Coast Groundfish fisheries, such as escapement windows, sorting grids/grates, and modified codend meshes, to name a few. While BRD research continues to gain steam, observer programs should take advantage of the fact that they are in an ideal position to collect valuable, fishery-dependent data on their use.

*Special thanks to Mark Lomelli (PSMFC), Waldo Wakefield (NMFS), Bob Hannah and Steve Jones (ODFW) for lending their expertise and assisting with development of the WCGOP BRD data collection protocol.*

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Hannah, Robert W. and Jones, Steve. 2014. Mid-Season Pink Shrimp Update. Newport, OR: Oregon Department of Fish and Wildlife. 4 pp.

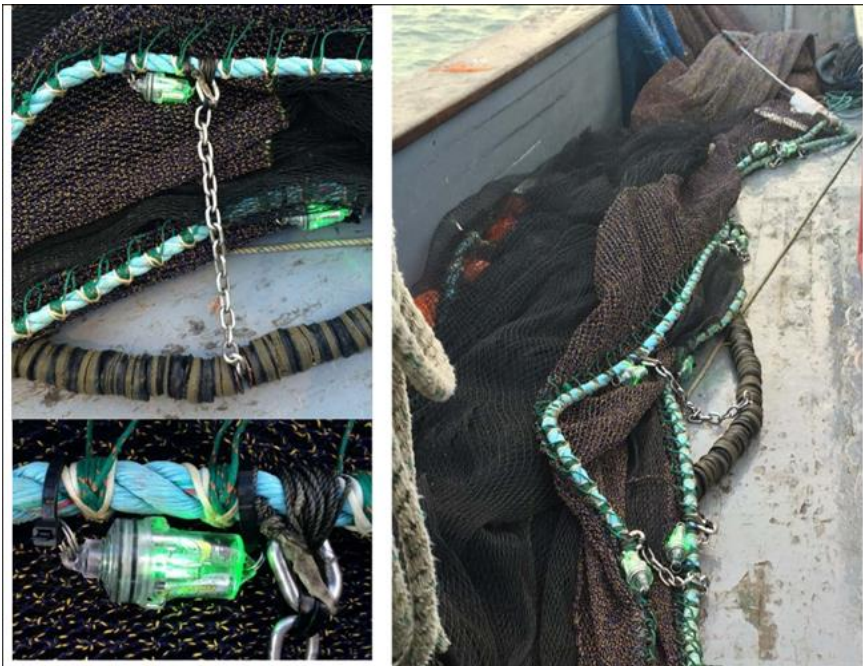


Figure 1: LED BRD and placement. Photos courtesy of ODFW and PSMFC.

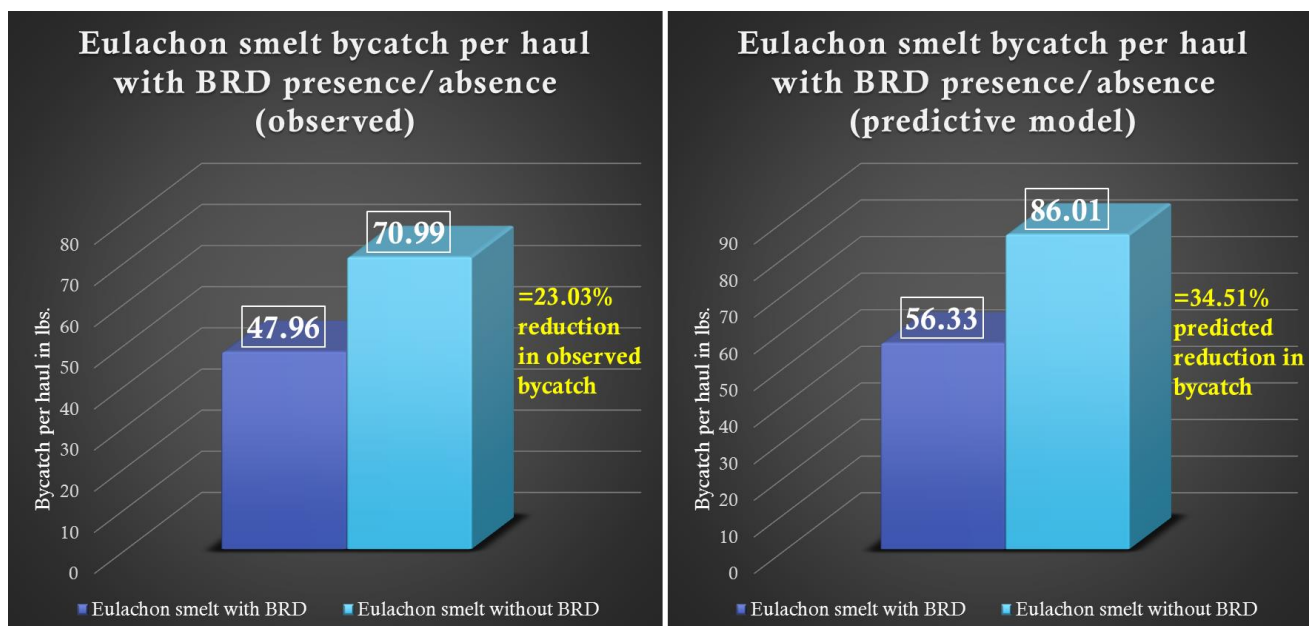


Figure 2: Eulachon smelt bycatch, as observed on pink shrimp vessels with and without the use of light BRDs.

## CREW-BASED OBSERVER PROGRAM OF WWF-PAKISTAN: A POSSIBLY DEPENDABLE SYSTEM OF OBSERVERS ON SMALL SCALE FISHERIES OF INDIAN OCEAN COUNTRIES

Muhammad Moazzam<sup>1</sup> and Rab Nawaz<sup>1</sup>

WWF-Pakistan, Karachi, Pakistan

There are about 700 gillnetters that operate in Exclusive Economic Zone (EEZ) of Pakistan and in the Area Beyond National Jurisdiction (ABNJ). Pakistan is a member contracting party of the tuna Regional Fisheries Management Organization (tRFMO) i.e. Indian Ocean Tuna Commission (IOTC). According to IOTC Resolution 11/04 on “A Regional Observer Scheme” all CPC are required to improve the collection of scientific data, at least 5 % of the number of operations/sets for each gear type by the fleet of each CPC while fishing in the IOTC area of competence of 24 meters overall length and over, and under 24 meters if they fish outside their Exclusive Economic Zone (EEZ) shall be covered by this observer scheme. For vessels under 24 meters if they fish outside their EEZ, the above mentioned coverage should be achieved progressively by January 2013. For the compliance on this resolutions, observers were deputed on fishing vessels to collect information on board fishing vessels which can be used for quantifying species composition of target species, bycatch, by-products and dead discards, collecting tag returns, etc.

For the artisanal vessels, their landings are required to be monitored at the landing place by field samplers who are also required to collect similar information on land during the unloading of fishing vessels so as to quantify catch, retained bycatch, collecting tag returns, etc. The IOTC Resolution requires level of the coverage of the artisanal fishing

vessels be progressively increased towards 5% of the total levels of vessel activity (i.e. total number of vessel trips or total number of vessels active).

Pakistan is not compliant to the IOTC Resolution 11/04, as no observer was placed on tuna gillnetters or no filed sampling is being done in case of artisanal vessels. Under the Deep Sea Fishing Policy, 2009, there is a provision that executing agency i.e. Marine Fisheries Department will post scientist/observers/officers on selected vessels as and when required for collection of fisheries data. Fishing in the Exclusive Economic Zone of Pakistan was started in 1982. Since inception observers used to be posted on all the vessels operating in EEZ of Pakistan. Operation of fish trawling was started and continued till 2005 whereas tuna longliners (mainly from Taiwan) were operated from 1991 and intermittently it continued till 2009. On all these vessels including trawler and longliners, observers were posted, however, no quality could be collected through this observer program, mainly because observers were not trained, willing to work and almost no scientific fisheries data could be generated. No observers were ever placed on tuna gillnetters although most of these were either above 24 m or even if less than 24 m, they periodically operate in water beyond EEZ.

Considering this to be one of the non-compliance to IOTC Resolutions, WWF-Pakistan planned to facilitate Government of Pakistan in starting a credible Observer Program in July 2012. In the initial phase, a number of observers mainly educated children of fishermen and other youth from coastal communities were selected and trained to be as Observers. This effort failed because these trainees refused to work on fishing boats because of the living conditions on the fishing boats. This experiment was repeated many a time and finally it was decided to look for other options. In the meanwhile, WWF-Pakistan has obtained a funding from Indo-Pacific Cetacean Research and Conservation Foundation (Government of Australia) for assessing the extent of mortality of cetacean in tuna gillnet operations. In an attempt to collect the realistic data about cetacean entanglement, services of captain of a tuna gillnetter was acquired in October 2012. This turned out to a good solution, as this captain was willing to collect information about number of tuna caught each day, along with number of other bycatch species as well as number of cetaceans and other protected species caught during the fishing operation.

Considering this to be a success, this captain was trained to identify species of tuna and bycatch species as well as protected species. A template was developed to record the data and the captain was provided with a camera to record the fishing operation, tuna catch as well as any entanglement of other bycatch and protected species. In the process captain of another vessel was acquired who has also started collecting information about tuna fishing and bycatch. Under the Project Indo-Pacific Cetacean Research and Conservation Foundation, there was provision for only two observers, however, considering the success of deployment of Captain as observers, WWF-Pakistan, WWF-Pakistan funded deployment of two additional observers through its own resources. One of the two observers, was a crew member (not captain), however, the quality of data and information was not compromised.

Deployment of the four observers on tuna gillnet helped in generation of information about the catch of tuna species in each haul, their average weight, number and estimated weight of commercially important fish species, area of fishing (recorded using GPS), soak time, discards and number of entanglement of cetaceans, turtles, mobulids, whale sharks and



sunfish etc. The fishermen were also trained to record total length of three specimens of each species. The data collection protocol used by the crew and captain was in line with the requirements of the IOTC Resolution 11/04, despite a different template being used by the fishermen.

Information gathered by fishermen especially photographic record as well as through a debriefing after each trip revealed that a number of bycatch species especially turtles, mobulids and whale sharks do not die in the entanglement and fishermen cast them overboard. In the process of dumping back in the sea, no care or welfare of the animals was taken into consideration. Considering this to be a good opportunity, these four observers are trained to carefully release these animals. Since then these observers so far safely release about 15 mobulids, 28 whale sharks, 5 sunfishes and thousand of turtles (mainly olive ridley and green turtles). Almost all dolphins and whale were observed to die immediately once get entangled in the gillnet because of drowning. However, still two dolphins and one Longman's beaked whale (*Indopacetus pacificus*) which were entangled but alive, were successfully released.

The observer program enable to generate information about temporal and spatial catches of 8 tuna species along the coast of Pakistan, in the EEZ and in the high sea. Data for commercially important species including sharks, billfishes, dolphinfish, narrow-barred Spanish mackerel, barracuda, trevallies, cobia and other finfish species is also recorded on regular basis. It also provided information about distribution and abundance of important protected and threatened species. Using the information collected through observer program an estimate of catches of large pelagic species are collected. Considering crew-based observer program to be a success, WWF-Pakistan has increased the number of observers to 32 since January 2015.

These observers were able to provide credible data of catches, bycatches and other fisheries related information which has helped in resolving some of unanswered questions. In addition to catch per boats, information about seasonality and bycatch species and mortality of some of the threatened species such as turtles and cetaceans.

The information about entanglement and mortality of PET species, commercial catch and bycatch composition was not available for the any gillnet fisheries of the Indian Ocean. Through crew-based observer program of WWF-Pakistan, these much needed information is now regularly been collected and documented. Considering the success of this observer program, a number of countries in the region are considering to initiate similar program for their gillnet fisheries.

In none of the Indian Ocean countries, observer program on small scale fishing vessels is being implemented mainly because of lack of facilities on board fishing vessels as well as working environment of these vessels is suitable for the observers. Crew based observer program may be a suitable solution to tackle the issue. WWF-Pakistan has planned to install electronic monitoring on the vessels on which observers (crews) to ensure that the data is accurately recorded. WWF-Pakistan now has a database of catches of tuna and tuna like species as well as commercially important species (dolphinfish, cobia, barracuda, rainbow runners), cetaceans (whales and dolphins), marine turtles, sunfishes, sharks and mobulids. A similar database can be established in the regional countries.

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## IMPROVEMENT OF THE EL NIÑO EVENTS MONITORING ON BOARD SCIENTIFIC VESSELS ALONG THE PERUVIAN COAST

Ochoa, M., Peña, C., Bouchon, M., Rivadeneyra, S., Roman, G., Dominguez, N. and Limache, J.

Instituto del Mar del Perú, Perú

The Peruvian sea is located in the Pacific Ocean east of South America, in the most important area of upwelling in the world, with productivity levels unsurpassed by any other marine ecosystem with high environmental variability in different time scales and that is the basis of a huge food chain, which favors the development of large volumes of fishery resources such as Peruvian anchoveta (*Engraulis ringens*)<sup>1,2</sup>. This is the reason why this monthly monitoring is performed in order to assess environmental conditions and the impact of possible El Niño and La Niña events.

Since 2014, IMARPE has the Presupuesto Por Resultados (PPR) called "Reducing vulnerability and attention Emergency Disaster" which brings scientific information from the monitoring of these events, for effective management, prevention and mitigation of the impacts<sup>3</sup>

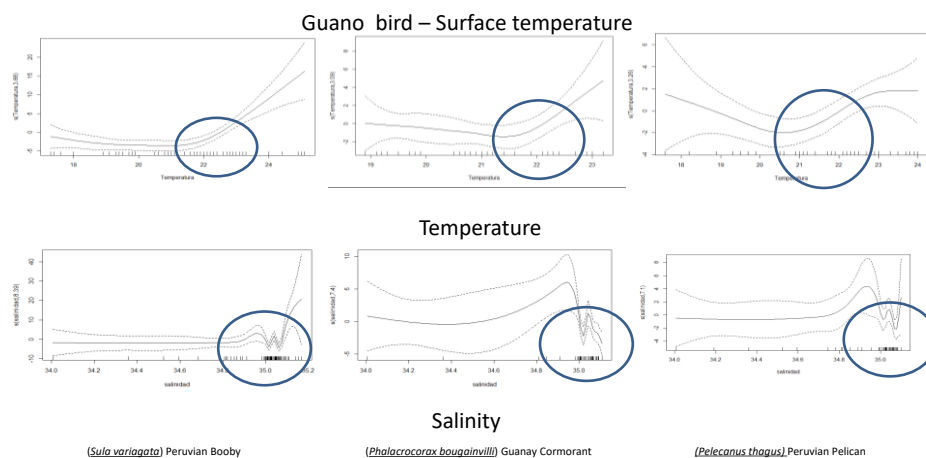
Part of this program is the monthly monitoring and bio-oceanographic operations off Paita (05 °) and Chicama (8 °) which are performed up to 100 nautical miles to analyze the physical, chemical and biological abnormal conditions, such as indicator species in different magnitudes<sup>3</sup>. Biological monitoring has been implemented as a new methodology for bird watching as indicators of abnormal events, distribution and predator-prey relationship with pelagic species among other.

The sighting of seabirds developed during navigation includes perpendicular lines to the coast and 7 oceanographic sampling stations off Paita (05 °) and Chicama (08 °). The observer, collects information and classifies it according to the following table:

Descriptions	About the set
Sea birds classification	Guanobirds
	Migratorybirds
Materials	Binoculars
	Contometro
	Notebook
Activity of presence	Searching
	Eating
	Socializing
	Resting
sea bird	Flying
During navigation	Geographical position
	Distance between group of birds and the vessel
	Surface temperature
	Salinity surface
	Date and hours of sighting os seabirds

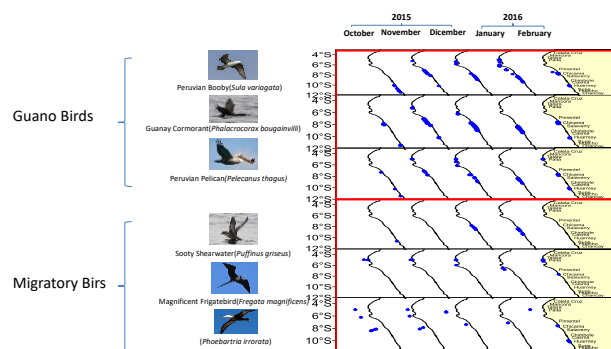
**Table 1.** Collection of information during navigation

Generalized additive models allowed to observe the relationship between the environmental variables (explanatory) and the behavior of birds (response variable). Guano birds Peruvian Booby *Sula variagata*, Guanay Cormorant *Phalacrocorax bougainvilli* and Peruvian Pelican *Pelecanus thagus*, adapted to warm conditions with surface sea temperatures up to 21 degrees and higher salinities 35.1 (UPS), would explain any changes in feeding and foraging strategies, seeking their prey in areas near the coast directly related to the anchovy distribution <sup>4</sup>. On the other hand the presence of Superficial Subtropical Waters and income Equatorial Superficial Water in the northern region during El Niño event (2015-2016), allowed the oncoming of certain species most commonly associated with warm conditions such as: Magnificent frigatebird (*Fregata magnificens*) among others (Fig. 1 y 2).



**Figure 1.** Behavior associated guano birds to environmental conditions

Finally, the results allowed to appreciate the sighting of seabirds, which can contribute to the ecosystem assessment and research complementing other programs of IMARPE. Remains implement other methodologies that help to improve the understanding of the behavior of the food chain in the marine ecosystem, during abnormal events by analyzing other biological indicators to assess impacts in the Peruvian sea. (Fig. 3)



**Figure 3** Distribution of environmental seabirds and distance to the Peruvian coast during the Niño event 2015-2016

<sup>1</sup>**BOUCHON M. et al. 2010.** Biología de la Anchoqueta peruana, *Engraulis ringens* Jenyns. V Panel de Expertos en evaluación de la Anchoqueta Peruana. Bol. Instituto del mar del Perú 25(1 y 2) 23-30.

<sup>2</sup>**AGÜERO M. 2007.** Capacidad de pesca y manejo pesquero en América y el Caribe. FAO Documento Técnico de Pesca. N° 461. Roma. 403 pp.

<sup>3</sup>**PALOMARES, R.** Estudio y monitoreo de los efectos del Fenómeno El Niño en el ecosistema marino frente a Perú PPR 068.MIMEO IMARPE, 2p.

<sup>4</sup>**JAHNCKE J, GOYA E. 1998.** Las Dietas de Guanay y del Piquero Peruano como Indicadores de la Abundancia y Distribución de Anchoqueta. Bol. IMARPE.17 (1 y 2): 15-33.

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## **Open Discussion Session**

### **Helen – WWF**

Questions for Michiel Dammers -

- What number of observers and will there be reluctance for fishermen to take them
  - 20 observers -> 10 trips/yr
  - 8 trips/yr for Shrimp
  - 10 trips/yr for gillnet
- 20 participating vessels, yes sometimes difficulty having captains say yes to taking observers.

Tuna Regional Fisheries Management:

Questions for Yuna Kim –

- Require 5% coverage, trying to increase %, her too? Was not aware of other observer program at IOTC. Are observers related to his program?
  - Yes, 5% coverage for her program too. Working with Korea, Namibia, China, vessels operate South of 25°

Questions for Vanessa Tuttle –

- Program started this Spring -> not getting a lot of the carcasses back on birds.

- Using standardized observation protocol?
    - No, developed in-house
- 

## **Poster Presentations – Extended Abstracts**

### **Pacific Salmon Identification: Are we doing enough?**

**Roy Morse**

#### **NOAA Fisheries**

Pacific salmon support economically and culturally important fisheries across the North Pacific. Observers in Alaska may encounter any of the five species of Pacific salmon, which can be challenging to distinguish from each other when in their high seas color phase. The North Pacific Observer Program trains new observer trainees and returning observers in the identification of the salmon species, and requires observers to collect scale samples to aid in confirmation of field identifications. But is that enough to ensure acceptable levels of accuracy? One way to assess observer identification skills is to track performance on the identification exams that observers are required to pass before each deployment.

Scale collection occurs when salmon are encountered during sampling for all observed fisheries in Alaska. Unique scale features reflect the life history of individual salmon species, assisting in easier species confirmation when observers return from deployment. During debriefing of the data salmon scales are reviewed for confirmation, then stored. Certain species have similar scale features that can be challenging for Observer program staff to confirm. When large numbers of salmon scale specimens are collected, Observer program staff randomly select a percentage of these scales for review. Issues can occur when the observer either misidentifies a species, or the scales are unreadable. Two common species, Chinook (*Oncorhynchus tshawytscha*) and Chum (*Oncorhynchus keta*) in Alaskan waters, are rarely misidentified based on scale confirmation. The other three species of salmon are not commonly encountered by observers and can be easily confirmed by Observer program staff. Data can be changed to unidentified salmon if a confirmation cannot be established through reading of the scale. The data on salmon scale confirmation is currently not tracked, but protocols should be established.

Returning observers receive a fish exam annually and new observers at the conclusion of 3-week certification course. Examination performance is monitored to maintain high quality training and fish identification skills of the North Pacific Observer. These data collected from the exams quantify the total number of specimens identified on the exam to the total number of correct responses. Exam performance is distributed by taxa groups, and individual species to facilitate future training in fish identification. Table 1 shows new observers at 90% accuracy and prior observer at 94% accuracy. Indicating that both levels of observer experience do very well on salmon identification.

These data indicate that observers in the field have a high level of accuracy in species identification. Potential ways to further improve salmon identification accuracy could include the addition of photos, specimen collection, or genetics.

	% Correct			% Correct	
	New observers	Prior observers		New observers	Prior observers
Crabs	95.2	97.4			
Skates	89.9	95.5			
Flatfish	92.1	94.3			
Incidentals	92.0	94.9		Chinook salmon	97.5 96.4
Salmon	90.3	94.1	{	Chum salmon	87.4 96.1
Gadids	90.6	98.1		Coho salmon	87.5 82.4
Rockfish	84.3	91.5		Pink salmon	71.7 89.5
Sculpins	79.5	90.3		Sockeye salmon	85.7 89.7

Table 1

## The Evolution of Scientific Sampling in the North Pacific

**Kayla M. Ualesi**

**Pacific States Marine Fisheries Commission, Fisheries Monitoring and Analysis Division, Alaska Fisheries Science Center, National Marine Fisheries Service, NOAA**

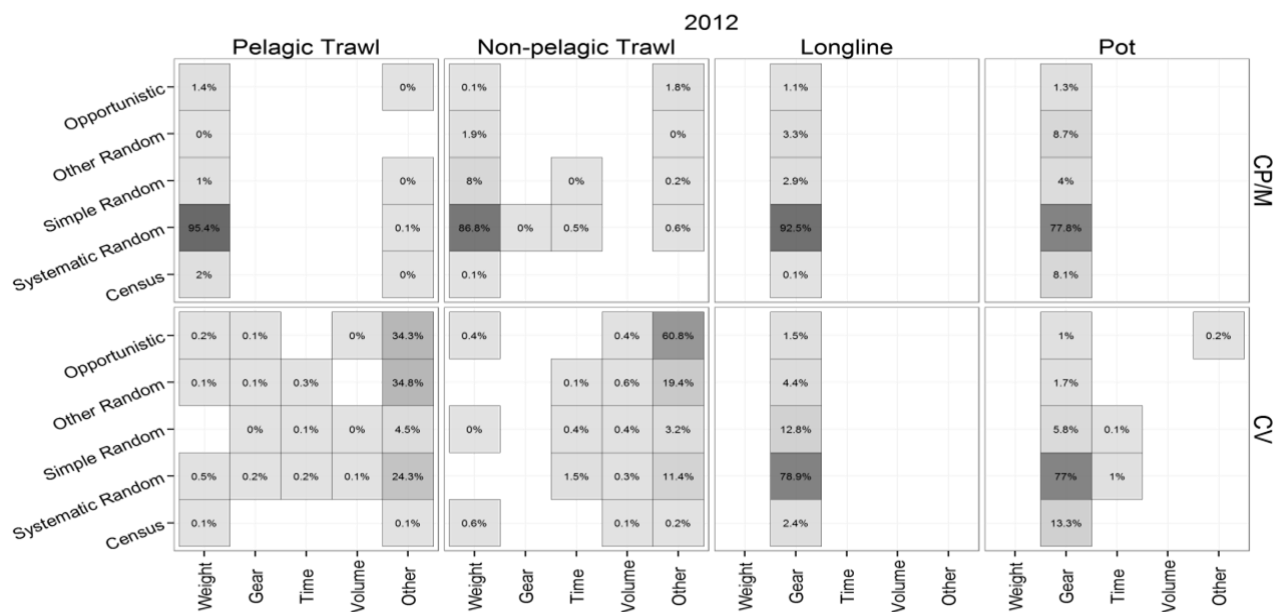
Fisheries observers collect quality data aboard commercial fishing vessels so that stock assessors and other data users can make quantifiable statements about catch in the North Pacific. Because high quality data is needed to meet these needs, a science based approach to random sampling in the North Pacific is necessary. Sampling protocols in the North Pacific have been improving incrementally as is necessary in the every changing commercial fishing industry. The North Pacific Observer Program (Observer Program) has taken strides towards scientifically defining how samples are collected by establishing sample unit codes and taking a more scientific approach to the sampling methods already in place.

Prior to 2008, observers in the North Pacific Observer Program collected one large sample at a randomly chosen point throughout a haul. In 2008, the Observer Program implemented a more rigorous sampling method to improve catch estimations. Instead of one large random sample, multiple random samples were collected throughout a haul. It was determined that multiple samples result in a more accurate representation of the total population. With the new concept of multiple samples, there were two main sample designs: simple random sampling (SRS) and systematic random sampling (SYS). In SRS, sample units are selected for inclusion based on a set of random numbers from a random number table or other random number source. In SYS, sample units are equally spaced throughout the population from a randomly selected start point. In general, SYS was and still is the preferred method since it allows for a spatial coverage of the haul unlike SRS which could lead to all samples being taken too close together. Both sample designs require observers to define a sample unit which could be time, weight, or gear. In 2008, the program had not established a method for effectively reporting which sample unit was used.

In 2010, the Observer Program defined how samples were collected by establishing sample unit codes (Figure 1). These codes allowed data users to better understand how the target population is divided to form the sample frame. Each sample unit type is assigned a number to aid in data entry. Code 1 is a gear unit type. This code is used when the sample frame consists of units defined by discrete segments of gear, such as segments of longline gear, pots or a group of pots or longline segments. It can only be used on a pot or longline vessel. Code 2 is a time unit type. It is used when observers collect or tall all fish they encounter during the unit of time defined by the sample frame. It is used on pot vessels and occasionally trawl vessels. Code 3 is a weight unit type. A predetermined weight of fish defines this unit. Observers use this code when the sample frame is a list of equal weight units and all the fish within that weight unit can be collected. This unit is only used on a trawl vessel. Lastly, code 5 is defined as other unit code. It is used anytime that the unit defined within the sample frame cannot be collected in its entirety. Observers use this code to describe occurrences when the actual amount of fish that is collected is not equal to the size of the sample unit. It is used on trawl vessels. The use of these codes improved communications between observers, observer program staff members, as well as data users.

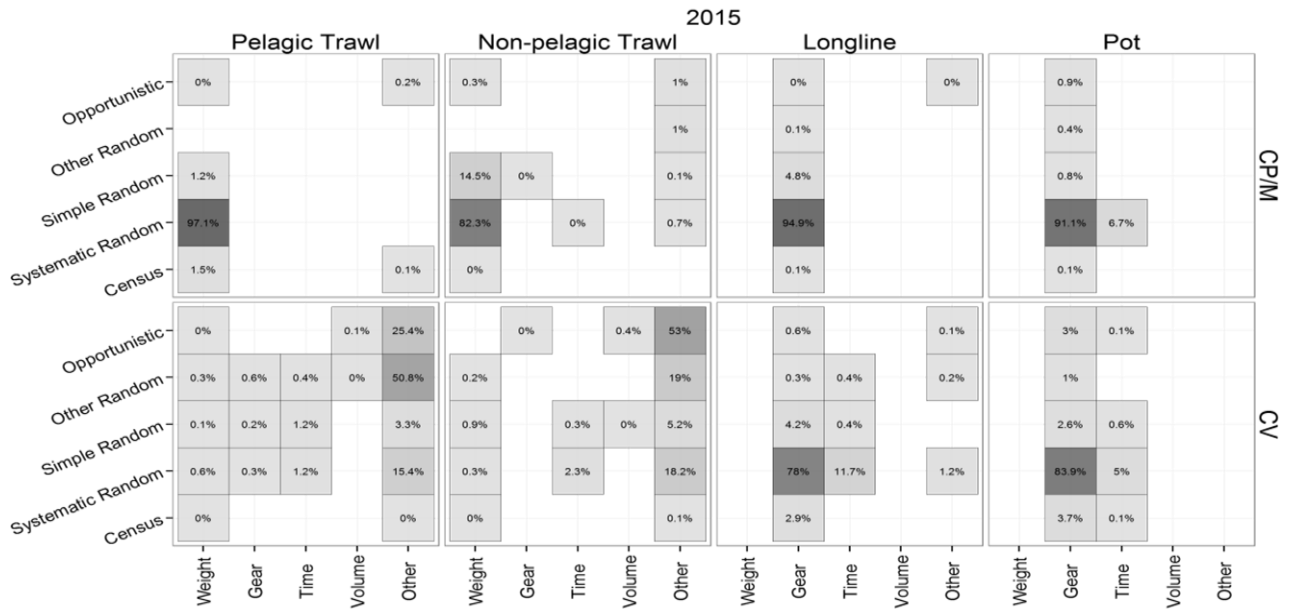
In 2016, the Observer Program recognized that observers were still facing difficulties on certain vessel types where it was more challenging to accurately convey how they were constructing their sample frames. Upon review of 2015 data (Figure 2), it was apparent that clarification of unit codes needed to be made. In order to rectify this issue, sample units have been clarified even further by taking a more scientific approach to the sample methods that have been in place since 2008 (Figure 3). Sampling instructions were simplified in order to improve observer decision making. Sampling instructions were simplified for observers to improve decision making. Also, the language in the sampling manual was clarified to further improve communications between observers, observer program staff and data users. By making these improvements, it increased the repeatability of sampling designs and reduced assumptions associated with previous data collections. With this improvement, the observer program promoted certain sampling techniques known to work best in specific scenarios. Code 1 (gear) became the only sample unit type available for fixed gear vessels (longline and pot). Code 2 (time) is no longer a preferred method. If an observer is unable to define a different spatial unit, they are instructed to contact the Observer Program. While time is

used as a proxy for collecting units of weight or gear, it is no longer considered its own sample unit. Code 3 (weight) is the most common on trawl vessels. If a trawl vessel is equipped with a flowscale, observers are able to establish a unit of weight that makes up their sample. On vessels without flowscales, observers now strive to establish a weight based unit by collecting a predetermined unit of weight from the accessible population. Code 5 (other) is no longer used on a regular basis. Every effort is made to collect weight based samples on a trawl vessel. This unit code is only used when there is no way to collect the entire sample unit defined within the sample frame. Data collected using this new approach is more scientifically sound and data users can better understand the methods used by fisheries observers who execute rigorous sampling designs aboard commercial fishing vessels in the North Pacific.

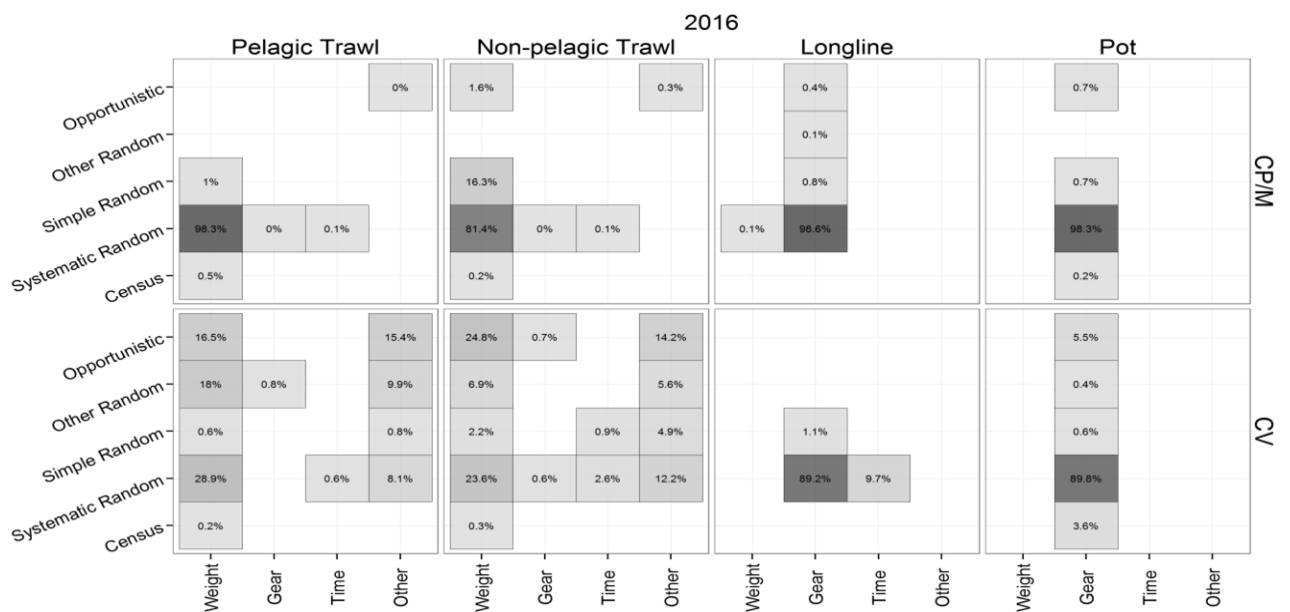


**Figure 1:** Sample unit code usage dependent on sample design and vessel type in 2012. [Note: Catcher processor vessels/ motherships (CP/M) and catcher vessels (CV)]





**Figure 2:** Sample unit code usage dependent on sample design and vessel type in 2015. [Note: Catcher processor vessels/ motherships (CP/M) and catcher vessels (CV)]



**Figure 3:** Sample unit code usage dependent on sample design type and vessel type in 2016. Due to the clarification and simplification of sample unit codes in 2016, sampling designs used by North Pacific observers are now easier to replicate and data collection methods are more easily communicated with data users. [Note: Catcher processor vessels/motherships (CP/M) and catcher vessels (CV)]

References

(AFSC) Alaska Fisheries Science Center. 2008 Observer Sampling Manual. North Pacific Groundfish Observer Program. AFSC, 7600 Sand Point Way N.E., Seattle, Washington, 98115.

(AFSC) Alaska Fisheries Science Center. 2010 Observer Sampling Manual. Fisheries Monitoring and Analysis Division, North Pacific Groundfish Observer Program. AFSC, 7600 Sand Point Way N.E., Seattle, Washington, 98115.

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## **Abstracts of presentations that did not provide Extended Abstracts**

**Successful fisheries management requires a thorough understanding of fishers behaviour - what can observers do?**

**Ruben Verkempynck, Marloes Kraan, Brita Trapman and Michiel Dammers**

**Wageningen IMARES, Noord-Holland, Netherlands**

Successful fisheries management requires a thorough understanding of fishers behaviour; what we define as the collective set of decisions made every day on board of fishing vessels by fishermen. Sudden and drastic changes in fisheries management, as e.g. the current implementation of the landing obligation in European waters, confronts us with the following question: is our current knowledge of fishers' behaviour sufficient to prepare for changes in fisheries? For now, most will agree that it is unclear how fishers will respond to new rules and regulations.

At sea observers spend a week (in Dutch demersal fisheries) on board of fishing vessels and do their work collecting catch data alongside the skipper and crew. In some aspects they participate in the lives of the fishermen, eat together, sleep together, talk, joke and process fish. They in fact also are the eyes and ears of our research institute (or the ambassadors) and can potentially bridge the gap between science and fishing practice. They hear many stories, observe behaviour, are the first to experience changes in the environment, etc. From a social science perspective they sit on a gold mine.

Unfortunately not a lot is done with this information. One of the reasons for this is that this information is not recognised as valuable and subsequently is not collected. Would that however be done, this would result in valuable information that might give a better understanding of fishers behaviour and fisheries practice. In a transdisciplinary project focussing on getting a better understanding of fishers' behaviour, IMARES will develop a protocol for at sea observers to gather more data whilst they are on board anyway, in relation to fishers' behaviour. This will be done together with the sea-going observers, fishermen and scientists in the institute. The observers will be trained in social science

methods such as interviewing and observing, and ethical issues will be discussed with fisher crew, observers and researchers.

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## **Beneficial Trends In Catch Monitoring**

**Julian Hawkins**

**Integrated Quota Management Inc, BC, Canada**

Existing observer programs often realize their regulatory and sustainability objectives but at the expense of the economic health of the fishing industry. Yet fishers understand, and frequently welcome, a systematic regulatory structure where clear rules help limit outliers and protect livelihoods. Successful monitoring programs are typified by strong industry-regulator interaction, non-disruptive procedural changes and a plan to reduce the economic impact to fishermen. As modern, established fishery observer programs seek to improve capability and reduce costs, so too developing world and artisanal fishery monitoring programs are growing in number. Both disparate trends are seeking to leverage cost and capability improvements brought by new technology and yield better value to the fishermen and processors for verifiably ethically and sustainably caught fish. This trend to verify aspects of each fish caught satisfies regulators, retailers and consumers beyond what was previously acceptable - yearly paper or spot audits - and signals a trend to improved fishery reputation and vitality.

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## **Seabird intensive observer training programme of BirdLife International**

**YUNA KIM<sup>1,2</sup>, Bronwyn Maree<sup>3,4</sup>, Cleo Small<sup>5</sup> and Ross M Wanless<sup>6,7</sup>**

<sup>1</sup>Seabird Conservation Programme, BirdLife South Africa, Cape Town, South Africa, <sup>2</sup>Common Oceans Programme, Food and Agriculture Organizations of United Nations, Rome, Italy, <sup>3</sup>Seabird Conservation Programme, BirdLife South Africa, Cape Town, South Africa, <sup>4</sup>Common Oceans Programme, Food and Agriculture Organizations of United Nations, Rome, Italy, <sup>5</sup>BirdLife International Marine Programme, Royal Society for the Protection of Birds, Sandy, Bedfordshire, United Kingdom, <sup>6</sup>Seabird Conservation Programme, BirdLife South Africa, Cape Town, South Africa, <sup>7</sup>PercyFitzPatrick Institute, DST/NRF Centre of Excellence, University of Cape Town, South Africa.

Tuna fisheries in the Areas Beyond National Jurisdiction (ABNJ) are managed by five tuna Regional Fisheries Management Organizations (RFMOs). The RFMOs requires longline vessels operating below 25°S to implement at least two of three measures; bird-scaring line, night setting and line weighting. Observers can play important roles to facilitate, support and strengthen the use of best practice seabird bycatch mitigation measures by fleets. However, many national observers are not well skilled in taking the roles yet. Therefore, Birdlife International, as a part of FAO's Common Oceans programme, funded by Global

Environment Facility, developed an intensive, seabird-relevant observer training courses to deliver to observers from key tuna fishing countries. The observer training programme is comprised of lectures covering the biology of seabirds, best practice for seabird bycatch mitigation, scientific approaches to conducting experiments at sea, and practical sessions on seabird identification and using various measures. The programme enables observers to conduct at-sea trials to test the effectiveness of bycatch mitigation measures. The training has been provided to Korean observers and multiple at-sea trials to test line weighting options has been successfully conducted. Participation of different national fleets in at-trials is expected and this will enable tuna RFMOs to measure and improve the effectiveness of seabird bycatch mitigation measures. Ultimately, our goal is bycatch mitigation best practices adopted by at least 40% of the tuna vessels operating in the RFMO's areas. Increasing observer coverage rate and implementing electronic monitoring system will be necessary to achieve the goal.

## Session 4. Reducing risk in a high risk job.

**Leader: John LaFargue**

Observers encounter many hazards working on commercial and recreational fishing boats. They encounter everything from poor vessel conditions and extreme weather to harassment, disease and violence. This session identified such hazards and what has been done to successfully mitigate them. We also explored remaining needs, and identified strategies that will resolve them. In particular, we heard about the hazards that observers face and how education, safety equipment, and field support can reduce them and how to build a strong safety culture

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### **Oral Presentations - Extended Abstracts**

#### **Reducing risk in a high risk job – a Pacific Islands perspective**

**Peter Graham**

##### **Pacific Islands Forum Fisheries Agency**

Fisheries Observers play a critical role in fisheries management, in that they gather fundamental scientific information and data and should be able to do so in an environment free from obstruction, harassment, intimidation or assaults and any hindrance due to the condition of the fishing vessels in which they are deployed. However, Pacific Islands Regional Fisheries Observers (PIRFO) increasing role over the last few years with compliance monitoring of Western and Central Pacific Fisheries Commission' (WCPFC) conservation and management measures (CMM) has also increased the risks for observers.

Discussions about this being high risk job have been around for many years, and this Conference it is a great opportunity to share ideas and experience of how best to mitigate those risks.

PIRFO observers are faced with risks of injury due to poorly maintained longline fishing vessels, dilapidated deck and work areas, and risks to their safety because of the captains desire to review the observers data and communication difficulties with captains and crew that could lead to confrontational situations, and a tendency to self-harm. Secretariat of the Pacific Community (SPC) records for the FFA Member Country Observer programmes together with UST Observer Programme for the period 2014 and up and until July 2015, show that 391 incidents were reported, obstruction-intimidation of Observers the most common and the Master requesting Observer not to report a specific event.

With a large number of observers routinely deployed on vessels every year, averaging between 1700 and 2100 for the last 3 years, there is the opportunity to collect detailed information on safety standards and safety incidents that would be invaluable in an effort to

prevent or reduce the number of accidents, and every opportunity should be taken up. With such information at hand, observer training can be regularly modified so as to mitigate reoccurrence of such incidents.

To ensure that fishing vessels are safe and seaworthy, Fisheries Agencies are requiring inspections of the fishing vessels prior to licensing. Licensing conditions for such inspections currently exist in all FFA Member States, though not strictly adhered to. The primary focus of the inspections are to determine the quantity of fish onboard for catch reporting purposes, however it's an opportunity to examine the safety aspects of the vessels and inspected areas include the deck and work areas, wells and freezers, galley, and sleeping quarters noting that many Pacific Islands observers are a lot bigger than the area built for the smaller Asian crew member. Examining the vessels' documentation including the registration and survey certificates is also important. The validity of the safety equipment is also checked.

Although pre-fishing inspections are part of the licensing conditions, there have been numerous times where many of the longline fishing vessels are already at sea and usually there for long periods of time, and the Owners have convinced the licensing authorities to forgo such pre-fishing inspections. This practice however is changing as Members become more aware of the risks this poses for IUU fishing and safety of observers, and ensure vessels are being inspected prior to receiving their license, if not in the port of the licensing authority, at one of its' neighbors.

As many of the longline fishing vessels fishing within the Pacific Islands are at sea for long and extended periods, it is inevitable that the conditions of the vessels will deteriorate, and enforcing the requirement to have them inspected by the licensing authorities at least once a year, the renewal of the fishing license was seen as the most opportune time.

Prohibiting transshipment at sea, thereby forcing the fishing vessels to offload their catch at the port, enables licensing authorities to properly inspect the vessel itself and the examining safety gear and equipment aboard. Fisheries Port Inspectors are also now more committed to inspecting all safety gear and equipment, and incorporating such in the process prior to licensing.

The difficulties posed by the lack of communication because the captain and crew speak a different language to the Observer, though not a safety risk in itself, has caused confrontational situations to arise. Understanding cultural sensitivities helps observers and observer placement officer better understand the people they are working with and forms part of the PIRFO training. It is introduced and drummed into the observers during their initial training and they are reminded again during debriefing sessions. Involving the vessels' Company Agent, who usually has good command of English, in the pre-fishing inspection and observer placement briefings, goes part of the way towards mitigating the language barrier. Even when asking such basic things as where are the vessels' safety gear and enquiring about basic emergency procedures, can cause offense if not properly communicated, therefore having the Agent present and translating helps. It also means that if issues with the safety of the vessel arises or becomes evident, he has first-hand knowledge and then obligated to rectify the issue.

Complacency among many of the Asian fishing vessel Masters to forego regular safety drills or ensuring their safety equipment is regularly checked and still useable, has made Pacific Islands Observer trainers lift the benchmarks in regards to competency of observers in firefighting, damage control, first-aid and 'man over board' procedures and skills.

With the WCPFC expanding and strengthening the safety provisions for the Regional Observer Programme (ROP), through new minimum standards that come into force as of 1 January 2017 requiring that each ROP authorized observer programme shall ensure that when undertaking ROP-related trips, observers are equipped with an approved independent two-way communication device and a waterproof personal lifesaving beacon.

The minimum standards also provide that each ROP authorized Observer programme will ensure that they have an "Emergency Action Plan" (EAP) in place to accommodate any reported observer emergency including interference, harassment, intimidation and other personal safety issues.

The EAP must include communication protocols and appropriate contact information used in an emergency and as a minimum will include - when to report; who to report to (*noting there must have a 'Designated Officer/s' who is responsible for maintaining a device capable of receiving a signal from an approved independent 2-way satellite communication device*); Follow-up responses (*established procedure to initiate contact with observer, the vessel, and, if necessary, the appropriate enforcement authority; this procedure must also include clear procedures that must be taken in the event of various emergencies*); remedial action (*appropriate measures to address violations made against observers and be resolved through real legal and nationally recognised procedures including appropriate punitive measures against vessel captains or crew found guilty*).

As many FFA Member countries do not have written EAPs, FFA Secretariat is working with Members to develop such procedures that are compatible with the WCPFC minimum standards and the proposed conservation and management measure on observer safety, and will work with them to ensure they are properly implemented. Appropriate training will be undertaken with the observers and their Coordinators to ensure that not only do they have an understanding of the use of such tools, but are actually competent in their use.

Having such additional personal communication equipment would also alleviate the use of the fishing vessels communications equipment and confrontational situations arising.

With respect to self-harm, observers are being asked to report any concerns they have, as part of their regular scheduled reporting to their program coordinator.

At the 13<sup>th</sup> Annual Ministerial Forum Fisheries Committee Meeting in Port Vila, Vanuatu,

(5 – 6 July 2016), Ministers **stressed the importance** of expediting work to ensure the safety of observers in the performance of their duties, noting their fundamental role in collection of data for fisheries management and compliance purposes.

FFA has been encouraging its Member to be proactive with pursuing Observer-related violations identified during debriefing of Observers as Members have been rather complacent in the past.

At a recent Judicial Seminar for Chief Judges, Judges and Magistrates from FFA Members countries held in Honiara, 25 – 27 July, observer safety was again discussed with an emphasis on violations against observers and considerations to reviewing the penalties against offending vessel Masters and crew so they are commensurate with the offence.

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### **Recent Actions in the WCPFC to Improve Observer Safety and Security.**

**Karl Staisch<sup>1</sup> and Bubba Cook<sup>2</sup>**

**<sup>1</sup>WCPFC <sup>2</sup>World Wide Fund for Nature (WWF)**

Mr Staisch provided the first part of this presentation, which addressed the implementation of the adopted measures to date, including any challenges or obstacles faced. Mr Cook presented the second part of the presentation, which addressed some of the technological tools available that potentially meet the requirements of the measure.

Mr Staisch described the genesis of and basic structure of the Western and Central Pacific Fisheries Commission (WCPFC) as well as the Regional Observer Programme (ROP). He noted that as the Regional Fisheries Management Organization (RFMO) charged with managing the single largest tuna fishery on the planet, the WCPFC depends heavily on observers, who perform a critically important job in the fisheries management process by providing fundamental scientific information, serving an indispensable role in monitoring compliance, and being the eyes and ears for their country and the region. He emphasized the large size of the WCPFC Convention Area and the commensurate large responsibility for observers and observer programmes.

Mr Staisch went on to explain how the ROP is comprised of qualified National Observer Programmes subject to meeting minimum standards subject to an audit, ensuring a high quality of performance of observers and programmes. He noted that the ROP, comprised of subregional and national programmes, involves 23 separate countries and agencies further made up of approximately 1200 observers, 50 observer debriefers, and 2 WCPFC ROP staff. He further explained that there are approximately 2800 observer trips per year with about 200-250 observers on those trips at any one time. He explained that the data collected by these observers is submitted to the Commission and considered Commission data.

Mr Staisch strongly emphasized that the WCPFC has always considered observer safety a priority and have a number of standards in place that authorized programmes have met, as well as this many programmes have additional safety measures in place. He noted that following recent incidents involving the death or disappearance of observers in the Pacific Ocean, the WCPFC for the first time elevated observer safety to a separate high level agenda item in 2015 to better address observer safety and security. As a dual step, the WCPFC introduced and approved a proposal specifying that by January 2017: (1) Each observer program shall ensure that observers from their program be provided an approved independent two way communication satellite device and a waterproof personal lifesaving beacon before any boarding for a trip; and (2) Each observer program will ensure that they



have an “Emergency Action Plan” (EAP) in place to respond to reported observer safety issues.

Mr Staisch elaborated that the first requirement may consist of a single device such as “Satellite Emergency Notification Device” or it may be a combination of an independent satellite-based system such as a Sat phone plus a personal lifesaving beacon (PLB). He also elaborated that the EAP must include communications protocol and appropriate contact information in an emergency and as a minimum will include: When to report; Who to report to; Follow up responses; Remedial action; and Legal or nationally recognized procedure. He further noted that the two provisions must work in concert to be successful and that the technology must be effective and reliable, with transmission capability 24 hours a day and 365 days a year around the globe.

Mr Cook then took the podium to describe the variety of technologies available that were determined to meet the WCPFC proposed standard. He described the technologies as consisting of two categories. Category 1 consisted of standard distress beacons, which included: Digital Selective Calling (DSC) units; Personal Automated Identification System Transponders (PAIST; also called Man Overboard or MOB transponders); and Personal Locator Beacons/Emergency Locator Transmitters (PLB/ELTs). Category 2 was comprised of two way emergency communication devices that included: Satellite Emergency Notification Devices (SENDs); and Satellite Telephones (Sat Phones).

Mr Cook discussed the advantages and disadvantages of each technology and the process by which the WCPFC focused its recommendation. He noted that the DSCs and PAISTs were limited in their range and effectiveness, ruling out their use in such broad expanses of the Pacific thereby making the much larger range of the PLB/ELTs a preferred option. Mr Cook further addressed the use of a combination of a SatPhone and PLB combination, but noted that it is difficult enough to carry one device, much less two devices of which one can be quite bulky. He noted that, due to the combined features of the SEND units to operate as both a two-way communicator as well as a PLB, those features made them the preferred option.

Mr Cook further noted that the costs in relation to the benefits was heavily weighted toward the benefits with the capital and operational costs for a single unit over one year being around that of the ex-vessel value of two average sized yellowfin tuna or roughly about \$350USD. He concluded by observing the outstanding progress that the WCPFC accomplished in such a short period of time.

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## **Open Discussion Session**

**Andrew France, New Zealand**

*Question/Comment*

Are pretrip checklists tailored to different vessels and fisheries?

*Response*

**Lauren Carroll (NOAA)**

The same checklist is issued for all types of vessels and fisheries.

**Dennis Hansford (NOAA)**

*Question/Comment*

What is the “Green Dot System”? How many harassment cases realize successful prosecution and if the funds received are recycled into assistance for victims of those cases? How does enforcement assist with the funding for the victims of harassment/assault?

*Response*

**Jaclyn Smith (NOAA)**

“Green Dot” marks vessels as problem vessels in order for observers to know that there were problems in the past. The STAR program is able to help financially in some cases. Enforcement is still trying to get more funding regarding assisting victims.

Prosecution shouldn’t be what we base success on. We should base success on observers being comfortable enough to come forward and let us know that something happened. The last thing that should happen is to re victimize an observer after an incident.

**Unidentified from the North Pacific Observer Program**

*Question/Comment*

Are there any “no go” items on your safety checklists?

*Response*

**Lauren Carroll (NOAA)**

Yes, all items must be current and in order for the vessel to sail with an observer. If all items on the list are not current, the observer fills out an incident report for a safety deficiency.

**Karl Staisch(WCPFC)**

The vessel safety certificate that is used by the commission is based on the USCG safety vessel check system. The final word lies with the observer. If the observer is unhappy with the way the vessel comes out on the safety certificate they can refuse to board. The authorities where the vessel is in port are encouraged to make the vessels rectify any safety deficiencies so an observer can be placed onboard.

**Howard McElderry (Archipelago Marine Research Ltd)**

*Question/Comment*

Proposed the idea that as observers have a larger presence on vessels over time, their documentation of the vessels safety procedures/drills can lead to improvements in the safety procedures. There is a huge benefit to the programs by promoting these conversations.

*Response*

**Lauren Carroll (NOAA)**

The observers do an orientation and general check of the vessel for their safety plan and drills. Vessels are more likely to do the required drills with an observer onboard.

**Siosifa Fukofuka(New Caledonia)**

We have a comprehensive safety checklist that the observer, captain and coordinator sign.

**Dennis Hansford (NOAA)**

*Question/Comment*

To Bubba Cook, You said that SEND units are more cost effective. What are the costs?

*Response*

**Bubba Cook(WWF)**

They are cheaper to operate than a SAT phone. The units cost around \$300 and a plan for \$100, "roughly the cost of two good size yellowfin tuna", pretty cheap investment to insure the safety and security of observers. SEND units provide the most features for the most economic price. They provide two way texting and act as a PLB. A transshipment observer has been using it to post on FB and keep tabs with friends and family, it can be an effective psychological tool. Independent communication is very important as well. The units can be used privately so vessel personnel can't listen in.

**Amanda Barney (Ecotrust)**

*Question/Comment*

Appreciated the way Jacquelyn highlighted explaining the statistics to people. Recently she had to deal with a situation and the first thing the victim did was to say they hadn't acted inappropriately. It's very important that a woman shouldn't be ashamed of what happened to her and to empower them. Is there a process if a case doesn't get prosecuted, that you can say to an employee "thank you for reporting this and this vessel will no longer get a female observer"?

Do female techs have same protection as the observers?

*Response*

**Jaclyn Smith(NOAA)**

I'm looking into giving more assistance to victims in order for them to be able to work. I need to look into regs regarding female techs.

I can't tell an observer not to go on a vessel because she is a female. The contractors are the ones that place observers.

**Judy Dwyer (DFO)**

*Question/Comment*

What is involved with the auditing process? Can you tell us who conducts the audit and what kind of criteria is used?

*Response*

**Karl Staisch(WCPFC)**

Each program must meet a list of standards in order to be authorized as a ROP. Some programs don't initially meet the standards, so we send a representative in to help them meet the standards. Every two to three years we meet with the program to make sure the ROP is still meeting all the standards.

**Judy Dwyer (DFO)**

*Question/Comment*

How is the audit done, is it a paper audit or do you talk to observers or the providers?

*Response*

**Karl Staisch(WCPFC)**

Normally we go to the program in person, go through the standards to check the information collected, and talk to observers and their hierarchy. We look at the training facility. It takes three to four days to conduct an audit.

**Reuben Beazley (Seawatch)**

*Question/Comment*

What are the steps that documentation of an incident go through to get to enforcement?

*Response*

**Jaclyn Smith(NOAA)**

Multiple options are available in order to remain flexible, including SAT phones, radio, ATLAS and SEND units can be used to send an OL message to management.

**Unidentified**

*Question/Comment*

Is there a minimum reporting time to trigger action, if so what is it?

*Response*

**Bubba Cook(WWF)**

Ideally you have a daily check in, but that's up to the ROPs. It's very easy with the SEND units. They are light weight and should go everywhere with the observer.

**Tom Knudson (Reveal News)**

*Question/Comment*

For Peter, can you give specific examples of harassment? Have observers been hurt on these boats? Have you ever heard of any observers being thrown over? For Carl, you mentioned two observers that have been lost, can you tell me a little bit more about those cases.

*Response*

**Peter Graham (FFA)**

They are mostly obstruction from going in to the wheel house to check vessel position and intimidation. Carl could go into more detail.

**Karl Staisch (WCPFC)**

They could be anything from hiding the observer's gear to intimidation by not feeding them. There have been some cases of actual harassment that have been followed upon by enforcement. There have been several deaths, two in Papa New Guinea, one was a murder, and the other observer disappeared from a vessel. Some think they may have committed suicide.

**Dennis Jaszka (North Pacific Observer)**

*Question/Comment*

Using the new technologies available to you, who is capable of responding to an emergency and have you, highlighted any concerns with relaying emergency calls?

*Response*

**Bubba Cook (WWF)**

It's important to have an EAP in place and know who is at the end of the line and what they are required to do.

Multiple organizations work together in a rescue situation.

**Sara Cierpich (NOAA)**

*Question/Comment*

When a vessel is found to be unsafe, what is the process to get a vessel up to standards?

*Response*

**Panel**

Vessels can't deploy without observers. OLE backs up observers.

Sometimes there is a suspension of the vessels permits until they fix the problems.

In the Cook Islands the threat of suspending licenses normally gets them to react. Most Pacific Islands have a similar system as Cook Islands, purse seiners are 100% coverage, so a vessel cannot leave port without an observer.

**Bubba Cook(WWF)**

There is a responsibility on behalf of the observer to report on safety issues. However, it is a matter of trust between the observer and observer authority that the observer's claim is not only heard, but supported. If observers worry that they might not get another assignment they will be reluctant to report. For instance, consider if an observer is very thorough in the execution of the vessel safety checklist and finds a variety of safety issues that results in the vessel being delayed dockside. Now consider if that observer is then retaliated against by an authority instead of that authority firmly seeking that the vessel corrects the discrepancies. That would send a chilling message to all the other observers that the concerns of the vessel, financial or otherwise, take priority over any safety and security concerns of the observer, resulting in a lack of confidence in the system that discourages observers from reporting those safety and security concerns out of fear of reprisal

**Liz Mitchell (APO)**

*Question/Comment*

Would it be helpful for observers to record problems with harassment even if they don't want official action?

*Response*

**Jaclyn Smith (NOAA)**

Yes, even unofficial documents would help to have a general history of issues. There is a myth out there that there are a lot of false reports, which is untrue. Harassment is rarely falsely reported. It is underreported. In AK STAR suggest that only 10% of these crimes are reported.

**Liz Mitchell (APO)**

*Question/Comment*

How can you identify trends of harassment? Do you feel harassment is on the rise?

*Response*

**Jaclyn Smith (NOAA)**

Feels that it is not on the rise, stats suggest that it is fairly consistent throughout the years, reporting is increasing because observers are feeling more comfortable coming forward.

**Chris Rilling (NOAA)**

### *Question/Comment*

Who is paying for the SEND units? If you add the cumulative cost of deploying 300-400 units the cost can be quite high. Who is bearing that cost, the commission, independent countries, the industry?

### *Response*

#### **Karl Staisch (WCPFC)**

It's a combination of industry and the observer program. Industry benefits from observers so they tend to pay for most of it. The commission has funds available that programs can apply for.

#### **Bubba Cook(WWF)**

Technology is just the first step; there are still other measures to secure the safety of observers at sea. FFA is developing a Person of interest list, we already have a vessel of interest list, but "Vessels don't commit crimes...people do."

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## **Poster Presentations – Extended Abstracts**

### **Observer Safety Program Reviews**

#### **Richard Kupfer**

#### **National Oceanic and Atmospheric Administration, Fisheries Service (NMFS)**

#### **Background**

Fishery observers are deployed on commercial fishing vessels and in processing facilities to collect data for National Oceanic and Atmospheric Administration Fisheries Service (NOAA Fisheries) to use in the management and conservation of marine resources and preservation of economic potential and protected species. This information is used to support fisheries science and fisheries management decisions nationwide. NOAA Fisheries regional observer programs (ROPs) cover deployment of observers in 7 geographical regions across multiple fisheries, and are guided by the NOAA Fisheries National Observer Program (NOP) (<http://www.st.nmfs.noaa.gov/observer-home/>).

Commercial fishing is one of the most hazardous occupations in the United States with a fatality rate 39 times higher than the national average (CDC/NIOSH 2014, <http://www.cdc.gov/niosh/topics/fishing/default.html>). Observers are regularly exposed to the same dangers as industry personnel and suffer the same injuries and illnesses recorded in all monitored fisheries. The recent loss of two NOAA Fisheries trained observers, one in a domestic fishery and one in an international fishery, as well as a foreign observer on a US vessel, prompted NOAA Fisheries leadership to request a review of Observer Program safety

policies and practices. While minimum observer safety training requirements have been standardized nationally, safety practices and policies are governed by USCG regulations and the Magnuson-Stevens Act, as well as additional regionally-specific requirements. In reviewing the safety of US observers, it was clear that a more comprehensive approach, than just evaluating safety training standards, was needed.

## Review Design

In a new approach for the agency, NOAA Fisheries decided to aggregate all elements that may have an influence on observer safety into one framework called a “Safety Program”. In building this new framework to review, NOAA Fisheries asked all the Regional Observer Program (ROP) managers and their respective Safety Advisory Committee members to work with the National Observer Program (NOP) to identify all the elements that influence observer safety. The identified safety elements represent the core of NOAA Fisheries Observer Safety Program, and are broken out into seven major groups with multiple review tasks in each group.

### 7 Core Safety Elements

1. Safety Reporting
2. Communications
3. Practices & Policies
4. Training
5. Equipment
6. Regulations
7. International

In order to conduct this review, NOAA Fisheries is hiring a team of independent auditors to compile documentation on current policies and evaluate their application to the practices of NOAA Fisheries Observer Safety Programs. The experience requirement for the audit team was defined by the specific elements that NOAA Fisheries is requesting be reviewed. The audit team will travel to each ROP to observe trainings and policies in practice. They will also be conducting interviews with key personnel and meeting with Observer Provider companies to evaluate continuity between NOAA Fisheries’ and the provider company’s policies. In addition to visiting ROP training centers, the audit team will also be traveling to field offices to evaluate Safety Programs with the compounded difficulties of remote operations.

During the review of the Regulations and International core elements, the auditors will be tasked with reviewing NOAA Fisheries and the United States regulatory responsibilities to identify any gaps between the two. They will also be comparing NOAA Fisheries defined role with the international observer community to identify any areas of responsibility that require greater clarification or that do not match with NOAA Fisheries national standards.



Once all data has been compiled and the on-site visits have been completed the review team will analyze the data and present its findings in an initial report to NOAA Fisheries six months after the review process begins. The final report will be presented three months after the initial report to include any processes/programs that were not able to be fully evaluated during the initial review phase. The additional three months are needed due to the scheduling of regional Observer trainings which correspond to fisheries and industry needs rather than management and review needs.

## **Outcome**

The overarching goal of this review is to evaluate current NOAA Fisheries observer program safety practices to identify gaps and recommend changes to the working environment that will result in improvements to mitigate the dangers inherent to the industry and observers. In addition, the results of this review will be used to make recommendations that will allow for the development of flexible self-evaluation tools that will adapt to changing safety concerns as they evolve. Each ROP and the NOP will be able to use these self-evaluation tools to continually monitor and change Observer Safety Programs while potentially setting an agency standard for risk assessment. The identification of regional, national, and industry “best practices” along with the ability to continually monitor changing safety risks will help ensure the safety of our observer community. NOAA Fisheries intends to share the results of this review, and the agencies response with all of its fisheries management and observer program partners. By sharing the lessons learned from this review, NOAA Fisheries hopes that all of its domestic and international partners will be able to benefit for sake of ensuring the safety of our global observing community.

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## **Observer Safety On The U. S. West Coast, Vessels 18 To 680 Feet In Length**

**Thomas Holland and Scott Leach**

**NOAA Fisheries, United States**

**Pacific States Marine Fisheries Commission, United States**

Preparing observers to board vessels that range from 18 to 680 feet requires safety training that is both broad in scope and yet specialized to the size vessel observers are likely to encounter. On the U.S. West Coast, observers that observe for the Northwest Fisheries Science Center (NWFSC) are deployed by the West Coast Groundfish Observer Program (WCGOP) on small catcher vessels (18-98 ft), and the At-Sea Hake Observer Program (A-SHOP) on larger at-sea processing vessels (256-680 ft). The catcher vessel training takes place in Newport, Oregon while the processing vessel training is in Seattle, Washington. The NWFSC safety trains on average 147 observers a year. The A-SHOP averages 48, while the WCGOP averages 99 trainees a year.

To become a safety trainer at the NWFSC, you must first be trained yourself. Prospective trainers attend a week-long class conducted by the Alaska Marine Safety Education Association (AMSEA). The class covers hands-on safety lessons as well as basic teaching

techniques. The future trainers demonstrate all of the skills they will be teaching to observers. Also covered is a case study where supervisors had insufficient training for an emergency situation. To be certified to teach observer safety, NWFSC requires attendance to this class and a refresher class every three years. They also require a current certification in first aid and CPR.

The NWFSC follows guidelines specified by AMSEA in the training of all observers. For example, all observers must be able to don an immersion suit in 60 seconds or less, and observers must be able to enter a life raft from the water. Lesson plans are prepared, and followed, for all topics covered in a training. To insure the safety of the observers as well as the trainers, National Observer Program (NOP) student to trainer ratios are followed. This increases safety and maintains an individual approach.

The two training programs have many similarities and overlap on drills conducted and topics covered. Safety issues present on both catcher and at-sea processing vessels trained in both programs include: fire safety and hands-on firefighting, signals and hands-on flares, flooding drills, man overboard drill, abandon ship drill, donning an immersion suit, swim positions, righting a life raft and familiarization with both observer program issued and vessel safety equipment.

The challenges and conditions present on at-sea processing vessels compared to catcher vessels is quite different. Observers on at-sea processing vessels have trips averaging 21 days, where they will conduct their sampling below-deck in the vessel's factory. Observers on catcher vessels take trips ranging from 1 - 25 days, where sampling will occur on the open deck, in close proximity to net reels, winches, longline gear or pots. Unlike at-sea processors which only fish with trawl nets, catcher vessel observers can encounter multiple gear types including rod and reel, trawl, troll, pot and longline. The A-SHOP also includes training for hazards found in fish processing factories and larger vessels, while the WCGOP trainings focus on smaller vessels and their inherent dangers. An outline of the similarities and differences presented here are an example of the dangers observers face and how to best prepare for them.

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## **Conducting Effective Training Drills During Observer Safety Training: Building Muscle Memory and a Strong Safety Culture**

**Adriana Myers**

**North Pacific Observer Program, Fisheries Monitoring and Analysis, Alaska Fisheries Center, National Marine Fisheries Service, NOAA**

***“Luck favors the prepared”***

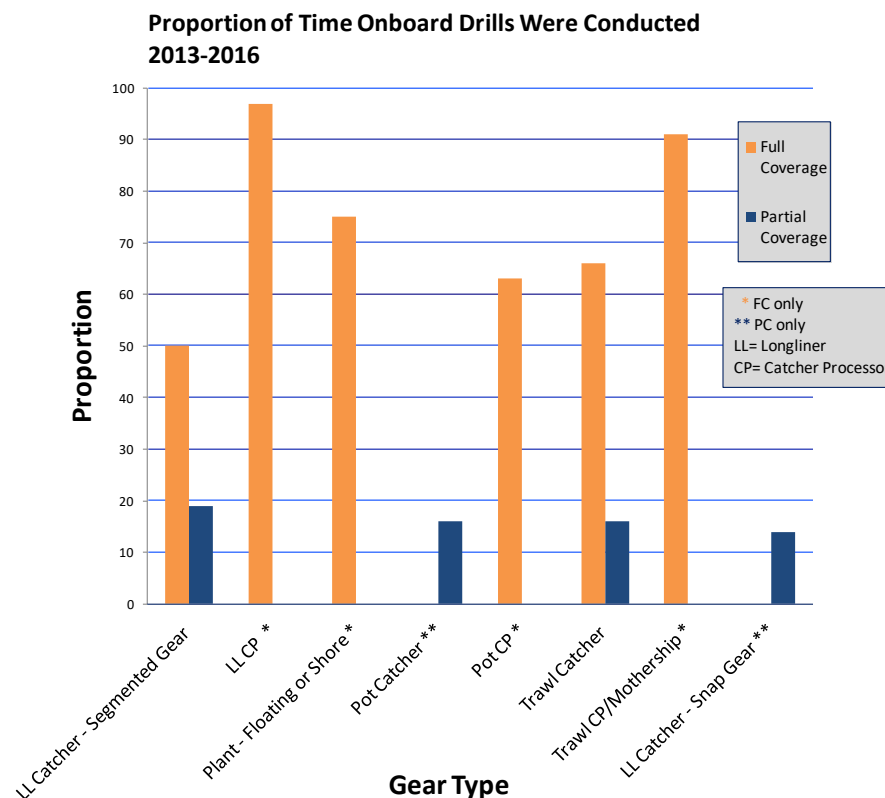
Commercial fishing continues to be ranked as one of the deadliest occupations both nationally and internationally. The United States Coast Guard requires commercial fishing vessels to conduct hands on safety drills once every month. All fishing boats in Alaska are subject to an inherent amount of danger and it is crucial that everyone onboard receives the

proper practice to know how to respond to an emergency. It is important to recognize that not all fishers receive adequate training or will act appropriately in an emergency. Adequate safety drills are one of the most efficient and successful ways to practice response plans and ensure that everyone on board understands and demonstrates their preparedness in a real emergency.

Among the many challenges that fisheries observers face when working aboard commercial fishing vessels, safety is the primary focus. The North Pacific Observer Program assumes the responsibility to best prepare observers.

Fisheries observers in the North Pacific Observer program assigned to large fishing vessels that are required to carry an observer at all times are more likely to experience and participate in emergency drills since they are deployed for longer periods of time. However, based on observer data recorded on their Vessel Safety Checklist, small fishing vessels that only have observer coverage during selected trips rarely conduct safety drills while the observer is on board. This creates a unique problem in which observers don't have the opportunity to practice emergency plans with the rest of the crew and assess if the crew is prepared to act properly in an emergency.

Observers are required to complete a thorough Vessel Safety Checklist before the vessel departs the dock. The frequency of safety drills conducted while onboard is reported on this Safety Checklist. These data are recorded and summarized by gear type and coverage sector by all observers in a post deployment survey. Figure 1 illustrates the proportion of time drills were held while observers were onboard based on these data.



## Figure 1

Since drills are essential to keeping our observers prepared in case of an emergency, all our trainings and briefings at the North Pacific Observer Program incorporate safety drills. At the core of our safety drills are the Seven Steps of Survival:

1. Recognition
2. Inventory
3. Shelter
4. Signals
5. Water
6. Food
7. Play

Our drills require the observers to work in teams with a variety of exercises. One such exercise is to complete a station bill and conduct abandon ship drills in which everyone is assigned a specific duty as outlined in the station bill. Drills are focused on what the observer may encounter and be expected to do.

Practicing these drills on a regular basis as part of the North Pacific Observer Program training curriculum builds muscle memory which is an excellent tool to condition the body on how to properly follow the seven steps of survival and effectively prepare our observers. Drills also contribute to promote a strong safety culture among our fisheries observers who learn to feel responsible for their own safety and pursue safety practices on a daily basis to minimize risk.

***“It’s better to be careful 100 times, than to get killed once”*** - Mark Twain

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## Observer Safety: Communication and Education

**Katie Herrera**

**Riverside Technology, Inc.**

Two areas that can greatly affect safety at sea are communication issues and levels of safety education. Communication between a company and their observer, and observer and their captain and crew, and the vessel with land based emergency responders such as the Coast Guard are connections that need to be established and maintained. Educating our offshore community on safety measures directly tailored to life at sea would also improve safety levels. As a former observer, I am now tasked as an assistant observer coordinator with the pelagic observer program and have seen, first hand, the gaps in a system that can be greatly improved. My display will discuss ways to bridge those gaps in communication and safety by addressing ways to improve upon areas such as: communication breakdowns at sea,

outdated communication equipment used by vessels and land based operations, and safety resources and training designed for both observers and captains to survive and thrive with only basic offshore tools. Safe environments are made and upheld when everyone is an active and engaged participant.

Our ambassadors on the sea, observers, are faced with a myriad of challenges. Communication problems occur on all sides of the complicated relationship observers have with all entities involved. The captain and crews of the vessels, the Coast Guard, the contract company, and the observers themselves all have a responsibility to ensure the wellbeing of all offshore parties. The fleets of each observed industry are just as diverse as the species interacted with. In the Pelagic Observer Program based out of Miami, FL, 18% of our vessels are run by captains and crews where English is not the first language spoken. The potential for language barriers is increased, with the observer ending up at a disadvantage. Without being able to accurately communicate information of any kind, things become lost in translation. Vessels run by speakers of a foreign language should have just as much consideration given to them in regards to communication as the rest of the fleet. Presenting materials such as selection letters, observer information, United States Coast Guard contacts, and new Federal regulations, will bring everyone to the same understanding. By not doing this, undue pressure is placed upon the observer to help educate these individuals on new regulations.

S.O.S stands for Safe Observer Sticker. It's a basic design that effectively communicates what to do should an observer become incapacitated, especially on vessels where the observer's native language is not the first one spoken. Stickers can be easily translated to different dialects, spoken frequently in each program. These stickers were constructed to be placed on observer gear bag/clipboard/Grundens/boots/personal items etc but could also be placed in a multitude of areas on a vessel (with permission) selected for observer coverage. The material is weatherproof and durable for any offshore condition. The sticker is a highly visible, direct reminder, of the order of operations an observer program would want a vessel to follow should their observer experience an emergency at sea. By immediately contacting the Coast Guard, an emergency situation offshore now has the awareness it needs. An effective protocol for our observers also ensures an effective protocol for vessels and their crews, even when an observer is not present.

Offshore, most communication is between land based operations are done through radio signals. While this works great for our vessels, however if an observer was ever in a situation where they didn't want information broadcast to a wide network of individuals, there wouldn't be an option. The Pelagic Observer Program (POP) uses InReach by Delorme, which allows our observers a confidential means of relaying information about their well being and status offshore. This device features an app that observers can download to their smartphone to make use easier. There is also an SOS feature and GPS tracking should the observer need them. In times where it has been necessary to communicate with an observer during an emergency situation, it has proved to be invaluable. It is an affordable and direct way to keep up with our observer fleet while they are deployed. Other means of relaying confidential information between the observers and their programs are satellite phones and Iridium Go. Satellite phones being a great way to relay information quickly and efficiently and the Iridium Go network allows the user to have phone call, internet, SMS, SOS capabilities.

An observer is a diverse role in which to take on. They are educated in the sciences, first aid/CPR response, and data collection. While our observers carry a large amount of education and awareness going into the offshore environment, vessel captains and crews more than likely will not carry the same knowledge. For example, United States Coast Guard requirements state that captains are only required to seek First Aid/CPR instruction once in their life. Increasing the vessel operator's understanding of health and safety increases the safety and health of everyone around them. A great program to encourage both observers and Captains to attend, is run by the National Outdoor Learning School, NOLS. This non-profit organization holds a class centered around wilderness survival. An offshore environment is not a place filled with large quantities of medical supplies and a doctor at the ready. This organization teaches students how to deal with an emergency out of range of traditional treatment. Students are taught how to assess a patient, make appropriate evacuation decisions, and effectively administer first aid to injuries occurring commonly in a wilderness/offshore environment. Observers are well trained in offshore safety, taking a one-week safety course. Improvements to USCG captain's requirements to include safety awareness, would be highly beneficial in an offshore emergency. A safe environment is one without risk. This is something that as programs we cannot guarantee in an offshore commercial fishing environment, but there are certainly steps we can take to ensure risk is as minimal as possible including keeping open lines of communication and increasing safety training.

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## **Timeline and Lingerin Questions Regarding the Disappearance of a Transshipment Observer**

**By Elizabeth Mitchell**

### **Association for Professional Observers**

The observer community and observer program managers were shocked and heartbroken by the September 10, 2015 news of the disappearance of our dear friend and colleague, Keith Davis, a transshipment observer on assignment aboard an Inter-American Tropical Tuna Commission (IATTC) transshipment vessel. Keith chaired the Observer Professionalism Working Group (OPWG) at the IFOMC for many years and was a former board member of the Association for Professional Observers (APO). He helped draft the International Observer Bill of Rights (IOBR) and Codes of Conduct for Responsible Observer Programmes – Health and Safety (CCROP-HS) and Stakeholder Responsibilities (CCROP-SR), which was presented at the 7<sup>th</sup> IFOMC in Chile, 2013. Keith Davis had an unwavering commitment with seemingly limitless energy toward improving the profession of observers and was instrumental in elevating the level of observer professionalism and participation at this conference. Keith's disappearance sent rippling trepidations throughout the observer community and all remain without closure. In absence of any official statement regarding the investigation, this is an attempt to piece together available information. This timeline is based on updates from Keith's employer, MRAG Americas (September and October 2015); phone and e-mail conversations with the FBI (October 2015, August 2016 and October

2016); US Coast Guard documents during the investigation; some of Keith's last photographs and data entries on the Victoria No. 168; and previous knowledge of Keith.

**In 2009**, Keith began working as a Western and Central Pacific Fisheries Commission (WCPFC) transshipment observer for MRAG Americas. In July 2009, at the 6<sup>th</sup> IFOMC in Portland, Maine, USA, Keith helped organize a meeting of stakeholders in transshipment observer programs. At this meeting he showed a video that highlighted potential human trafficking conditions – a vessel capacity of 25 with 65 crewmembers on board, sleeping in the halls and on the decks. He also mentioned the difficulty in counting and identifying fish in this program. It is typical for the fish being offloaded to have most of their identifying characteristics previously removed and often observers are expected to count and identify the fish without adequate access to them.

**In 2011**, when returning from a WCPFC Transshipment trip, Keith had experienced harassment on board a Japanese transshipment vessel. I encouraged him to report the harassment to the responsible agency, which he apparently did.

**In 2013**, after one of the panel presentations at the 7<sup>th</sup> IFOMC in Viña del Mar, Chile, Keith commented that RFMO officials were not doing enough to protect fisheries observers. The following morning, Keith told his family and colleagues at the conference that he had been approached and told to “back off” and that he “didn’t know what he was getting into”. He appeared visibly shaken and declared that he would retire from the transshipment observer programs.

**In 2015**, Keith had decided to return to the Transshipment Observer Program, this time for the IATTC, and boarded August 5 the M/V Victoria 168, a Chinese operated, Panama-flagged transshipment vessel. This vessel accepts fish from Gilontas Ocean Group, based in Taiwan and delivers to Rocmar Seafood, S.A. located in Panama.

**August 5 to September 4, 2015**, Keith entered photo and video documentation of transshipments. Taking at least 167 photos, there may have been more after this date because he collected data until the day he disappeared. The subject of the photos included vessel identification characteristics (call signs, names painted over previous names, company insignias on smoke stacks, vessel registration numbers, and port names); 50 photos of fish needing identification confirmation or further discussion (mostly sharks and billfish, but also some tuna); and camera and video documentation of marine pollution violations on half of the fishing vessels and the Victoria 168.

**August 20 – 31, 2015:** Keith sent a series of e-mails to NOAA fish identification experts to suggest additional work was needed to create improved fish identification materials for transshipment observers. Most of the fish were fully dressed, missing most identifying characteristics. He advocated for requiring the tuna to be left whole, which would facilitate positive identification to species, as he believed this was necessary to prevent tuna laundering.

**August 30, 2015:** Keith made notations that Chung Kuo No. 858 “had cancelled due to death of Indo crew.” On September 2, Keith reported more crewmember injuries: “Chung Kuo No. 818 also cancelled...back to port...sick crew member.”

**September 5 or 6, 2015:** Keith transmitted data to MRAG on schedule.

**September 7, 2015:** MRAG exchanged e-mails with Keith about disembarkation and travel plans.

**September 10, 2015:** Keith recorded his last transshipment (Chung Kuo No. 818) and noon position:

09/07/15  
underway - 1025 15°30.78S / 91°33.20W  
7.9 kn / 65°

09/08/15 14°31.51S / 89°24.33W  
7.8 kn / 68°

09/09/15 13°16.95S / 86°42.75W  
7.3 kn / 69°

09/10/15 12°27.14S / 85°05.53W 39°

**September 10, 2015, 12:50 – 14:05 PDT:** Keith disappeared and was presumed overboard.

**September 11, 2015:** Original Message from the Victoria No. 168, reporting Keith's disappearance:

On Fri, Sep 11, 2015 at 4:44 PM, [REDACTED] <[REDACTED]@cwpanama.net> wrote:

From: VICTORIA168 <VICTORIA168@amosconnect.com>  
Date: 2015-09-11 11:50 GMT+08:00  
Subject: Shipboard Observer Men Missing  
To: "Miss. [REDACTED] 王雅玲" <[REDACTED]@gilontas.com>

To: Gilontas Ocean Co., Ltd  
Attn: Miss [REDACTED]  
Miss [REDACTED]

Vsl 10/Sep 0810 F/V Ck-818 Along Side

0835 Commenced Transfer work  
1130 Lunch Time Was with Capt together Have Lunch  
1450 2nd mate Have been see him from # 3 hatch ship side  
go back accommodation  
1605 Transshipment Finished C/O need he Signature Found Can't  
found him.  
1615 F/V Ck-818 Cast off  
1620 Vsl Every body do all vsl Search again and again could not  
found for.  
Fm 1620-2225 we are already do 3time all vsl's space cheked also not  
found is confirmed which men is not on vsl already. and then master  
Execution Expanding square sea searching Till 2230 also not found  
which men. and continue Exculte Expanding square sea searching for.  
2230 Contact Peru coast Callao MRCC dadio Telephone no body answer.

The Victoria No. 168 notified Gilontis Ocean Group headquarters **eight hours after Keith** disappeared, who then notified Rocmar Seafoods, the vessel's agent, some hours later. Rocmar Seafoods notified MRAG 12 hours after Keith disappeared, who notified the US Coast Guard (USCG) 5 hours after that. ***This clearly illustrates that immediate protocols need to be enacted for prompt reporting of missing, injured or ill observers.***

**September 11, 2015:** USCG briefed various investigative departments. USCG Investigative Service couldn't do anything because there was no evidence a crime had been committed. Peru's SRR (Search, Rescue and Recovery) couldn't go beyond the 200 miles (Keith



disappeared 500 miles off Peru). No assistance was available at the US Embassy in Peru or Ecuador. The Joint Interagency Task Force and the JIATF – Counter Drug Officer was alerted. A US C130 was approved for launching and could have arrived at the scene in 2 hours. They received clearance from US authorities but the plane was grounded in Peru for unknown reasons.

**September 12, 2015:** The USCG asked for information about the Chung Kuo No. 818, as the “reporting source (assumed MRAG) had concern about possible people on board from longliner that could be catching a ride back to shore (these people are not part of the standard crew).” ***This is important because potential suspects could have left the scene and the Chung Kuo No. 818 was never called into port or otherwise investigated.***

**September 13, 2015:** The Victoria No. 168 ended its 72 hour search for Keith, after which they made way for Manta, Ecuador but then changed plans to go to Panama (the vessel’s flag state) instead, which led to an additional 4 days delay in the investigation.

**September 20, 2015** early AM: The Victoria No. 168 arrived in Panama. Panama had decided they would lead the investigation and left the Victoria No. 168 unattended overnight.

**September 21, 2015**, AM: Panamanian authorities began investigation. The Chung Kuo was finally contacted by radio by US authorities.

**September 27, 2015:** The vessel allowed to leave for Ecuador to offload its fish. The FBI met the vessel in Ecuador to inspect the hold because they were not allowed to do so in Panama.

**November 29, 2015:** Despite an ongoing investigation by both Panama and the United States into Keith’s disappearance, MRAG Americas and IATTC placed another observer on board the Victoria No. 168 and business resumed as normal.

**May 25, 2016:** The IATTC reported at its 90<sup>th</sup> meeting, that its transshipment observer program is ***“operating without any major problems.”***

**October 12, 2016:** Panama closed its investigation. The FBI is keeping the case open.

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## **Classifying Hazards To Observers: Analysing Current Training And Suggestions For Improvement**

**Pat Carroll**

### **IAP World Service/ NMFS**

There are three readily identifiable hazards encountered by offshore observers. These are the marine environment, which includes vessels and ocean survival, vessel crews and factory personnel, as well as illness and various biohazards. Observer training to address these distinct hazards, is allocated unequally, if at all, to the possible detriment of the observers and observer programs

The first and most obvious hazard to observers would be the rigors and perils of the marine environment. Commercial fishing is consistently ranked as the most dangerous occupation in the United States, and observers are trained accordingly. A third or more of initial classroom and hands on training provided to new observers addresses this hazard. This training is standardized within observer programs in the US, following guidelines established by AMSEA{Alaskan Marine Safety Education Association}. This suite of training includes fire fighting, cold water survival and survival suits, signals, EPIRBs, as well as station bills, rescues, and Mayday calls. This training involves both classroom lectures as well as hands on interaction with rafts, flares, and various types of PFDs, both on land and in pools. Typically initial observer safety training also involves presentations and interaction with the US Coast Guard who demonstrate and explain various rescue procedures as well as dewatering pumps. All observers must pass this training to progress on to deployment, as it is vital to survival at sea during emergencies, and is taken very seriously by the observer programs. This training often results in the observers being the most safety conscious and prepared person on the vessel in the advent of emergencies at sea.

The second type of hazard to observers is the crews and associated fishing personnel. This interpersonal hazard, which is very real, is inadequately addressed by current observer training. Fishing crews, captains, owners, and factory workers come from a wide variety of backgrounds and personal histories that may be radically different from that of a newly trained fisheries observer. These individuals also have a different set of priorities than the observer which can lead to conflict, with potentially hazardous outcomes for the latter. Some attempt is made to train observers in conflict resolution, with classroom lectures and discussion, but there is little in the way of actual training to make them aware of the sorts of people they might encounter and what to do when things go wrong, and how to prevent them from going wrong in the first place. What does one say to a person just released from 15 years in prison for assault, who is sleeping on the bunk below, on a 35 foot fishing vessel out for two weeks? How does one make the best first impression on Vietnamese shrimp boat?{take off your shoes when you enter the house}. A general overview of the types and nationalities of the various participants in the local fishing industries might go a long way towards preparing observers for hazardous interpersonal situations. This could be strengthened by having these participants, fishermen and captains, visit training classes to speak to new observers and perhaps give insight in how to behave and reduce potential conflict.

The Third and final type of hazard encountered by observers are illness and biohazards.. This type of hazard is addressed to some degree in certain regions, due to necessity, as certain pathogens , have become more prominent, as in the case of MRSA or Methicillin-resistant Staphylococcus aureus. Other pathogens potentially encountered by observers include tuberculosis, hepatitis, influenza, meningitis, lice, and bed bugs. A compounding factor for observers potentially exposed to these is the lack of immediate medical care presented by being offshore, as well as lack of knowledge about these hazards. Another compounding factor for this type of hazard is the multinational character of many fisheries and plants. Fisheries personnel come from many regions of the world where these diseases may be more prevalent or emergent, there by potentially exposing observers to them in the close quarters of vessels and plants. Initiative could be taken by observer programs to develop base line testing and possible vaccination for these pathogens, as well as education about them. Best hygiene practices should be developed and promulgated, as in the case of

MRSA, which is best prevented by frequent bathing and changes of clothing as well as bedding

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## **Abstracts of presentations that did not provide Extended Abstracts**

### **It's Never Going To Happen To Me....until It Does: A Summary Of Safety Related Incidents Encountered By Observers In The Northeast Fisheries Observer Program**

**Lauren Carroll and Mike Tork**

**NOAA Fisheries, MA, United States**

The National Oceanic and Atmospheric Administration (NOAA) has adopted minimum safety training standards that have been deemed critical in preparing observers for the hazards associated with commercial fishing operations. These standards include risk awareness, emergency response, CPR/first aid, a comprehensive pre-trip safety checklist and at-sea survival training. This training is the most important aspect in preparing an observer for the job. However, it does not guarantee immunity from encountering emergencies while at sea. Since 2010, the United States Coast Guard (USCG) has documented over a thousand casualties, including 36 deaths, which have occurred in the northeast commercial fishing industry. A summary of the Northeast Fisheries Observer Program (NEFOP) data shows that observers have reported 165 safety related incidents between 2010 and 2016. These include safety concerns (weather, unsafe vessel operation, etc.), flooding, fire, collisions, groundings and injuries. The actions demonstrated by observers when responding to these incidents highlight that the skills acquired during their NEFOP safety training play an integral role in mitigating emergency situations at sea. With this, we can surmise that safety culture and safety at sea in the commercial fishing industry may be enhanced by the presence of fisheries observers.

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### **Sexual Harassment - Prevention and Education**

**Jaclyn Smith<sup>1</sup> and Julie Dale<sup>2</sup>**

**<sup>1</sup>National Marine Fisheries Service Office for Law Enforcement, AK, United States,**

**<sup>2</sup>Standing Together Against Rape, AK, United States**

Part of the National Marine Fisheries Service (NMFS) Office for Law Enforcement (OLE) mission is to investigate sexual harassment of observers. NMFS OLE has partnered with Standing Together Against Rape (STAR), a local Alaskan advocacy group, to address the sexual harassment that observers may face while on assignment. Together NMFS OLE and

STAR are fighting sexual harassment by increasing their efforts on prevention and education.

There are three main groups that NMFS OLE and STAR are focused on. Observers are now being trained to recognize potential threats, and to handle conflicts that may arise due to personality conflicts. NMFS staff, including OLE, is being trained to provide support to observers and establish rapport with them in the field to develop a higher level of trust. Fishing industry tailored training will focus on improving the work environment, and will also address victim blaming culture. With the addition of prevention and education on sexual harassment, NMFS OLE and STAR are hoping to help develop a working environment observers can feel safe and secure in, and ultimately eliminate the risk of sexual harassment.

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### **An Analysis Of The Current Bed Bug (*C. Lectularius*) Infestation Occurring In The Hawaii-based Longline Fleet And Its Effects**

**Jennifer Schultes**

**Pacific Islands Regional Observer Program, HI, United States**

This presentation will depict the current state of the bed bug (*C. lectularius*) infestation occurring within the Hawaii-based U.S. longline fleet. Through an analysis of NOAA historical records, extent and pervasiveness of the infestation will be determined. The presentation will also summarize the qualitative effects an infestation can have on work place safety and data quality. Finally, It will theorize potential strategies for managing an infestation from within a vessel and the fleet as a whole.

## Session 5. Can observers effectively perform scientific AND compliance functions?

**Leader: Judy Dwyer**

In many observer programs, observers are expected to fulfil both scientific and compliance roles, recording scientific data on catches, bycatches and taking biological samples, whilst also recording any regulatory infractions that vessels and crews may make. This can place the observer in a difficult and often dangerous position and, it is thought, may have even led to fatalities. This session gathered and discussed the various ways and means of protecting observers from repercussions when they are collecting information on compliance breaches.

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### **Oral Presentations - Extended Abstracts**

#### **The Collection of Compliance Related Data by CCAMLR Scientific Observers**

**Isaac Forster**

**CCAMLR, Australia**

##### Introduction

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was established under the 1982 Convention of the same name. The CCAMLR Convention Area is extensive, covering approximately 11% of the world's ocean, is remotely located in the southern ocean, and contains sensitive ecosystems that have been subjected to minimal anthropogenic disturbance relative to other ocean regions. Due to the remoteness, challenging environmental conditions, and the expense of accessing the Convention Area, relatively few independent scientific expeditions have been undertaken and the vast majority of the marine environment remains unsurveyed.

CCAMLR practices an ecosystem based approach to fisheries management, outlined in the text of the CCAMLR Convention<sup>1</sup> and also in the CCAMLR Conservation Measures<sup>2</sup>, a comprehensive set of regulations in the categories of compliance, general fishery matters, fishery regulations and protected areas. The details of several of these conservation measures require the deployment of Scientific Observers to gather data on both the target species, and the wider marine ecosystem, and to report on compliance with fishery regulations.

##### Scheme of International Scientific Observation

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<sup>1</sup> <https://www.ccamlr.org/en/organisation/camlr-convention-text>

<sup>2</sup> <https://www.ccamlr.org/en/conservation-and-management/conservation-measures>

The CCAMLR Scheme of International Scientific Observation (SISO)<sup>3</sup> was established in 1992 and is a key contributor to CCAMLR data, ensuring the CCAMLR Scientific Committee<sup>4</sup> can provide the best available scientific advice and recommendations on ecosystem management to the Commission. The data collection requirements for SISO observers vary depending on the target catch species, the developmental stage of the fishery, and the particular area where the fishery takes place. In general the scientific data collected consist of a series of standard biometrics for both target catch and bycatch species, and observations of seabird and marine mammals encountered during fishing operations. Compliance related data collection includes verifying the design of, and monitoring the deployment of seabird and marine mammal mitigation devices, vessel waste management procedures, IUU vessel and gear sightings and general observations of vessel operations.

Currently there are three commercial fisheries operating in the CCAMLR area. These are:

- Patagonian and Antarctic Toothfish (*Dissostichus eleginoides* & *Dissostichus mawsoni*).
- Mackerel Icefish (*Champsocephalus gunnari*)
- Antarctic Krill (*Euphausia superba*)

With the exception of the Antarctic Krill fishery, and in the exclusive economic zone fisheries of some Commission members, all SISO observers appointed to vessels must be of a different nationality to the flag state of the vessel. The logistics of the deployment of observers are conducted under a bilateral arrangement between the country deploying the observer and the flag state of the vessel, however terms of the appointment are conducted under the wording of the SISO<sup>5</sup>. The terms of SISO are clear that an observer is onboard a vessel “to observe and report on the operation of fishing activities in the Convention Area with the objectives and principles of the Convention for the Conservation of Antarctic Marine Living Resources in mind”.

#### Using Observer Data for Compliance Evaluation

CCAMLR implements measures to support the conservation and management of Antarctic living marine resources by reducing the risk harvesting activities may have on the sustainability of target species, on species taken incidentally as by-catch and on the marine ecosystem. CCAMLR seeks to achieve optimal levels of compliance with conservation and implements a range of measures to do this:

- Vessel licensing.
- Vessel Monitoring System (VMS).
- Monitoring of vessel transshipments.
- Monitoring of vessel movements (Convention Area and Port entry and exit notifications).

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<sup>3</sup> <https://www.ccamlr.org/en/science/ccamlr-scheme-international-scientific-observation-siso>

<sup>4</sup> <https://www.ccamlr.org/en/science/scientific-committee>

<sup>5</sup> <https://www.ccamlr.org/en/document/publications/ccamlr-scheme-international-scientific-observation>

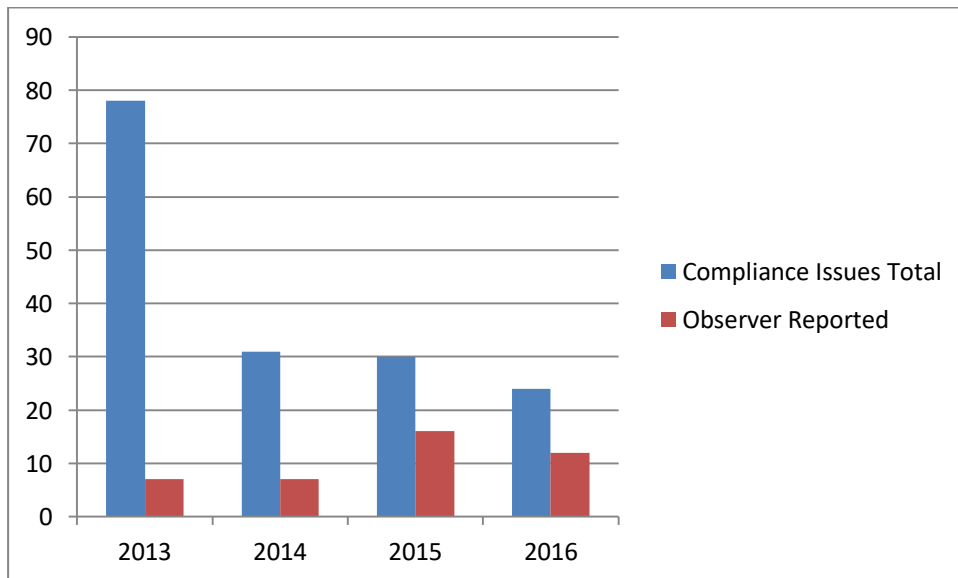
- Catch Documentation Scheme for *Dissostichus* spp.
- System of Inspection (at-sea and in port).
- Compliance Evaluation Procedure.

In 2012, CCAMLR adopted Conservation Measure 10-10 for the implantation of a Compliance Evaluation Procedure (CCEP). The CCEP evaluates Contracting Party implementation of, and compliance with, conservation measures in a responsible, open, transparent and non-discriminatory manner. The CCEP uses information provided to the Secretariat, as required under the CAMLR Convention, conservation measures and other rules and procedures including SISO submissions and the System of Inspection.

Compliance issues are summarised by the Secretariat and provided to Members for response and are then collated and provided to the Commission for consideration. Compliance issues that observers have identified and reported to the Commission through a confidential cruise report template are included in this procedure. The observer’s name is kept confidential, and the issues are considered by the Standing Committee on Implementation and Compliance where representatives Contracting Parties, NCPs, NGO and industry are present.

#### Compliance Issue Summary

A summary of compliance issues with reported contributions from observers, from the past four complete compliance reporting periods is displayed in Figure 1, whilst Table 1 details the number port, at sea inspections and observed cruises.



**Figure 1:** Total number of reported compliance issues and observer reported issues.

	2013	2014	2015	2016*
Port inspections	106	126	110	76
At-sea inspections	20	24	17	15

Observed Cruises	113	119	116	59
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**Table 1:** Number of vessels inspections both in port and at sea, and number of observed cruises.

\* denotes incomplete period.

Although a high number of compliance issues were identified in 2013 in comparison to the other three reporting periods, 49 of these were due the adoption of new VMS unit requirements. Discounting these issues, observers have contributed between 23% and 53% of all reported compliance issues over the last four years and contribute more information for the evaluation of compliance than the System of Inspection, despite there being fewer observed cruises than dedicated vessel inspections from statutory officers.

### Conclusion

SISO appointed observers in CCAMLR fisheries undertake a dedicated scientific data collection program, providing data that is used for stock assessment purposes, and monitoring wider ecosystem effects from fishing activities. Observers also report data and observations on implementation and compliance issues, and the reporting procedure is undertaken through a confidential reporting template. In most CCAMLR fisheries SISO observers are not the same nationality as the flag state of the vessel, which may increase the opportunity for conflict with vessel's officers and crew due to language or cultural differences. Therefore SISO observers are not dedicated compliance officers, and any issues reported by observers are only evaluated annually during the Commission meeting with representatives of the vessel's flag state through the CCEP. This system ensures better safety for observers as they are not required to directly interact with vessels operators or owners on matters of compliance. Considerable numbers of compliance issues are raised by observers, and the SISO system of reporting forms an important component of the CCAMLR fisheries regulatory arrangements.

## **Connecting the dots: Lessons from the establishment of the PNA Observer Agency**

**Duncan Souter<sup>6</sup>, David Byrom<sup>1</sup>, Dr Transform Aqorau<sup>7</sup>**

In September 2013 the Parties to the Nauru Agreement (PNA) Observer Agency (POA) commenced operation, with its main initial task to coordinate observer placements on purse seine vessels fishing under the Federated States of Micronesia Arrangement (FSMA). Around 85 vessels are currently licensed under the FSMA, which allows them to fish in any of the EEZs of the eight south Pacific members of the PNA<sup>8</sup> - an area almost 40% bigger than continental Europe. Vessels are subject to 100% observer coverage

<sup>6</sup> MRAG Asia Pacific

<sup>7</sup> Parties to the Nauru Agreement Office

<sup>8</sup> Federated States of Micronesia, Kiribati, Marshall Islands, Nauru, Palau, Papua New Guinea, Solomon Islands and Tuvalu.



requirements, as well as a range of regional (Western and Central Pacific Fisheries Commission; WCPFC) and sub-regional (FSMA) observer nationality restrictions<sup>9</sup>. Since its establishment, the POA has successfully coordinated close to 40,000 observer sea days covering over 1400 trips.

At the strategic and policy level, overall responsibility for the POA and FSMA rests with the CEO of the PNA Office, who takes decisions within a policy framework established by the PNA Parties. At the operational level, day-to-day administration of the agency is undertaken by MRAG Asia Pacific in close coordination with the National Observer Coordinators from each of the PNA Parties (who also operate their own national observer programs for separate vessels).

The POA operates in a geo-politically complex and dynamic developing-world environment with considerable logistical, administrative and communications challenges. The program is coordinated across multiple countries, involving multiple layers of governance, and across multiple currencies, cultures and timezones. Successful operation of the Agency requires compliance with a complex suite of regional (WCPFC), sub-regional (PNA) and national regulations, as well as extensive coordination with regional and national fisheries administrations, the fishing industry, observers and logistical service providers throughout the Asia Pacific region.

The relatively recent establishment of the POA offers a number of lessons in the design and delivery of contemporary observer programs, both at the strategic and operational levels, that have wider applicability particularly to those operating in challenging developing world environments. Some of the main lessons are summarised below, many of which are inter-related.

- **Take every practical opportunity to minimise risk** – The POA operates in a complex multi-stakeholder and multi-jurisdictional environment with considerable logistical and administrative challenges. A key lesson learned from the early years of the POA is to take every opportunity to minimise risk across all aspects of the operation. To that end, the POA has a range of measures in place across administrative, financial and operational components of the program to deal with uncertainty and actively minimise risk. For example, at the program resourcing level industry cost recovery arrangements are structured to minimise the risk of non-payment (FSMA licenses are not issued until observer fees are paid) and of insufficient resourcing to cover fixed costs (industry costs are split according to fixed and variable costs, with full fixed costs for the year paid upfront). At the administrative and operational levels, clear contractual rules that observers are paid only after submission of complete data sets mitigates the risk that data is not submitted;
- **Communication is key** – strong communication is critical at all levels. At the program management level, clear and active lines of communication between those responsible for day-to-day delivery (MRAG AP) and those with overall responsibility for the FSMA program (PNA CEO/Parties) and are essential to guide the strategic direction of the program and deal with issues as they arise (e.g. compliance breaches

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<sup>9</sup> For example, for the purposes of the FSMA, observers need to be PNA nationals from a country other than the Home Party (the sponsoring PNA state) of the vessel as a means of promoting independence and impartiality between the observer and vessel.

requiring investigation). Moreover, regular performance reporting is essential to demonstrate the program is meeting operational goals. At the operational level, the importance of having staff available 24 hours a day, seven days a week and 365 days a year who can make quick operational level decisions cannot be overstated. Under a regime of 100% observer coverage, where logistics and timing are critical and the program is coordinated across multiple timezones, it is essential that program coordinators capable of responding immediately to operational level issues (e.g. requests for observers, flight changes, observer advances, etc) are available at all times. The POA's experience suggests that delays in operational responses of even a few hours can result in arrangements spiralling out of control. By contrast, responding immediately and professionally to operational issues builds confidence amongst all stakeholders that they are in good hands. In practical terms, this means the 'nerve centre' of program coordination needs to be physically located in a place with reliable, power, internet and telephone **ALL** the time. A key complement to this is having a clear chain of command – there needs to be clarity around the types of decisions able to be taken by each staff member and who's responsible for what;

- **Get good staff** – Notwithstanding the obvious benefits of good administrative and IT systems, ultimately observer program management and coordination is still a people-driven thing. Nothing replaces good staff. The lesson from the early years of the POA is to know what you're looking for and get people with skills and temperament to suit. In the environment in which the POA operates, temperament and personal integrity are paramount, as is the capacity to make good decisions on the run in a dynamic environment;
- **Keep it simple** – In administratively and logistically challenging environments like the South Pacific, complex administrative and operational arrangements are doomed to failure (or at the very least inefficiency). Where possible, administrative and operational arrangements should be kept simple. Simplicity, in turn, helps build stakeholder understanding and acceptance of the program (people don't like what they don't understand), builds robustness and resilience of the program (not everything has to go perfectly for things to work) and encourages administrative efficiency (staff aren't spending their time explaining complex arrangements to stakeholders). The POA was faced with a number of design challenges in its early days, and as a matter of policy, the simplest option was generally chosen (which our experience, at least to date, suggests has been the right approach). A good example is the structuring of payments for debriefing. Two options were available – pay by the hour for debriefing or pay a flat fee per completed debrief. Hourly payments would have required a system to monitor hours across multiple jurisdictions, which in practice were largely unverifiable. Instead, a flat fee per completed debrief was chosen, with the fee set equivalent to the average amount paid according to hourly rate approach. Paying a flat fee is considerably simpler administratively, encourages efficiency in debriefing and assists in getting observers paid sooner;
- **Build in incentives to encourage the outcomes you want** – The POA's administrative and operational framework includes a range of measures that incentivise parties to achieve the program's overall goals. For example, the collection of high quality, accurately and timely data is a central objective of the FSMA Observer Program. To

this end, POA observers are paid different rates according to the quality and timeliness of data submitted. All observers are debriefed according to a standard regional framework and receive an overall score based on quality and completeness. Observers submitting their data on time and receiving higher debriefing scores are paid higher rates. In 2016, a further incentive is being trialled whereby observers exhibiting good behaviour throughout a trip (e.g. full compliance with weekly reporting requirements, turn up on time to airports/debriefs etc) are paid a 'behaviour bonus' in the form of a small additional sum for each sea day. Incentives can also be honorary – for example, the POA operates a 'golden caliper' award given to the observer judged to be the best overall performer for the year based on data quality and behaviour.

- **Operational arrangements need to be dynamic (or 'redundancy, redundancy, redundancy')** – Stuff breaks. People don't show up. Things go wrong. It happens (sometimes often!). In the early POA experience, the main lesson learned is to have in place multiple redundancies to account for uncertainty (e.g. Plans A, B, C and D for flight itineraries where there is a history of flight cancellation), and actively develop systems to minimise risk. For example, an early problem for the POA was observers, often inexperienced with international travel, missing flights. Missed flights do little to endear the POA to vessels (particularly given vessel can't fish without an observer), cause staff untold and unnecessary stress, and ultimately costs someone money. Most of the missed flights were happening in a few key transit ports, so within the first year we had established a network of agents, independent of fishing companies, to accompany observers to and from airports on time, and back and forth to transit accommodation. The net result is that while the system costs money and missed flights will always be a threat, the number of actual flights missed has declined substantially and program coordinators are getting (slightly) more sleep;
- **Deal with misdemeanours hard and early** – apart from dealing effectively with the initial incident, addressing misdemeanours either by observers and vessels both hard and early has the advantage of establishing a clear framework of behavioural expectations and sending a message to all stakeholders that the program is serious about integrity and high standards. Word of the initial punishment inevitably spreads throughout observer and industry networks and serves to encourage positive behaviour from all stakeholders;
- **Invest in good quality information management systems (IMS)** – put simply, good quality IMSs which are designed for purpose make life easier and programs more efficient. While we commenced operations with a simple, in-house built Access database that capably handled the main administrative functions, the POA is now operating on a purpose built, second generation, web-based IMS that seamlessly integrates administrative, financial and operational functions, and allows access by multiple users across the different regional POA offices. The lesson is that while good IMSs cost money upfront, a well-built system saves time and promotes efficiency in the long run;
- **Be aware of cultural differences and sensitivities** – In the case of the POA, program coordinators are dealing day-to-day with national agency staff and observers from

eight different island nations, logistical service providers in multiple transit ports and fishing company representatives, most of whom are Asian nationals. There are considerable differences in culture and interests between the different stakeholders, particularly between Asian fishing company representatives and Pacific Island observer staff. Program coordinators need to understand and be sensitive to such differences and make acceptable compromises where necessary to ensure the smooth operation of the program;

- **Don't skimp on good financial systems** – Having robust, accurate and reliable financial systems is the minimum price of entry for anyone aspiring to administer an observer program. While stakeholders will often cut a program manager some slack on operational type issues, no such leeway exists on financial issues (nor should there be). Having strong, efficient financial systems builds confidence in the professionalism of the program and builds support amongst observers. One of the most common complements the POA receives is its capacity to ensure observers get paid efficiently.
- **Build a culture of continual improvement** – despite the best planning in the world, no program gets it perfectly right from the beginning. Some things don't work as well as they should and circumstances change. Programs need to be sufficiently nimble to adapt to changing circumstances and have active programs in place to identify opportunities for continual improvement. The early history of the POA has been one of continual refinement and development of systems to optimise performance, deal with unforeseen challenges and minimise risks. Formal systems are in place through MRAG AP's ISO 9001 certified Quality Management System to identify opportunities for improvement of administrative and operational systems, while a number of structures have been established (e.g. Annual PNA Coordinator's Workshops) to review performance and discuss future improvements.

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## **Finding A Balance Between Scientific and Enforcement Data Collection**

**Andrew Whatley**

### **NOAA Southeast Observer Program, TX, United States**

Observers can be an effective tool for enforcement (compliance), however, regional variations between programs and safety should be acknowledged when determining the scope of responsibilities. The number one job for any observer, in any region, is to safely collect scientifically unbiased data reflective of a fishery. The most important compliance duties should be prioritized to avoid compromising data collection responsibilities and be consistent between regions. Some examples of compliance that would qualify based on these guidelines are documenting Marine Pollution (MARPOL) violation data, blatant fishing violations (usually gear related), compliance with observer's work and safety, and violations of the Marine Mammal Protection Act and Endangered Species Act.

Additional compliance duties for observers should be decided on a regional and program basis due to the complexity of regional specific issues. Observers in the Southeast United States (SE) Reef fish and Shrimp By-Catch Observer Program cover 7 distinct fisheries, are placed on vessels that range in size from 18.5' to 104' long, and depart from ports ranging from the Mexico/Texas border to Key West, FL in the Gulf of Mexico and the southeastern Atlantic coast as far north as the North Carolina/Virginia border (Figure 1). For enforcement purposes, this area spans eight distinct bodies of State Waters and two separately Federal Managed Waters. The number of rules, regulations, and laws that span these multiple areas can differ significantly for the different fisheries. For example, a fisheye Bycatch Reduction Device (BRD) used in the shrimp fishery in Texas state waters must be at least 36 square inches and no more than 12 meshes off center (TPWD, 2016). Conversely, in South Carolina a BRD only has to be 18 square inches and no more than 15 meshes off center (SCDNR, 2016). I believe it is unfeasible to require observers to know all of the laws and regulations throughout this region.

To better allocate compliance duties, the SE observer programs and the regional NOAA Office of Law Enforcement (OLE) created a list of violations that are specific to the SE and assigned them with a low, medium, and high severity qualification (Table 1; NMFS, 2016). The majority of the list is clearly defined and is directly compatible with information observers are already gathering. I believe there are still some violations on the list that observers may be unaware of due to their complexity and ever changing statuses. A few examples include; size limits, spatial infractions, species specific open/closed seasons, and specific Individual Fishing Quota (IFQ) landing information.

Another possible issue with increasing observer's enforcement duties is observer safety. Individuals or vessels with documented violations could potentially retaliate against the observer who reported them. Current protocol in the SE allows the captain and/or owner to have limited personal information such as the observer's full name, private cell phone number, vehicle type and license plate number. To compound the issue, if the vessel and observer's home base are located in the same locale the opportunity for retaliation may be more likely. With today's technology, even living several states away from the vessel port may not prevent retaliation incurred from compliance reporting.

In summary, I believe there are universal violations that observers can report for all regions. However, each region has their own set of unique problems/obstacles and should be allowed to develop an observer's role in enforcement. As an Observer Program the question becomes, when do observers stop being field scientists and become enforcement agents?

Table 1. Compliance violations by category referenced as low, medium, or high priority by OLE used by the SE United States Observer Programs. (NMFS, 2016).

<b>Violation Observed</b>	<b>Violation</b>	<b>OLE Comments</b>
Handling prohibitions	Smalltooth sawfish	Medium -> High (i.e. take or negligent handling)
Gear violations	Required fishing gear (non-stainless steel circle hooks)	Low -> Medium (i.e. using majority illegal hooks)

Gear violations	BRD requirements	High (uninstalled, sewn shut, dysfunctional, etc.)
Gear violations	TED violations (angles, openings, etc.)	High (angle, bent bar, undersized opening, etc.)
Gear violations	Reef fish as bait/filleted at seas	Medium to High level (unless filleted for consumption at sea). Fact specific
Gear violations	Use of illegal gear (reef fish longline, buoy gear, fish traps)	High (Fish traps) Longline/buoy gear dependent on location
Gear violations	Not in possession of required turtle handling devices	Low; Fix-It, SS, VW, WW, etc.
Gear violations	Marking of all floats with vessel name and number	Low; Fix-It, SS, VW, WW, etc. unless blatant disregard
Handling prohibitions	Harassing marine mammals, turtles, seabirds	High
Handling prohibitions	Attempting to purposefully injure marine mammals, turtles, seabirds	High
Observer compliance	Failure to take an observer when selected due to no communication, inadequate/unsafe conditions, etc.	High
Observer compliance	Harass, intimidate, obstruct an observer	High
Observer compliance	Assault an observer	High
Retention Limits	Retain a marketable species under the size limit	Low -> Medium (Species specific, significant disregard)
Retention Limits	Retain a marketable catch in an amount greater than allowed	Low level; Depends on species and if catch limit is certain amount of fish or significant disregard for regulations.
Retention Limits	Retain a marketable catch during a closed season	High (Species and/or Quantity specific)
Retention Limits	Retain a prohibited species	High (Species and/or Quantity specific)
Retention Limits	Offload of IFQ species prior to allowable times	Medium -> High
Retention Limits	Offload of IFQ species at non-approved landing location	Medium -> High
Spatial violation	Fish in a closed area	High

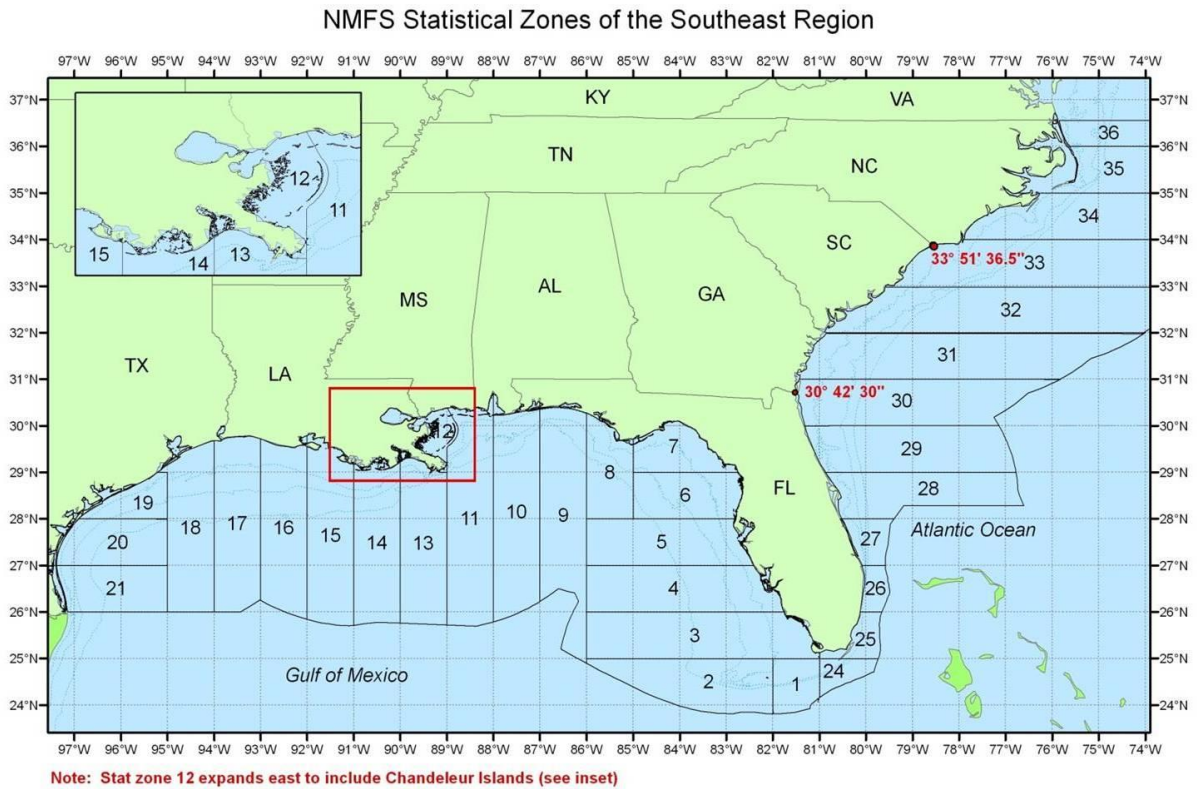


Figure 1. Coverage Area for Southeastern United States Observer Program (NMFS, 2016).

NMFS. 2016. Characterization of the U.S. Gulf of Mexico and southeastern Atlantic otter trawl and bottom reef fish fisheries. Observer Training Manual. NMFS, Southeast Fisheries Science Center, Galveston Laboratory, Galveston, TX. (available at [http://www.galvestonlab.sefsc.noaa.gov/forms/observer/obs\\_training\\_manual\\_5\\_2016.pdf](http://www.galvestonlab.sefsc.noaa.gov/forms/observer/obs_training_manual_5_2016.pdf))

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**The synergistic relationship between compliance monitoring and scientific data collection in the North Pacific Observer Program**

**Melanie M. Rickett**

**North Pacific Observer Program, Fisheries Monitoring and Analysis, National Marine Fisheries Service, National Oceanic Atmospheric Administration**

Vessels fishing in the North Pacific federally managed fisheries are required to carry observers on some or all trips. Observers are responsible for collecting catch and biological data used in real-time management of these fisheries. On catcher processor vessels that both fish and process their catch at sea, the designated observer sample stations in the catch processing factory enhances the observer's ability to collect high quality scientific data. The presence of real time video monitoring of fish holds widens the visual scope at the sampling station and allows observers to detect sorting of species of interest from the catch prior to sampling, hence preventing one source of bias in the data collections. These two systems work in tandem to allow the observer to conduct data collection and compliance monitoring simultaneously. Although the North Pacific Observer Program (Observer Program) is able to utilize the sample station and the video monitoring system on larger vessels, it may be possible to implement a similar system on smaller catcher vessels in other parts the North Pacific and other regions. With the right regulations this type of platform can be recreated on smaller vessels with a simple camera system, and a designated location for observers to collect and work up scientific data.

### **Scientific data collection**

Catcher processors participating in Limited Access Privilege Program (LAPP) fisheries are required by regulation to have an observer sampling station. These observer sample stations are a designated area on a vessel where the observer processes (counts, weighs, measures, etc.) samples. In addition to the required sample station, these vessels use motion compensated flow scales to record the cumulative weight of catch flowing into the vessel's processing plant. Observer sampling stations must meet a specific set of requirements before they can be certified by the Observer Program, such as minimum work space (not to be  $<4.5\text{m}^2$ ), table and motion-compensated platform scale (MCP) height restrictions, flowscale readout visibility, non-slip floor types, adequate amount of lighting, access to a water source, and unobstructed access to catch. Observer sampling stations are certified by Fisheries Monitoring and Analysis division staff and motion compensated scales are certified by NMFS Alaska Regional Office staff. Certification is good for one year from the date the observer sampling station or motion compensated scale was approved<sup>1</sup>.

Since 1992, the addition of a designated observer sample station in the catcher processor factory has increased the observer's ability to collect high quality scientific data. These designated observer sample stations were introduced as part of the Community Development Quota (CDQ) program, which is a LAPP whereby permits are issued to Alaskan communities to harvest a quantity of fish representing a portion of the total allowable catch (TAC). The purpose of these stations was to give observers a low traffic area close to the sample collection point with specific equipment requirements, including MCP, thus ensuring the observer's ability to collect accurate data<sup>1</sup>. The observer can collect samples of the catch while monitoring the flow of fish from the hold and has sufficient space to process those samples, recording species composition and obtaining biological tissues. The addition of these observer sampling stations has increased the observer's ability to collect high quality scientific data.

The observer sample stations have evolved over time in response to regulatory changes and currently are required on all catcher processors participating in any LAPP. The sample station itself provides a platform from which observers can monitor the flow of fish prior to



or during catch sorting (Figure1). Additionally, the sample station gives observers the ability to watch for potential sources of sampling bias such as presorting of catch or mechanical bias (example: incline belts). Some sample stations are now required to have cameras and video monitors strategically located so that the observer can watch for such biases when clearing the belts before and after sample collections.

### **Compliance Monitoring**

As early as 2008, new regulations incorporated real time video monitoring into the sampling station, allowing the observer to conduct data collection and compliance monitoring simultaneously. Video monitoring systems widen the visual scope at the sampling station, allowing observers to watch for species of interest being removed from the catch prior to sampling, which prevents one source of bias in the catch estimate.

There are two types of video monitoring systems that observers work with when deployed on vessels fishing in the North Pacific. The first is the bin monitoring system which was implemented on the Bering Sea and Aleutian Islands (BSAI) catcher processor trawler fleet (in the non-pollock fishery) in 2008. The bin monitoring systems are a series of cameras that help observers monitor for sample biasing and prohibited species presorting that may occur in the live tanks (or fish holds) prior to or during sample collections. The second type is the salmon monitoring system, which was implemented in 2009 on the American Fisheries Act (AFA) BSAI pollock catcher processors and mothership fleet. These cameras capture the movement of salmon from the moment fish enter the factory to when they are sorted and placed into the certified salmon bins.

In the BSAI non-pollock catcher processor trawlers, there are two bin monitoring system options. Option 1 (limited tank access) does not allow anyone into the fish holds without the observer's prior knowledge, and not during sampling periods. Option 2 (video bin monitoring), is a series of cameras inside the live tanks and allows the observer to see all crew activity in the bins. This video is kept on board for 120 days and can be reviewed by the NMFS Alaska Regional Office or Office of Law Enforcement (OLE) upon request. The required monitoring systems were put into place to help observers not only detect sampling bias, but also monitor for compliance of prohibited species sorting.

In 2011 salmon bin monitoring was implemented into the observer program. The purpose of this video monitoring system is to help monitor the sorting of salmon in the factories from the point where fish enter the factory and salmon are moved into the designated bins. With the increased importance on salmon numbers, observers could not be expected to monitor all hauls for salmon bycatch in addition to maintaining their current duties. These cameras allow for the crew to do the sorting of salmon and the observers to verify total count at the end of each haul. With the video monitoring system, the observer can continue to collect other biological data, and Alaska Regional Office staff can review video if there is any indication that salmon are not being accounted for within the catch.

### **Synergistic Interaction**

Historically, sample biases such as presorting of organisms (specifically prohibited species such as halibut) and crew sorting in the fish bins have resulted in a decrease in data quality, increased intimidation, and sometimes hostile work environment for observers. Observers

can use the video monitoring systems to verify that there are no sample biases occurring in the fish bins prior to collecting species composition data. In the past, observers would address this issue with crew and keep documentation of the incidents, which was then reported to Observer Program staff at the completion of the deployment. Observers who deal with sampling bias issues in the field might find themselves in situations that could be intimidating or worse yet hostile. It was the observer's word and documentation that OLE used to investigate sampling bias and harassment cases. Now, with video monitoring in the fish bins, observer documentation can be supported by the video surveillance. While observers use the real time monitoring for scientific data collection, OLE and the Alaska Regional Office use the hard drive video backup for compliance monitoring. The real time view provides observers the ability to report potential violations and compliance issues. Additionally, OLE and the Alaska Regional Office can request video from the hard drive to monitor for compliance without directly implicating the observer. Detecting these kinds of biases can allow the observer to notify vessel personnel, Observer Program staff, OLE, and sometimes industry to resolve compliance issues before situations escalate. Ultimately these video systems allow the observer the ability to focus on the scientific data collection and minimizing sample bias without the stress of playing a direct compliance role.

Sampling stations give observers the optimal platform for collecting unbiased data in a factory setting. With the introduction of compliance video systems observers can now monitor for compliance and collect biological data simultaneously. Due to the way compliance monitoring is regulated and recorded, observers can aid in reporting compliance issues in real time and the video footage that is recorded can help confirm a potential violation without putting observers in the middle of the investigations. The video records can support observer statements, effectively adding corroborating evidence to observer testimony.

Ultimately observers can focus on the scientific data and let the monitoring systems document the compliance issues. With the observer reporting compliance issues inseason (near real time communications between observers and advisors) while fishing is occurring, the vessel personnel, Observer Program staff, OLE, and sometimes industry can work more closely together to resolve sampling issues before they become a larger problem. The real time reporting can potentially improve data quality while discouraging intimidation, and improving the work environment for observers.

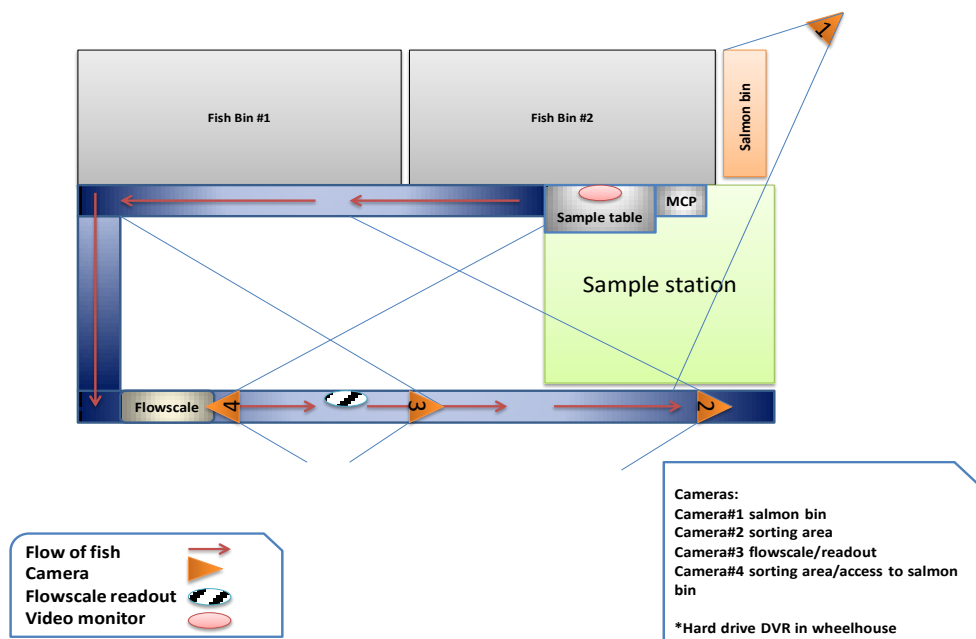


Figure 1: Layout of Typical Observer Sampling Station with Salmon Bin Monitoring

Sources:

1. (AFSC) Alaska Fisheries Science Center/ 2016 Observer Sampling Manual. Fisheries Monitoring and Analysis Division, North Pacific Groundfish Observer Program. AFSC, 7600 Sand Point Way

## Highlights From A Marriage Of Science And Compliance In The North Pacific

Mr Nathaniel LAGERWEY, Ms Jaclyn Smith, Alicia Miller

### NOAA Fisheries

#### Abstract

Staff from the Alaska Division of the NOAA Office of Law Enforcement (OLE) and the North Pacific Observer Program (Observer Program) work together daily to accomplish goals of observer protection, data collection, and resource management in the North Pacific. The OLE utilizes compliance data collected by observers to support the Observer Program and shared resource management objectives. This presentation will focus on some mechanics of this collaboration and approaches used by the OLE.

The presentation is intended for Theme 5. Can observers effectively perform scientific AND compliance functions? It will be structured to share ideas from the North Pacific and to seek ideas from other programs. The goal is to strengthen the understanding of science and compliance roles in fisheries and to demonstrate a successful marriage of those roles.

Presenter, Nathan Lagerwey, is the Deputy Special Agent in Charge for the OLE in Alaska. He began his career as an observer prior to beginning 16 years in fisheries law enforcement. Lagerwey is a trainer on observer topics and his investigations have focussed on cases that directly impact observers and/or observer data.

## Introduction

I, Alicia Miller, provided this presentation about the highlights of the success of the observer's dual role in science and compliance in the North Pacific. I stepped in for Mr. Nathan Lagerwey who was unable to attend the conference. I am a fishery management specialist for the Alaska Regional office and I have specialized in working with the North Pacific Fishery Observer Program in Alaska for the last 9 years. Started my career as an observer before becoming a part of the Observer Liaison office, working for the Alaska Division Office for Law Enforcement. I have provided training to observers on compliance monitoring and reporting as well as written regulations to support the implementation of the Observer Program in Alaska.

## Collaborative response

The North Pacific Observer Program has a very close and cooperative relationship with the Alaska Region Office for Law Enforcement. NOAA Law enforcement investigate and prosecute fisheries violations and what I'll be describing to you today is how that cooperative relationship works to provide support to observers when they need it most. Observers are in a uniquely vulnerable position on a fishing vessel and this can be exacerbated by the observer's role in compliance monitoring. An Observer's role in Alaska has long incorporated elements of both science and compliance into the observer's data collection duties and this is made possible in part because of the collaborative and established response if an observer feels unsafe or threatened on a vessel.

The collaborative response between the North Pacific Observer Program and Law Enforcement is the result of many years of partnership, training, mutual respect and understanding of the needs and objectives of all parties involved and includes the following steps:

Recognition – An observer recognizes that the situation and circumstances are beyond conflict resolution and decides to ask for help due to threatening circumstances.

Report – Observers are provided contact information for NOAA OLE, USCG, and Observer Program staff, so someone is available to receive this type of phone call at all times.

Procedures – No matter who receives the call, there are established routines for who must be notified and when. This type of phone call sets off a series of events where additional information is gathered, so that assets can be inventoried to inform those involved with making a plan. All involved have received training on how to provide immediate first response support to an observer.

A Plan – A group of essential individuals are gathered to determine a plan to assist an observer who has reported a threatening situation. The group evaluates information available, logistical options to secure the observer's safety and then executes the plan, removing the observer from danger and providing the observer with advocacy information

and space to process the event. The specific course of action will depend on the severity of the situation, the location of the event, and the available resources in the area. An observer reporting a threatening situation on a vessel at sea may be removed from the vessel by the USCG, Alaska State Troopers, or the vessel may be directed to go to the nearest port under strict orders to not have contact with the observer while maintaining communication as much as possible with the observer.

Support – The Liaison office, Observer Program staff and the observer’s employer are the main resources for support following an event such as this. Periodic victim advocacy training has been scheduled to maintain a supportive environment.

#### History of the Liaison office

Beginning in the late 1990s, the Liaison office was established by a formal agreement between the Observer Program and Law enforcement Agencies in Alaska. NOAA office for Law Enforcement first assigned an Agent to specifically investigate and track complaints submitted by Observers. This program has grown through the years with at least seven different Agents, several Enforcement officers, and a contractor assigned to the Observer Liaison office in Anchorage and Seattle. The liaison office has been co-located with the Observer Program staff since 1999, sharing office space with observer program staff. This co-location allows for easy maintenance of the cooperative relationship between the observer program and law enforcement and also provides observers and program staff with immediate access to Agents and officers in the event a response is needed. The liaison office ensures that there is a small group of people that sufficiently understand the goals and objectives of both the Observer Program and law enforcement to assist and facilitate interactions between the two.

#### Challenges

Limited law enforcement resources have always been a concern that requires law enforcement to prioritize which reports are investigated. Reports of Harassment and Interference have always been a high priority. An initial challenge was to establish methods and protocols for how reports would be filed and tracked. A searchable database was created to house statements written by observers and facilitate tracking the outcome of those complaints. Evidence preservation is another challenge necessitating clear procedures for how to recognize evidence and preserve the chain of custody. The establishment and training of these procedures is essential to ensuring that this program functions smoothly.

The North Pacific Observer Program is a large observer program in the United States. In recent years, the program has deployed over 400 individual observers for more than 40,000 days at sea each year resulting in the creation of more than 1,500 compliance statements forwarded to the various law enforcement agencies each year. The collaborative relationship between the Observer Program and Law Enforcement continues to evolve and adapt and this a key component that supports the observer’s dual role in science and compliance in the North Pacific.

## **How Transparency Helps Keep Observers Safe**

**By Elizabeth Mitchell and Simione Cagilaba**

### **Association for Professional Observers (APO)**

Fisheries observers collect critical independent information that allows fisheries managers to make decisions based on sound scientific data. Observers work primarily at sea, alongside commercial fishermen in a demanding and unforgiving environment, facing the same difficult and dangerous work conditions as the fishermen. Additionally their responsibilities include reporting on compliance to fisheries regulations that cannot be collected by any other means. They collect biological information on commercial catches that could impact future operations and profitability of the vessel. Because of this, they sometimes face obstacles and interference from those same fishermen in completing their duties, which can manifest in the form of threats, intimidation, bribery attempts, harassment and even violence toward the observer.

Why observer harassment and other witnessed violations are of public concern.

The ocean's fisheries are publicly owned and we rely on fisheries managers to responsibly manage them. Accountability must be the cornerstone of responsibly managed observer programs. It is the very reason independent fisheries observers exist in the first place, so assurance of accountability must be in place at every level of the observer program. If observers are not able to effectively complete their duties (due to interference or worse), the fisheries managers are not getting the necessary information they need. Likewise if observer program staff is not responsive to the observer's needs, the observer cannot effectively operate in such a potentially hostile environment and the program isn't achieving its goal. This, of course, is of public interest.

Oversight of fisheries monitoring programs is necessary to make sure that observers receive adequate support to effectively and safely carry out their duties, free from violence and interference. Transparency imparts the necessary confidence to the observer community *and* the public that the agency is monitoring the observers' safety to ensure that they may continue to successfully report on this critical information. If observers lack confidence in the system that is supposed to represent and protect them, they cannot be expected to do their job appropriately or effectively. Likewise, without transparency, the public will not have confidence in the veracity of the fisheries monitoring program. Securing the confidence of the public, and of the observers reporting the information, can only be achieved through an open and transparent reporting system.

Yet most observer programs in the world do not report on observer harassment or compliance information in a systematic or transparent way. Many observer programs also require observers to be sworn to secrecy with threats of punishment should they violate rules of engagement with the public. This secrecy surrounding what observers experience and witness misleads the general public about the true challenges in attaining sustainable fisheries.

Our organization regularly hears from observers who are facing problems in their programs. Some observers have experienced their employers blaming them instead of investigating the reported violation(s). This is especially problematic when there is no direct evidence or it is the word of the observer against many crewmembers. Others found that the entire chain of command conspired against them – the vessel personnel, the observer employer, the port coordinator, and a multitude of agencies and/or departments that deny culpability for the observers' welfare. Some observers decide not to formally report the harassment but rather to 'tough it out' because they know there will be no consequence for the vessel and no safeguards in preventing their re-assignment to the vessel that committed the violation. In these cases, they justifiably imagine the harassment will continue or get worse. Meanwhile, the public remains ignorant to the details of these hardships that observers endure. The vessel is sent a message that: observers aren't going to report the violations; if they do, the system is weighted in the vessel's favor; observer harassment and interference is acceptable; and, that they can brazenly continue this behavior without public scrutiny, despite agency statements to the contrary.

### Regional Fisheries Management Organizations – A Special Danger to Observers

The lack of transparency in Regional Fisheries Management Organizations (RFMO) and other internationally managed fisheries pose a special danger to observers. RFMOs are managed by consensus and any member state can withhold information collected by the observer without consequence. Observers can find themselves on vessels that are registered through 'flags of convenience'<sup>10</sup>. Observers are offered little, if any, protection, and jurisdiction of responsibility toward their welfare is confusing. Last year a long-time observer, Keith Davis, disappeared during an Inter-American Tropical Tuna Commission transshipment observer program assignment and is presumed to have died, possibly murdered. There were jurisdictional questions, multi-national stakeholders and a lack of direct communication between the observer and his employer. This led to an international maelstrom of denial of culpability and a stalemate in the investigation. Keith is the third observer to have died under suspicious circumstances within the last year under the management of various RFMOs. Observer harassment and interference or even observer deaths are not transparently reported by these agencies and are not demanded by the member states.

Observers monitoring RFMO fisheries have witnessed terrible human tragedies: crewmembers being bound to prevent self-harm due to mental trauma from extensive periods at sea; death from medical neglect, where the crewman was not even afforded a final burial in his home country; fishermen jumping overboard and swimming to the transshipment vessel to escape the vessel they had been trapped on for two years; and withholding proper nutrition and clean drinking water. The RFMO transshipment vessels are facilitating this treatment by delivering human "cargo" to vessels that stay indefinitely at sea and these observers are witnessing it. They are placed in the midst of human trafficking, drug running, firearms trade, and other illegal acts and the observer is expected to stay silent. The consumer meanwhile remains ignorant to these atrocities.

### The Need for Public Oversight of Fisheries Monitoring Programs

These are publicly owned resources and the public depends on fisheries agencies to manage the fisheries responsibly. These agencies employ observers to collect this information. If observers are 'disappearing', the agencies are not getting the necessary data they need to manage the fisheries responsibly. If observers are witnessing human trafficking, the fishery is not sustainable. So, aside from the obvious moral duty that these agencies have to transparently report on these hardships and illegal activity occurring under their management, *they aren't getting the data they need to manage the fishery responsibly.* Human trafficking, shark-finning, drug-running, setting nets on whales, and other illegal fishing activities reported by observers, in the course of catching fish for our dinner table, is certainly of public interest and requires closer public engagement in our fisheries monitoring programs. Public engagement is necessary to develop solutions to: 1) ensure observers are able to record this information safely; and, 2) develop transparent solutions to tackle the problems they are reporting.

See, EJF (2009) *Lowering the Flag - Ending the use of Flags of Convenience by Pirate Fishing Vessels*. London  
<http://ejfoundation.org/sites/default/files/public/Lowering%20the%20flag.pdf>

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## **Open Discussion Session**

1. Gwynne Schnaittacher, AK Division: Any statistics on regional reports from observers, on harassment, etc.?
  - Liz Mitchell - No, but it would be good to have records on that, globally. A Public Employee NGO exists.
  - Jaclyn Smith - Stats like that are available at [alaskafisheries.alaska.gov](http://alaskafisheries.alaska.gov)
  - Karl Staich – 23 observer programs in the Pacific (WCPFC area) have to report on all instances on intimidation, etc, since 2007. All this information is publically available.
2. Amy Williams, DFO commented that having observers have a compliance function also adds to the social license of fishing industry. Requested clarification from Andrew Whatley: What types of changes in fishing habits did you see when you introduced compliance functions?
  - Andrew Whatley – Change in gear type or trip length to avoid having to take an observer.
3. Danielle Rivay from Intl. Pacific Halibut Commission: Toothfish is listed as an exploratory fishery in Antarctica. It is an important fish, do you consider it sustainable? And is there back-up for observers in remote areas?
  - Isaac Forster – characterization of exploratory vs established fisheries is done on a regional basis. Exploratory fishing rules are much stricter. In terms of sustainability,



CAMLR is trying to establish a baseline for toothfish to better set quotas and management measures. There is still some illegal fishing but it has been greatly reduced. He would not feel bad eating toothfish.

4. Howard McElderry, Archipelago Marine Services: Use of video for bins/salmon bycatch - real applications in a lot of places, different than EM, in background, good for security & data quality, but strength relies on audits, quality of imagery

- Melanie Rickett – regulations require the quality of image must be 5 to 7 frames per second plus a minimum resolution. Both of these are verified during the audit process. Information can be pulled in close to real time.

5. Ernesto from IATTC - update for Liz on stats and compliance - Since 2000, IATTC also managed bycatch program for dolphins, with protocols including compliance reporting from observers, report presented and available to public every October from [iatcc.org](http://iatcc.org). Reports about interference, harassment, bribes, etc. are openly discussed. Each issue is taken up by flag, so each member nation must react/respond accordingly. Also, Ernesto wanted to express that he feels ashamed that his organization has not adopted such good safety regulations, as quickly as the WCPFC has, in response to the tragedy with Keith Davis, and that it is up to the member countries to propose such new regulations, as well as accept them, not up to the staff.

6. Liz wondering where Keith Davis' disappearance was reported? Liz says that under transshipment, there were "no problems" reported.

7. Ruben Beazley, Seawatch Observer, Newfoundland, Canada - commented that he feels compliance and collecting data are one and the same and that compliance affects data collection and needs government support. He felt the problem lies in government's response to issues when they arise. Asked if anyone has seen observer data being used to charge vessels?

- Isaac Forster- in CAMLR, charges have been laid, but it is done with the country not the individual vessel.
- Jaclyn Smith, OLE, Alaska - yes, in Alaska, information collected from observers can be used as supporting evidence for compliance issues and has been used to prosecute. Observers are trained to recognize issues and if they see obvious violations, they should speak up to "assist" in compliance versus trying to enforce. Otherwise, they document and report.
- Duncan Souter- yes, observer info used to investigate and is passed on to each country, also formal process "Gen 3 Form" for FFA countries and risk assessments done from that data - recently used to look at IUU fishery and the observer data was the best data set.

8. David O'Brian, DFO – They are exploring the idea of introducing a compliance role in the dockside monitoring program in recreational fisheries, asking for license numbers, etc. Initially they had a strong negative response, but it has improved. Has anyone else tried this?

- Isaac Forster, CCAMLR- Different, because usually vessel by vessel and different crews, so not as linear.

9. Victor Ngcongco, CapFish, South Africa - How do you ensure that observers do not take on the role of compliance officer? Also, how do you avoid observers becoming an advisors to vessel masters, to avoid things like "The observer told me to do this."

- Melanie Rickett - In training, observers are told not to interpret regulations, to instead give follow-up contact information to boat
- Victor added that the way they deal with this issue is with increased communication - attend pre-sail briefing, explain observer role & duties, what's allowed, what's not allowed, etc. This has been very successful and now fewer conflicts on vessels.

10. Lara from International Pacific Halibut Commission – In Alaska they are hearing complaints from vessel masters that the observer did not inform them of violations, but reported them after the fact resulting in fines. How do you balance the process and safety of the observer with establishing a positive relationship with vessels? What is the priority?

- Jaclyn Smith, OLE – it was a big adjustment in Alaska when observers were added to the Halibut fishery. There was significant outreach conducted, but the focus was on getting observers out there. Still facing difficulties because although the program began in 2013 there are still vessels getting an observer for the first time. Ultimately the priority is collecting data and improving data quality.

## **Poster Presentations – Extended Abstracts**

### **Science and Compliance; How to find the balance? Multi-use Data Allows an Observer to Perform Scientific and Compliance Functions**

**Alicia Miller**

**Sustainable fisheries Division, Alaska Regional Office, National Marine Fisheries Service, Juneau, Alaska.**

Abstract

Data collected by observers deployed on vessels and processors participating in the diverse groundfish and halibut fisheries of the Bering Sea and Gulf of Alaska are used by scientists, fishery managers, and fisheries enforcement. Many data points collected by observers are multipurpose. This case study demonstrates how observer data are used for scientific, fishery management, and compliance monitoring in the North Pacific.

Objective

**To describe how an observer's role in scientific data collection is related to and supported by compliance monitoring and to identify how these roles evolve.**

Introduction

Observers collect essential data used by scientist to estimate fishery populations, fishery managers to monitor the use of quota allocations, and NOAA's office for Law Enforcement to monitor compliance with fishery regulations. Figure 1 demonstrates multiple uses for common data collection tasks. Independent scientific data collected by observers are used by fishery managers to monitor quota allocations and to evaluate the potential impacts of proposed management programs. Observer data is also used by law enforcement as evidence to prosecute those who violate fishery regulations.

Using a single data point for multiple purposes allows an observer to balance their role in science with their role in compliance monitoring. This balance has evolved through time as new fishery management programs are implemented. New programs tend to improve upon previous programs. Recent programs tend to implement more precise management tools, and demand more data be collected by observers. With each new program comes new requirements, also increasing the demands of an observer's compliance monitoring role. Overall, these changes have increased the amount scientific and compliance data collected by observers and contributes to altering the balance between the two roles.

Conclusions:

- An Observer's compliance monitoring role includes two distinct functions;
  - 1) Monitor for compliance with requirements that protect observers and facilitate data collection, and
  - 2) Monitor for compliance with requirements that protect and conserve natural resources.
- The balance between an observer's role in science and compliance is influenced by the extent that new fishery management programs maintain the multiple use of observer data. Programs that require separate and specialized scientific and compliance monitoring data jeopardize the balance between these roles.

## **Session 6. What are the latest technology trends for fisheries monitoring programs?**

**Leader: Dennis Hansford**

Technology is playing an increasingly important role in our fishery dependent data collection programs. This session explored recent innovations in this field including improvements in basic observer “tools of the trade”, automated reporting systems, electronic logbooks, electronic monitoring systems using still and video cameras, smart phone and satellite technology. The session discussed how technology influences and will continue to influence future fishery dependent data collection systems in individual fisheries, as well as at national, regional and international levels. We had excellent representation from vendors of technological systems who showcased their equipment in the conference exhibition areas.

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### **Oral Presentations - Extended Abstracts**

#### **ELECTRONIC EYE PLUS: ELECTRONIC MONITORING TRIAL FOR TROPICAL TUNA PURSE SEINERS**

**Iñigo Krug<sup>1</sup>, Jon Ruiz<sup>2</sup>, Oscar Gonzalez<sup>3</sup> and Greg Hammann<sup>4</sup>**

<sup>1</sup>**AZTI Tecnalia, Mahe, Seychelles**

<sup>2</sup>**AZTI Tecnalia, Bizkaia, Spain**

<sup>3</sup>**Marine Instruments, Galicia, Spain**

<sup>4</sup>**Marine Instruments, VA, United States**

Monitoring needs for the tropical tuna purse seiners in the Atlantic and Indian Oceans have been increasing considerably. Scientific monitoring, and mainly control requirements, such as the so-called "verification of best practices", have pressed the industry to move towards 100% observer coverage, making it necessary to find cost-effective alternatives or complements to human observers.

Since 2012, at least 3 different Electronic Monitoring Systems (EMS) have been tested versus On Board Observer's data, involving at least 1 foundation, 3 vendors, 4 research organizations and 5 fishing companies in the Atlantic, Indian and Pacific Oceans. Both analogical and digital video and still photographs capabilities have been tried.

The Electronic Eye (EE) Plus is an electronic monitoring system based on the automatic recording of high definition photographs and gear sensor data developed by Marine Instruments S.A. This system is an updated version of the first EE, which was adapted to the actual monitoring necessities of the tropical tuna purse seine fleet.

The overall objective of this study was to test the use of EE Plus on tropical tuna purse seiners, and determine its effectiveness to reliably document fishing effort, set-type, catch by set, including bycatch –such as sharks, rays, billfishes and turtles– and to verify implementation of the "best practices", understood as the correct handling of the bycatch and the utilization of non-entangling FADs (Fishing Aggregation Devices). To achieve these objectives, EE Plus and an experienced observer were deployed simultaneously on a complete fishing trip for later comparison of the collected data. The pilot study was conducted on F/V Egalabur, a 91 meter length overall vessel that operates in the Atlantic Ocean. It was a known challenge to conduct the project with the minimum number of cameras that this size vessel should install in order to cover all the required areas on board and fishing activities: 2 on main deck, 1 on fore deck and 2 wells deck (conveyor belt). EE Plus system can support up to seven cameras.

Overall results showed that EE Plus is a valid tool to monitor most of the data needs without significant differences compared to human observers. A closer look revealed that both EE Plus and on board observer identified same number of fishing sets, its date, time (shooting, rings up, end of the set) and set location. As well as the correct identification of set-type for all these fishing events: 35 monitored sets (24 FAD and 9 FSC sets).

Total retained tuna catch for the complete trip estimated both by EE-Plus and on board observer had less than 5% difference (806 vs 840 tonnes). Furthermore, GLM results corroborated that there were good indications that EE and observer data were equally reliable methods for estimating total catch per set

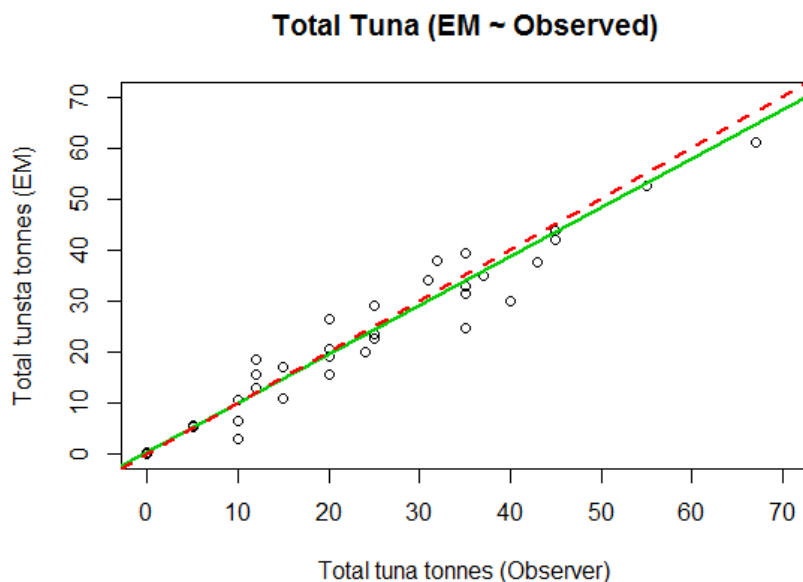


Figure 1: The solid line in the figure shows the fitted linear regression and the dashed line indicates the expected 1:1 relationship. The 95% confidence intervals of the intercept encompass 0, and 1 is enclosed by the 95% confidence intervals of the slope.

Within the complete trip, only one set had some small tuna quantities discarded. These discards were both identified by the EE-PLUS and observer.

EE-Plus slightly underestimated total number of sharks. The on board observer registered 197 sharks, while the EE-Plus data contained records of 178 sharks (90%)

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## **The Use Of Commercial And Recreational Vessels As Marine Data Collection Platforms: Opportunities, Constraints And Solutions**

**Amos Barkai**

### **OLRAC SPS**

#### Introduction

Roughly 150 000 vessels, from cargo ships to passenger carriers, recreational yachts, commercial fishing vessels and oil tankers, roam the world's oceans every single day. These vessels are immersed in all that the seas and oceans have to offer: they observe enormous amounts of marine phenomena and experience the full range of environmental conditions, including currents, waves and temperatures. The collective data-gathering potential of these vessels is as vast as the ocean itself.

#### Aim

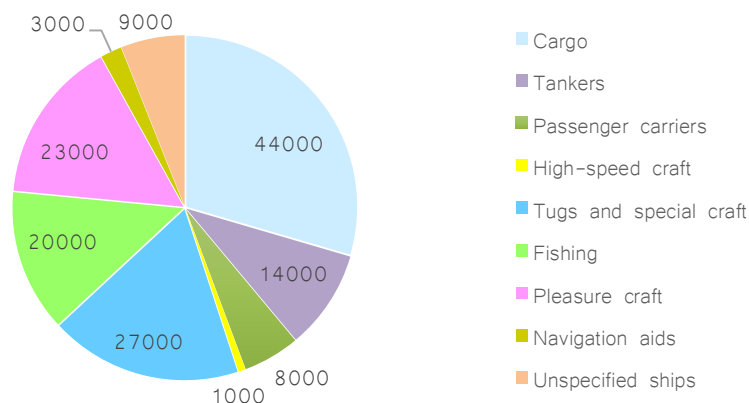
The vision is to use "citizen science" for marine observation and make each one of these vessels a potential data collection platform, relying predominantly on localised observation data collected on a ground-roots level from several individual sources. The technology developed to facilitate the data-gathering function will manage the entire process, from input to storage, management and analysis, all through a user interface intuitive to technology laymen. This will allow any type of vessel to become a sophisticated data collection platform with the use of a simple entry-level computer or mobile device. GPS connectivity will be an added benefit as will the keen eye of the individual/s on board, with or without the assistance of binoculars.

#### Method

The author and his team of programmers and marine scientists have developed a generic, simple to use, yet very sophisticated electronic logbook (eLog) software technology called the Olrac eLog. The Olrac eLog has the capacity to collect and report virtually any observational data while at sea. The Olrac eLog solution comprises two components, viz., (i) a vessel unit known as the Olrac Dynamic Data Logger (OlracDDL); and (ii) a web-based shore server called the Olrac Dynamic Data Manager (OlracDDM), which has the capacity to store and manage data from any number of vessels on one integrated platform. Presently, the Olrac eLog is widely used in the commercial fishing sector. However, given that only about 13 % of vessels at sea at any given time are fishing vessels, the Olrac eLog solution is

now extending its scope into other marine sectors.

Number of vessels at sea



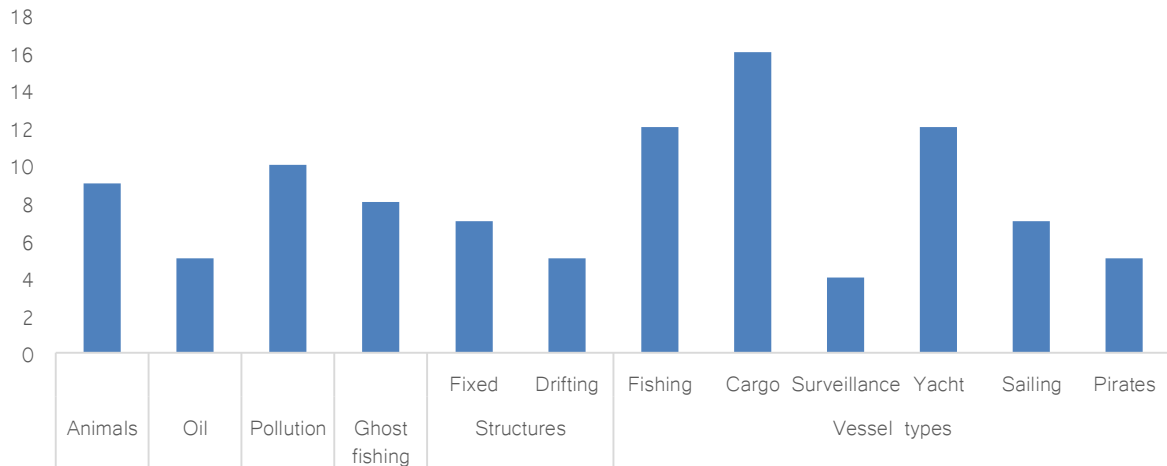
The main focus of the Olrac eLog solution developed by the author and his team is the collection of data “on the go” in the marine environment with a strong emphasis on the spatial and temporal dynamic of the observed information. As such, Olrac is able to capture any type of data in any form and format. This includes GPS data, numeric and alphanumeric fields, images, videos, tables and free text. The main power of the Olrac eLog solution lies in its ability to ensure that all data are collected in a precise and uniform manner, where data is entered using predefined lookup tables, digital maps or a catalogue of explanatory images. When possible, data and reports can be sent out in real-time using predefined common XML Schema Definition (XSD) via the vessel’s on-board SatCom or other communication equipment. However, data and reports can also be saved and sent at a later stage once the observer computer/tablet is within Wi-Fi or cellular network range.

This approach makes it possible to merge observations from many vessels into one common and unified platform. The Olrac eLog solution and vision have the capacity to transform hundreds of thousands of commercial and recreational vessels into “professional observers” of the sea without the need for any scientific or technical skills and with minimum training. The objective is for these data, once stored on a common platform, to be accessible to global users for commercial, scientific or environmental purposes, but without the intention of promoting a specific subjective agenda, be it ideological, commercial or political. The present plan is for the Olrac Observer version to be freely available for download on the internet; the associated cost recovery business model is yet to be developed.

## Results

The Olrac Observer unit is a specialised version of the Olrac eLog solution that allows users to record 512 species of marine life (seabirds n=359, dolphins and porpoises n=38, seals n=36, sharks n=28, whales n=15, rays n=12, jellyfish n=12, turtles n=7, other n=5), as well as 91 anthropogenic observations ranging from ghost fishing and oil slicks to floating debris and other vessels. The Olrac Observer not only collects data about the type of observation, but also spatio-temporal information such as the position and the spread of the observation around the vessel.

## Types of observations can be recorded on the Olrac Observer



This technology allows any sea-going person to record and store their observation in real-time and with great ease. Each observation is awarded with credibility from their peers on the Olrac Observer network who verify the accuracy and significance of the record. The observations can be accessed by eligible users from a central web-server in either raw or summarised form.

### Conclusion

With the strong societal drive towards citizen sciences, the author anticipates that the Olrac Observer will be a fun, engaging, intuitive and integral part of future marine monitoring.

The screenshot displays the Olrac Observer software interface. The main window shows a map with a green track and a 30 NM scale bar. A 'Trip: 08 Nov 2015 23:41:11' is selected. A 'Leatherback turtle' observation is highlighted, showing details like 'Activity Description: Jumping', 'Nr.of Healthy Adults: 8', 'Nr.of Healthy Young: 6', 'Nr.of Injured Adults: 1', and 'Nr.of Injured Young: 2'. The interface includes a sidebar with 'Start Details' and 'End Details', a top navigation bar with 'Night Mode (Off)', 'Tools', and 'Exit', and a bottom status bar with GPS coordinates.



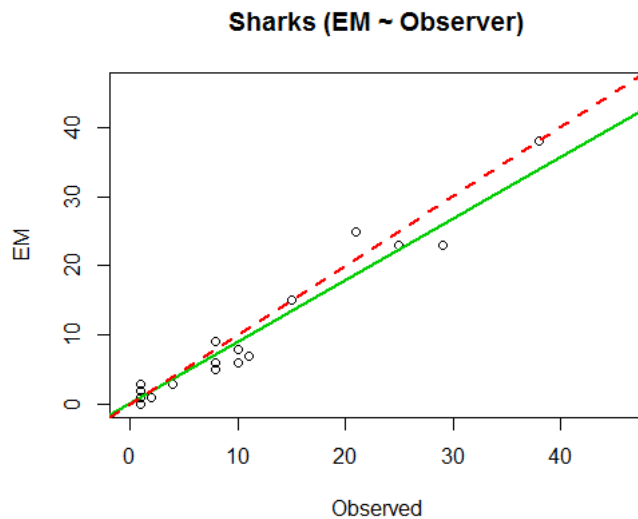


Figure 2: the GLM 95% confidence intervals of the intercept encompass 0, and 1 is enclosed by the 95% confidence intervals of the slope.

As a whole bycatch estimates on rays, billfishes and turtles presented results within expected margins and no significant differences between on board observer's data and EE Plus were encountered.

FAD and Best Practices monitoring and compliance verification were two new tasks assigned to EE Plus and the performance also shared the same level of expected results as previously mentioned. The success rate for fishing sets on FAD and number of FADs deployed was 100%. Meanwhile the FAD visits were underestimated by EE Plus it was always when the vessel did not get near to the FAD and it was out of camera view.

Minor differences on non-conformity numbers during released bycatch non-compliance actions might have been related to criteria differences between on board observer and EE Plus rather than the lack of images to monitor these activities.

Finally and based on this experience, the authors defined the electronic monitoring "minimum required standards" for the tropical tuna purse seine fleet before operational certification on a per vessel basis.

## **Open Discussion Session**

**Andrew France**, Ministry for Primary Industries, New Zealand

Q - Do the tablets used by observers to collect data need to have a clear path to the sky to transmit data/get GPS data/etc.?

A. **David Mathieu**- The tablet can be plugged into an external antenna on the vessel if needed. The tablet working wirelessly or needing a clear view of the sky depends on the size of the vessel and what material it is made from. There have been no transmission issues so far and the tablets have been used for military applications.

Q - How do the tablets handle saltwater and corrosion?

A. **Davie Mathieu**- The tablet hasn't been tested at sea yet

### **IPC/IATTC/ITTC**

Q - Do EM pictures from conveyor belts provide good enough pictures for catch composition?

A. **Inigo Krug**- You can't see which species it is when it is on the conveyor belt. They have asked fishermen to hold the fish up for the camera to see but the fishermen don't want to do it. They don't like doing that because they like to say they are catching smaller fish when really they are going for big ones and they don't want the cameras to catch them doing that. The cameras are limited to telling you the type of fishing activity. If an observer can't go on board, then it is better to have the cameras to get some data instead of no data. They are intended to subsidize observer coverage.

Q - Can you infer the type of set based on the tracking system (Electronic Eye Plus) you use?

A. **Inigo Krug**- the track guides you with a dot every 10 seconds. You can see all positions of the vessel when it is moving slower than 4kts. You can see when they are setting vs drifting based on how far apart the dots are.

Q - When using the tracking system (Electronic Eye Plus) and a human observer, is that like having two observers at once?

A. **Inigo Krug**- No because you need an observer on board who can cooperate with the vendors. You also want someone experienced onboard to document what is actually happening. A specific question or doubt can be answered by an observer who was there to see what was happening. We don't plan to deploy with both every time, this is just a pilot study so far. The tracking system isn't a substitute for observers it is more of a compliment to having an observer onboard already. If they don't want an observer we can ask if they will at least take the tracking system so we can collect at least some data.

**Matthew Kemp**, US North Pacific Observer

Q - Have you drop tested the rugged tablets? I'm concerned about the exposed antenna that folds out.

A. **David Mathieu**- The antenna is flexible and will swing down if dropped. We have tested it on a 3ft/1m drop and it was fine.

**Alfred "Bubba" Cook**, World Wide Fund for Nature (WWF)

Q - How easy is it to transport the Reach communication device/rugged tablet on a plane?

A. **Bryan Belay**- There are no problems on planes so far. The lithium battery is enclosed. You do need to keep it in a carry on instead of putting it in checked luggage. The only issues they've had with the tablet are keeping it charged. It's not a replacement for a PLB, which has a 10 year battery. Battery life depends on how often the observer uses them and that different depending on how often an observer talks to their family etc.

A. **David Mathieu**- I flew fine with my rugged tablet yesterday, I put it in my carry on instead of my checked bag.

**Melanie Rickett**, US North Pacific Observer Program

Q - What control do you have with the confidentiality of information sent on the Reach device? Does the device show the vessel's location if the observer posts something on Facebook? The vessel's fishing location information is supposed to be confidential.

A. **Bryan Belay**- There are protocols in place to keep confidentiality and we are developing specific protocols as we test them out. We have only tested them over the past year. I see everything they post to Facebook/text messages and I let them know that I can have access to read them at any time. I don't go out of my way to read all their personal messages, but they know that I do see them come up on my device. The Reach device doesn't connect GPS to social media sites like Facebook, so no vessel positions will be seen. They are told not to post pictures of any transshipment activity/fishing related activity. They are only allowed to post pictures such as sunsets. If the observer uses their device a lot and it becomes costly, then some of the money used to pay for it comes out of their paycheck. (If they use it for a lot of family/friends contact. If they use it a lot for work related purposes it is covered by the Provider Company).

**Amy Martins**- US Northeast Observer Program

General Comment - The camera on the Toughpad used in our program was found to be a low quality camera. We fixed this problem by issuing observers a separate digital camera that they use to take pictures that they then upload from the camera to the tablet. We are working on voice technology and soon we will be using a program that allows the electronic Marel scale to record weights directly on the tablet.

**Amanda Barney**- Ecotrust Canada

Q - What are the qualifications/training programs for someone who is reviewing the EM videos at the Pacific States Marine Fisheries Commission? Who is funding the training for the video reviewers?

A. **Courtney Donovan**- There are four videos reviewers at the PSMFC and they are all former observers. The training includes passing a video test. The funding for training is an in house cost.

**Emma Fowler**- US Northeast Observer Program

General Comment - One of my friends bought herself one of the Reach devices. She loves it, not just because it helps with safety, but also because it is an outlet to vent and feel connected to other observers. She wants one and supports that idea.

**Eric Brasseur**- US West Coast Groundfish Observer

Q - How confidential are the personal messages sent over the Reach device? Are the rugged tablets tested with gloves and salt water?

A. **Brian Belay**- I can see all the personal messages they send, I don't read them but they all know he can see everything sent.

A. **David Mathieu**- We haven't tested them at sea yet. We know that the observers will be careful with equipment like this where as the fishermen themselves most likely will not be.

Indonesian Program

Q - We still use paper data in our program. Does electronic data synchronize with paper data?

A. **David Mathieu**- We can alter the software to the specific observer program's needs. You can either keep the data in an electronic database or you can save it as a PDF and print it out each day and send the papers in when you come back to port.

**Scott Kauffman**-

General Comment- If you go to [www.eminformation.com](http://www.eminformation.com) , you can sign up for general email updates about EM. It's a good place to build a network of EM and ER. EM is a good way to help reduce operating costs for fishermen because the price is a threat to small boat's survival.

**Amy Martins**- US Northeast Observer Program

General Comment- We have looked into getting the Reach devices for our observers. We need a specific communication plan in place before the government will allow us to use it. We are testing it with a few observers but still need to come up with a policy concerning social media. Our observers will most likely be getting the Reach devices soon.

**George**- Pacific Island Regional Observer Program

General Comment- We need to review data management plans. It is easy to collect a lot of information with EM and ER but we need to decide what is data and what is not. For example, pictures of certain fish are required but other fish are not. In his program, they have a large number of tuna pictures because they are required to be taken, but now they can't delete them because its data.

**Suzanne Bryan** - Northeast Fisheries Observer Program

Q- What is the practicality of a touch screen with gloves and fish slime?

A. **David Mathieu**- You can use the keyboard to take notes, but we understand it is busy on deck and we want you to get all the important data you need. Observers will need to think differently and alter their data collection style if they start using the tablets on deck. Paper note taking and tablet note taking are very different and it's something they have to adapt to.

**Joshua Lee**- NOAA Pacific Islands Region Observer Program

Q -How well does a wet tablet screen work? My phone gets very sensitive when wet.

- A. **David Mathieu**- In 3 out of 4 cases the tablet worked fine with a wet screen. We wiped one down with a wet sponge and it worked fine. You can see him at his table for more feedback.

**Karl Staisch** - Western Central Pacific Commission

Q -The issue is not that they don't want EM, they just feel like their privacy will be invaded with cameras onboard. Do you have a response to that?

- A. **Courtney Donovan**- Usually they turn around so you can't see if they are using the bathroom on deck.

A - **Inigo Krug**- There are always blind spots even with cameras. The crews don't like working in a new place on deck. They will have to adapt and find a new spot to use the bucket if the camera is pointing right at their old spot.

A - **Bryan Belay**- Once the cameras are on board a boat (even small boats), they quickly learn where the blind spots are. When installing EM equipment, I like to show them the view from the camera so they can see the blind spots so they know where they can find some privacy. The installer helps them overcome some of these concerns.

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## **Poster Presentations – Extended Abstracts**

**Electronic Monitoring to support transparency and Efficient Management for Long-term sustainable fishing**

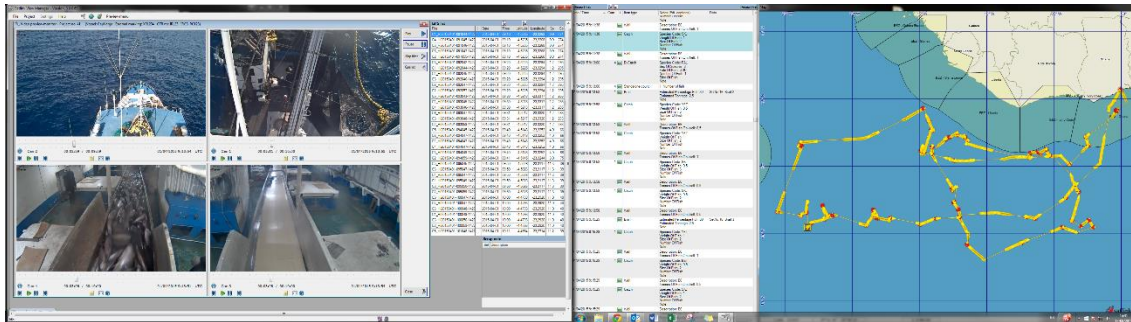
**Legorburu, G.<sup>1</sup>, de la Cal, J<sup>2</sup>**

**<sup>1</sup>Digital Observer Services (DOS), Spain**

**<sup>2</sup>Satlink, Spain**

In the last years, the accuracy and veracity of the data used for fishing management worldwide has been widely discussed. As previously mentioned from other sources (McElderry, 2008; Dunn and Knuckey, 2013; Monteagudo, 2014) Electronic Monitoring (EM) is the latest method to obtain reliable fisheries information across the extensive range of vessels operating the oceans. As the technology moves forward, management measures adapt, consumer demands change and access to fisheries increases, the extent of recorded information will increase in such way that data reviewing procedures and software need to progress accordingly.

Currently different fishing administrations, RFMOs and organizations are setting standards for the implementation of EM systems for fishing data achievement (Restrepo, 2012). In 2013 Satlink developed an on-board video recording equipment with remote access to real time information and capability to record fishing activity for later analysis. This system has evolved into the SeaTube EM system which is a fully operational electronic observer system thanks to the development of the Satlink View Manager (SVM) software.



As Restrepo says *“Electronic monitoring is much more than CCTV cameras”*. Efficient management of data requires the proper tools and resources including both technological and human resources. SeaTube/DOS EM system offers both of these with a state of the art on-board information recording system and post processing software, upon which certified protocols, training and expertise of the analysts behind the screens are applied.

Following regular updates, improvements in the analysis of trip data and considerations of client requirements, the SeaTube/DOS EM system has now an extensive range of fishing trip data liable which has been compared with on-board observers’ data, as well as Electronic Logbooks from E-Reporting. These comparisons demonstrated that SeaTube/DOS EM system fulfils ISSF PVR requirements for EM in tuna purse seiner fishery and also AZTI requirements for effective verification of the application of fishing good practice with regards to bycatch handling and FAD management. Furthermore, the EMS is also capable of providing assurances to fishery suppliers concerning the traceability of the fish products sourced, for example in instances of sourcing FAD free or Dolphin safe tuna.

Our findings show that the EMS estimates a greater quantity than that recorded by onboard observers. The ability for the EMS to repeatedly view activities, as well as events occurring at two different locations on the boat at the same time, for example below and above deck during tuna brailing, allow a more robust estimation of total catch, bycatch discards and species composition. EM also detects more FAD related activities than those reported by onboard sources. Furthermore, EMS is able to achieve similar results at the cost of far less time, while also not exposing human observers to potentially dangerous situations. As such the EM system can be considered an excellent cost effective solution to increase observer coverage and minimize analysis effort. In addition to monitoring compliance, the system can record and report scientific data such as tuna species and size composition, bycatch and discard composition, SSI detection and FAD activity, all of which have been tested against onboard observer and electronic reporting to generate the results shown in the poster.

SeaTube EMS, it is not designed to replace currently observer programs in place. The EMS needs inputs from the onboard observers’ expertise. However, EMS can complement existing observer programs either by providing increased coverage, or working with observers on the same boat to permit observers to carry out more technically specific duties

such as tagging and sampling. EMS increases transparency and confidence, minimizes training and deployment costs, and the resulting increased observer coverage across the fleet contributes a large range of fisheries activity data.

In conclusion, SeaTube EMS is an innovative tool by which fishing effort and catch information can be obtained, and compliance of management measures and voluntary schemes can be determined. All of this service is provided across a high percentage of the fleet with a corresponding reduced effort and cost in human resources. As extensive studies have shown, SeaTube EMS can provide transparency and assures accurate data collection. EMS can also complement at sea observers' skills and experience will enforce fishery monitoring and scientific data reporting quality.

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## **Electronic Data Collection Application for Dockside Observers**

**Kevin Romanin**

### **Archipelago Marine Research.**

Before the introduction of the 1Fish 2Fish app, dockside observers tasked with logging and verifying commercial fisheries catch unloaded at the dock had to record all landing data onto water-resistant paper notebooks and tally forms.

All calculations were performed manually on paper, often in adverse weather, with skippers standing by, impatient to get their data (they paid by the hour so wanted observers to complete their calculations as quickly as possible); however, these calculations could be time consuming, and any errors could have negative impacts on the vessels.

The 1Fish 2Fish team came together to help make dockside observers' lives easier, and to meet the fishers' needs in a timely manner. Archipelago's project team (including scientists, managers, programmers and data collectors) developed the 1Fish 2Fish app to simplify data collection, increase data integrity, and streamline data delivery. (This team has ensured the successful data capture of over 7,500 offload events over the last 4+ years in British Columbia's busiest fishing ports.) Designed to operate on the Android operating system, the app would also support opportunities for further development. The goal was to create a tool that was user-friendly for non-technical users, time saving at the dock and in the office, and able to automate the numerous manual calculations involved.

Using 1Fish 2Fish, dockside observers can easily log landing data as fast as the catch can be offloaded. 1Fish 2Fish simplifies the data entry process by guiding the user through five easy screens:

- The **Info screen** receives offload information, including: hail numbers, fishery type, vessel name, location and date. It also includes space to add comments and reference any associated documents (for example, occurrence reports, or special permits).

- The **Time screen** receives hourly time estimates and travel details for all staff at the offload (including observers, taggers, and piece counters). This screen automatically calculates billable time to the vessel and displays the total cost at the end of the offload.
- The **Tally screen** receives all catch information. For groundfish, catch is separated by the species, state, form, buyer, and quota categories. Depending on species and fishery requirements, this screen may also prompt for additional details such as size grades or percentage splitting of blended species. This screen can also receive tote and truck numbers associated with the catch to help when reporting on truck totals (to assist buyers and offloaders).
- The fourth screen is determined by the fishery type specified in the Info screen (because data collection requirements differ for each fishery type); for example, with a multiple license groundfish hook and line trip, this prompts for quota allocations between the two licenses, the halibut tag numbers used, and the logbook page numbers collected.
- The **Report screen** summarizes the data entered to assist with reporting during and at the end of the offload process. This screen can display offload progress, species conversion weights, average weights per species, and final quota numbers for use on the validation record.

1Fish 2Fish includes real-time data quality measures to catch outliers and ensure that the data is complete. The app triggers an alert for any unlikely values that have been entered, and displays a final checklist of any errors for review before the data is submitted. By ensuring the integrity of the data within the app, 1Fish 2Fish ensures that the data submitted is of the highest quality, requiring far less time and effort to verify in the office.

Before 1Fish 2Fish, finished data forms were taken to port offices where they were faxed to the main office for processing and manual data entry. Now the data is transmitted wirelessly, direct from the tablet, using one of three methods:

- Direct upload to the Archipelago data hub (eliminating the data entry step in the office).
- Transfer to a dedicated server (where it can be downloaded by other observers for multiple part offloads, or by office staff to help troubleshoot any errors).
- Email; for example, fish buyers who had previously relied upon the triplicate paper dock tallies can now receive offload summary reports from 1Fish 2Fish by email.

Having a tablet at the dock enables Archipelago to take advantage of other mobile applications to further enhance the dockside observers' tasks. With Dropbox, all users can access the procedures documents and fisheries regulations that they are required to carry without having to bring paper copies with them. Dropbox also allows for instant sharing of updates across the coast to make sure all observers have the most current versions of documents without having to do mail-outs. The camera allows for photos to be shared with the office for assistance with species ID questions or any regulation issues that might need



to be documented. Security applications keep the data secure and if a tablet is suspected lost or stolen, it can be traced using GPS and remotely wiped by the administrator.

In the office 1Fish 2Fish has saved many hours by sending the data directly to the data hub instead of manual data entry. The time previously spent tracking missing pages due to fax connections or filing errors has also been eliminated. With data going digital, Archipelago has also saved over 25,000 sheets of paper per year since 1Fish 2Fish was launched.

1Fish 2Fish is a valuable tool with the capacity to organize and collect data, perform calculations, support real-time data quality checks, provide instant reporting, and simplify data transfer. Thanks to the innovations that have saved many hours and resources, 1Fish 2Fish has become an integral part of Archipelago's groundfish dockside monitoring programs.

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## **Tips for Transitioning from Paper Forms to in-the-Field Electronic Recording**

**Eric Soderlund**

**International Pacific Halibut Commission, Seattle, WA**

### **Introduction**

The International Pacific Halibut Commission (IPHC) conducts an annual stock assessment survey comprising over 1200 sampling locations ranging from the southern Oregon border northward through the Bering Sea and along the Aleutian chain. It is one of the largest annual fisheries surveys in the world, generating a huge amount of data recorded on a suite of paper forms. The three-month-long survey is completed at the end of August and the data from the survey are used for the current year's stock assessment released at the end of November. The time needed for data entry, verifying, and editing data after collection makes for very tight deadlines for the stock assessment.

To minimize the time between collecting data in the field and providing those data, cleaned and verified, to the stock assessment team, we developed an electronic data recording system. The summer of 2016 marked the successful pilot deployment of EaSea (Entry at Sea, pronounced 'easy'), a Windows tablet-based data collection and reporting tool.

While every project is different, the processes and techniques we employed can be applied to the design and development of any electronic data recording tool.

### **Planning**

Defining the project scope is the fundamental first step to creating a system that meets objectives and is an improvement on the system currently in use. The project scope includes timelines, budgets, goals, and deliverables. It includes technical and functional specifications, describing in detail exactly what the system does, that guide the software development, inform equipment purchase decisions, and establish data security and safeguarding standards. Expect the functional spec to be updated with additional details as

the project progresses. Consider the skillset of the in-house team and determine in what areas help from outside experts will be needed. By listing and describing everything that can be recorded on paper forms, the flexibility, reliability, and power of paper as a data recording medium will become apparent, making the time ripe for reevaluating the anticipated gains made by transitioning to electronic recording.

It is easy to be attracted to flashy new technology. Be sure that functional specs satisfy the demands of the end product, rather than the abilities of available technology. For example, at the IPHC, we were intrigued by electronic fish measuring boards that ease the processing of high numbers of fish samples; however, on our longline surveys speeding up measurement is not a process bottleneck and the cost of an electronic fish measuring board would not be worth the benefit gained.

### **Development and Design**

The team's technical skillset will determine how much can be developed in house. For IPHC's EaSea project, the backend was created by an in-house programmer, with the help of a subcontractor who was hired to handle cloud service integration for uploads, downloads, and updates.

The user-interface for EaSea was designed by a small team with experience collecting the same data on the same type of boats. Because IPHC contracts commercial fishing vessels to conduct the survey, opportunities to provide technical support are limited to infrequent emails and satellite phone calls. This places extra importance on the intuitiveness of the software and ability of a novice user to navigate all the features with limited practice, training, or support. We believed that to a large extent the success of the software in the field relied on it having excellent usability. Therefore we followed user-centered design methods, in which all stages of the development and design process prioritize the needs, wants, instincts, and limitations of the user. These practices help create a system that behaves how the user expects it to behave for the task at hand. For more details on how to design for usability, the U.S. government's *DigitalGov* ([www.digitalgov.gov](http://www.digitalgov.gov)) has resources, such as their *Usability Starter Kit*, available for free download.

### **Testing**

Results from tests for functionality and usability guide the iterative development process; plan for multiple rounds of testing. Tests should be guided by a detailed test plan that includes test goals, specific tasks to test, and guidelines for reporting results and tracking issues. Functional tests investigate whether the system is doing exactly what it is expected to do and that the data are stored correctly. Functional testing, including bug testing, can usually be done by people working independently who do not have experience in the field. Usability tests determine whether users can easily make the software do what it needs to do to complete a task, and whether there is a better way to approach that task. For us, the most informative usability test was *think-aloud* testing in which participants verbalize every intent, action, and thought as they attempt to complete test tasks. Think aloud usability tests require a team, made up of a facilitator to work with the participant and observers to record results. Since there was often disagreement between what programmer and the design team think will work in the field, we used think aloud tests to settle those discussions.

Issue-tracking software proved very beneficial. Any issues noticed during testing, as well as ideas for modifications and new features, were categorized, prioritized, and recorded with issue-tracking software. At weekly meetings, the bulk of the time was spent reviewing and finding solutions to these issues discovered during testing.

### **2016 Pilot Deployment**

Survey data were recorded using EaSea on three different tablets that were on six different boats and used by eight field biologists, for a total of 58 fishing days, 289 sets worth of data, and 22,967 halibut biological records (plus associated effort, bycatch, and environmental data). Despite a few system crashes, no data were lost thanks to data safeguarding protocols that maintain real-time duplicate data files on separate drives, as well as copy the dataset to a removable storage device after each fishing event.

Because we recognized that learning how to do their job in a new way and how to use and troubleshoot a new device would add significantly to the field biologists' workload, we felt it was important to highlight ways that using the tablet would make their field work easier and more efficient. In the first two weeks of the pilot deployment, a few problems surfaced that were not noticed during testing. However, the field biologists provided such highly-detailed descriptions of the problem that the programmer was able to create fixes that were available for download at their next port visit. Halfway through the pilot deployment, the biologists were requesting never to return to paper-based collection. EaSea met both requirements for function and usability: no data were lost or corrupted and the biologists were able to operate and troubleshoot with minimal help from headquarters.

### **Future Plans**

Thanks to the success in 2016, IPHC plans to collect all survey data electronically in 2017. The first version was designed only to record what had been previously recorded on paper, and in 2017 we do not plan to add any additional features. However, plans are already forming potentially to integrate the tablet system with cameras, hydrophones, GPS, scales, and other devices for future research projects.

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## **Back Deck Tech: Technology enhanced data collection in the West Coast Observer Program**

**Jason Eibner**

**Northwest Fisheries Science Center, Newport Oregon, USA**

In the midst of program growth and expansion the West Coast Groundfish Observer Program (WCGOP) remains dedicated to producing the most accurate and timely fishing information/ analyses possible to inform industry and regulatory entities alike. Recent WCGOP projects incorporate new technology toward more accurate and efficient data collection/ processing to decrease data turnaround time. Highlighted below are two such projects, the WCGOP Digital Data project, and the WCGOP Observer Program Technology Enhanced Collection System (OPTecs) project.

## **Digital Data Project**

Prior to 2015 WCGOP policy required observers to complete database entry within three days of returning from a trip, and their data forms were shipped to staff at the nearest field office on a monthly basis. The data review process could begin upon receipt of the forms, and data finalization would typically take 4-5 weeks from the time that the vessel delivered catch. The inception of Individual Fishing Quotas (IFQ) in 2011 for the commercial fleet required faster data finalization time to ensure accurate and timely deduction from an individual's quota.

The Digital Data Project was created in an attempt to speed up data finalization by reducing the time it takes to receive data forms and begin the review process. We investigated the potential of having observers scan completed data forms to create a portable document format (PDF) file that is uploaded securely into the WCGOP database, along with their hand entered data. Once the scans are uploaded they can be accessed by WCGOP staff coast wide to begin the data review process. The scans can be flagged for errors and uploaded to the database for the observer to access and complete the corresponding edits to the paper forms. The resulting benefits include savings of both time and the cost of shipping data back and forth, and ultimately, faster catch reporting and deduction to the individual's quota.

In Jan. 2015 the Digital Data project was implemented coast wide and all WCGOP observers began using portable hand-held scanners to create PDFs of their data forms for upload to the database. Currently, three days after a vessel delivers their catch the observer is required to have data PDF's uploaded into the program database and transmitted along with their database entries for immediate dissemination to staff. As anticipated, uploading of data PDF's has enable the review process to start weeks earlier than in previous years, and now an individual's quota is debited, on average, 5 days from when they delivered the catch. Moreover, the data PDF's have proven useful when monitoring the progress of new, remote, or poorly performing observers by allowing staff to catch errors early, before they are committed over multiple fishing trips.

## **Observer Program Technology Enhanced Collection System (OPTECS) project**

The WCGOP OPTECS project is currently developing a pilot electronic back deck data collection system using rugged tablets synced with various components that will replace paper forms. The aim is to provide near real-time reporting of discard data for IFQ Vessel Accounting System (VAS) quota debiting, while increasing the accuracy and efficiency of the data collection process through data finalization.

Development of this system builds upon and collaborates with existing systems used by various research surveys within the NWFSC, (i.e., West Coast Groundfish Bottom Trawl Survey, Hook and Line Survey, and Acoustic Survey). These surveys have succeeded by using a rugged computer device integrated with a customized user interface (UI) application that allows communication with various data collection components (e.g., motion compensated digital scale, electronic length board, GPS, and barcode scanner) for automated or manual data entry into the device. This model serves as a springboard for creating a similar system, customized for WCGOP to use across a variety of fisheries and gear types employed along the US West Coast. The main components of the OPTECS will be a rugged tablet equipped

with a custom UI application, camera, barcode reader, and GPS paired with a Marel M1100 motion compensated digital scale.

The ultimate goal is to have WCGOP observers step off a vessel with electronically logged data, having passed rigorous automated error checks (already developed in 2014), that is ready for immediate upload into the secure WCGOP database, triggering progression to the VAS for quota management. A successful system would permit updated IFQ numbers to be available in the VAS within 24 hours. Moreover, data transcription and database entry will be eliminated, only the initial data entry into the tablet is necessary, and this makes the data collection and submission process more accurate and efficient. The data review process will also be simplified. Most data checks will be automatic, and there will no longer be a need to compare database entries to data forms, a tedious and time consuming effort. The OPTECS will also have the ability to add/ subtract data collection components and modules for customization and use over a variety of fisheries and gear types, as well as, adapt to the changing data needs of fishery managers, scientists, and industry members over time. Further benefits to going paperless include; cost savings estimated at ~\$18,000/ year for printed plastic Duracopy forms, an additional ~\$12,000/ year for shipping data forms from observer to staff throughout the QA/QC process, and environmental benefits from disuse of plastic forms.

The OPTECS project is currently in the later stages of UI application development and testing. Field tests with tablets and the integrated UI application are expected to begin in the fall/winter of 2016 and continue into 2017.

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## **Enhanced Technology In Use Within The United States Commercial Pelagic Longline Fisheries**

**Matthew Walia**

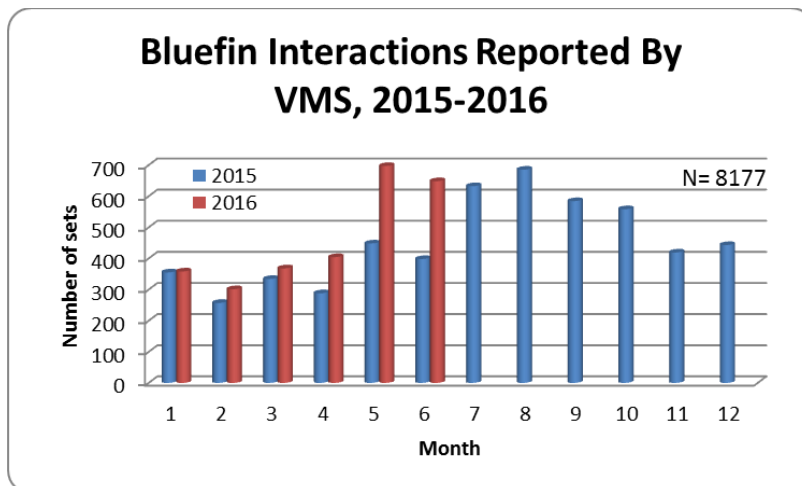
### **NOAA Fisheries**

The Atlantic bluefin tuna, *Thunnus thynnus*, is an economically-important and highly targeted species worldwide and is currently listed as a species of concern by the United States National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries) (NMFS, 2011). Pelagic longlining, in its most basic form and use, can be dated back to Japan during the 7<sup>th</sup> century (Yamaguchi, 1989). Currently in the United States, the commercial pelagic longline fleet has been monitored by the Pelagic Observer Program (POP), which collects and records a variety of environmental, effort, and biological data ranging from reproductive tissue, otoliths, muscle samples, liver sample, skin and dorsal spines. The wide range of data and samples collected by the POP are essential to understanding the life history of the Atlantic bluefin tuna, contributing to key understanding of the stock. POP data have been used to validate spawning areas encountered by the longline fishing fleet (Knapp, Jessica M., et al., 2014) as well as contributing to management decisions. The United States has long recognized the economic importance of the pelagic longline fishery and has sought to protect the resource through regulation and management decisions, highlighted in table 1. Since January 1, 2015, newly enacted regulations placed added technology on the United States commercial pelagic longline fleet to augment

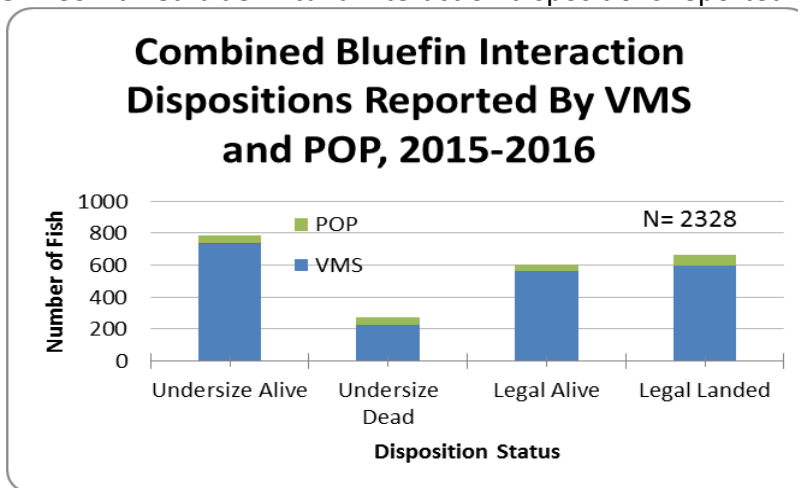
observer coverage, including enhanced Vessel Monitoring Systems (VMS) [79 FR 71606, Dec. 2, 2014; 80 FR 73146, Nov. 24, 2015] and electronic monitoring (EM) [79 FR 71588, Dec. 2, 2014] using video cameras. These innovations are part of the Individual Bluefin Quota (IBQ) Program and have added to the quality and robustness of data collected by the POP. NOAA Fisheries Office of Law Enforcement (NOAA OLE) plays an integral part in monitoring this technology, ultimately aiding in accomplishing management goals regarding the bluefin tuna. An overview of the implementation of and compliance for long-term regulations in this fishery will be presented, highlighting cooperation between multiple NOAA offices and the fishing industry. Observer interactions with bluefin tuna from the POP Program are compared to the VMS and EM data, highlighting the enhanced data obtained; from January 2015-June 30, 2016.

Historically; self-submitted logbooks, in addition to POP data and dealer landings, were the main sources of catch information on bluefin tuna. Logbooks submissions to NOAA are, at times, delayed and lack detailed catch information i.e. size and specific location. Observer coverage has historically been 8% coverage of the fleet fishing effort, by area and quarter for the year (Keene, Kenneth K.; et al. 2007). Higher observer coverage levels are mainly limited by cost and staffing concerns. To augment the gap in coverage, EM and VMS have been utilized to capture the entire fleet effort in regards to the bycatch of bluefin tuna, as part of the IBQ Program. The Highly Migratory Species (HMS) pelagic fishing fleet sends a daily bluefin set report through their VMS, reporting the date, set number, number of hooks, location, size and disposition of any bluefin tuna encountered. Compliance of proper forms submitted vs fishing effort is monitored by NOAA OLE. Since 2015, there have been 8,177 bluefin set reports submitted, with 553 encountering a bluefin tuna. Compliance outreach and enforcement from NOAA OLE has resulted in an increase of submitted VMS reports (Figure 1). Size classes of tuna encountered from VMS and POP data were categorized into four main disposition designations; undersize/released alive, undersize/dead, legal/released alive and legal/landed. Numbers and disposition can be seen in figure 2. The VMS data encompasses effort of the whole fleet, while POP levels represent a percentage of effort, by area. The numbers and disposition of bluefin tuna captured through EM data were not able to be included at this time due to data processing constraints. Camera footage is recorded for every haulback in order to capture images of bycatch boatside and on the deck of the vessel. Data compilation is in its initial phase and sub-sets of camera data are audited, using VMS, POP and dealer records to match bluefin encountered. However, since the EM program has been in effect, over 1,065 trips from 111 vessels have been recorded and submitted by the HMS fishing fleet. Using the enhanced technology of the VMS and EM data, bycatch data are looked at in the IBQ program, ultimately deciding on the correct number of bluefin tuna shares allocated per vessel. A HMS vessel is allowed to conduct fishing when their quota is positive and must rectify any deficits before departing again. The combination of technology used and monitored by NOAA OLE and HMS staff have helped capture an accurate and real-time picture of the bluefin tuna encountered by the fishing industry. The added coverage on the pelagic longline fleet provided by VMS and EM data would not be economically feasible using observers alone. Conversely, the data POP observers obtain is irreplaceable and critical to assess the health of the fisheries, but the added technology used can serve as a cost-effective example for other regional fisheries and nations to use, helping monitor, manage, and conserve bluefin tuna worldwide.

**Figure 1:** Bluefin tuna interactions reported by VMS, 2015-2016.



**Figure 2:** Combined bluefin tuna interaction dispositions reported by VMS and POP, 2015-



2016.

**Table 1:** Important Management Dates

Historically, the United States has considered fisheries as an important economic resource. The following dates mark events important to the pelagic longline fishery (Keene, 2011):

1871: President Ulysses S. Grant signs legislation for the Office of Commissioner of Fish and Fisheries.

1903: U.S. Fish Commission becomes The Bureau of Fisheries

1966: ICAAT is established

1970: The Bureau of Fisheries becomes NOAA's National Marine Fisheries Service

1971: FDA prohibits sale of swordfish with mercury content greater than 0.5 parts per million

1969: National Environmental Policy Act (NEPA)

1972: Marine Mammal Protection Act (MMPA)

1973: Endangered Species Act (ESA)

1972: ICCAT's recommendation to prohibit landings of yellowfin tuna less than 7 pounds is passed, thus

protecting juveniles.

1974: The first federally mandated (by law) observer program (tuna purse seine) is initiated by the

NMFS Southwest Fisheries Science Center. (Edwards, 1989)

1976: The Magnuson-Stevens Fishery Conservation and Management Act is signed

1978: FDA raises maximum allowed mercury content in fish to 1.0 parts per million

1979: ICCAT's recommendation to prohibit landings of bigeye tuna less than 7 pounds is passed, thus

protecting juveniles.

1985: The Atlantic Swordfish Fishery Management Plan (FMP) is implemented, mainly calling for

reductions in harvest of smaller swordfish, continued research and monitoring of the North Atlantic swordfish population and minimization of foreign impacts on the fishery.

1990: ICCAT passes its first recommendation on swordfish, calling for reductions in harvest of undersized North Atlantic swordfish; NOAA Fisheries Service follows with a ruling limiting harvest of undersized North Atlantic swordfish

1990: Magnuson-Stevens Act is amended to give the Secretary of Commerce authority to manage

Atlantic tunas; secretarial authority is delegated to NOAA.

1992: NOAA establishes the Highly Migratory Species (HMS) division to manage Atlantic tunas,

swordfish, sharks, and billfish.

1996: Sustainable Fisheries Act of 1996

1999: NOAA Fisheries Service publishes the final Fishery Management Plan (FMP) for managing

Atlantic tunas, swordfish, and sharks.

1999: ICCAT establishes 10 year plan for rebuilding North Atlantic swordfish stocks.

2000: Live bait use is prohibited in the Gulf of Mexico.



1999/2000/2001/2005/2015: NOAA Fisheries Service implements several large time-and-area closures for pelagic longline fishing, to reduce bycatch of Atlantic bluefin tuna, juvenile swordfish and billfish (Desoto Canyon: year-round, starting Nov 2000; Florida East Coast: year-round, starting March 2001; Charleston Bump: Feb-April; starting March 2001; Northeast Distant Waters Restricted Fishing Area: starting in 2004; Cape Hatteras Gear Restricted Area: Dec-April and Spring Gulf of Mexico Gear Restricted Area: April-May, starting in 2015).

2002 : Stock assessments determine that North Atlantic swordfish stock biomass is 94% of levels needed

for maximum sustainable yield (BMSY)

2004: Mandatory use of circle hooks; J-hooks banned

2005: ICCAT repeals minimum size limit of yellowfin tuna, but the NOAA Fisheries Service retains its

27" minimum size limit for fish caught in the U.S.

2006: Magnuson Stevens Reauthorization Act/ Consolidated Atlantic HMS FMP

2007: U.S. seeks a temporary suspension of Eastern Atlantic and Mediterranean bluefin tuna fishing at

ICCAT. ICCAT did not adopt the U.S. recommendation.

2009: North Atlantic swordfish stock is considered fully rebuilt

2010: The United Nation rejects the proposal to place the bluefin tuna on the Convention on International

Trade in Endangered Species (CITES) list, which was supported by the U.S.

2015: Creation and implementation of the Individual Bluefin Quota (IBQ) Program; consists of allocated quota shares within the HMS pelagic longline fishery, enhanced reporting and monitoring measures.

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## **Applying Technology Trends To Fisheries Observing And Monitoring: 3D Printing**

**David Chandler**

**NOAA Fisheries, FOS, United States**

**Saltwater Inc., United States**

Rapid digital manufacturing and 3D printing is a growing technology that, like other industries, fisheries observing and monitoring could take advantage of. 3D printing has never been more accessible than it is today. There are numerous desktop printers that will print quality prototypes and working end products right in the comfort of one's home or workplace. There are also service providers with industrial grade printers where one can send in their designs to be printed. One thing I have noticed about being an observer is the use of general tools and equipment in a specialized field. With 3D printing, observer programs can adapt to their unique conditions and requirements, designing and creating their own custom tools specific to the job at hand, making data collection more efficient and accurate. Electronic Monitoring (EM) is becoming increasingly used for applications where it is difficult or impossible to place an observer. 3D printing has vast potential with EM applications. One could look at each individual vessel or scenario and create whatever they would need to get the job done. Camera housings could be made custom to the camera being used and attach wherever they are needed on the vessel. Replacement and modification can be done in-house and immediately. No waiting for processing, production, or shipping. The beauty of 3D printing is one can get what they need when and how they need it. Having observed with the North Pacific Groundfish Observer Program (NPGOP) and At-Sea Hake Observer Program (A-SHOP), I've seen many ways 3D printing could be incorporated. I designed, printed and tested an otolith collection toolkit for my particular location and duties. Multi-purpose custom lids for the sampling baskets would be an improvement over the ones used now. Material and models can be made to help demonstrate concepts during training. These are just a few ideas. Imagine the possibilities when applied throughout all observer programs. This presentation will cover the process

from design to production and use of 3D printed items for fisheries observing and monitoring. The otolith collection toolkit will be showcased as an example.

#### Introduction:

Rapid digital manufacturing and 3D printing is a growing technology that, like other industries, fisheries observing and monitoring could take advantage of. 3D printing has never been more accessible than it is today with numerous desktop printers and service providers available. The process for creating 3D printed objects is universal and can be categorized into three main stages: Design, Prototyping, and Use. Using this process, I created an otolith collection toolkit designed for the At-Sea Hake Observer Program (A-SHOP) and North Pacific Groundfish Observer Program (NPGOP) to facilitate otolith and other specimen collection.

#### Design:

Computer Aided Drafting (CAD) programs are used to design parts or assemblies. Exact specifications can be met for any situation.

#### Printing/Prototyping:

Test prints can be made to verify tolerances or functionality. Once the design is ready a prototype or fully functional end product can be made with ease.

- Hinge tests were made in different material to test movement and rigidity.
- Vial, knife, pencil and forceps holders were tested for size and fit.
- Sponge door was tested for structural integrity.
- Vial block and holder portion was tested hollow vs. solid.

#### Use and Improvement

The otolith collection toolkit did very well for being the first iteration. Overall it performed as intended to facilitate and improve otolith and specimen collection. However, there are some things that will need improvement.

- The printed hinges were not thick enough and cracked under use.
- Latching mechanism was too thin and snapped.
- Forceps holder is not long enough to accommodate forceps with large angled tips.

#### Potential Applications

- Tools and equipment - Observer programs can adapt to their unique conditions and requirements, designing and creating their own custom tools specific to the data being collected.
- Electronic Monitoring (EM) – Each vessel can be looked at individually. Mounts or housings can be made to fit specific cameras and locations.

- Training – Material and models can be made to help demonstrate concepts.

## Conclusion

The possible applications of 3D printing throughout all observer programs is vast. Research, development and production can all be done in-house. Customization, modification and replacement of existing designs can be completed with very little down time. Just return to your design, make the changes and print another one. This is the beauty of 3D printing. One can get what they need when and how they need it. All of this can be done in the same day. As time progresses, rapid digital manufacturing and 3D printing technology will become even more accessible and more cost effective. The use of this technology to design and create tools and materials for fisheries observing and monitoring can positively affect the collection of quality, unbiased data to manage our Earth's resources.

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## Green Sturgeon-Post Release Impacts in California Halibut Trawl Fisheries

**Jason Vestre**

### PSMFC

Goal: To understand green sturgeon post-release impacts, provide further insights on green sturgeon movements, and strengthen NMFS and CDFW research collaboration with fishermen.

**Project partners:** California halibut fishermen, West Coast Groundfish Observer Program (WCGOP), California department of Fish and Wildlife, Researchers from the NMFS Northwest and Southwest Fisheries Science Centers.

### Background:

Green Sturgeon (*Acipenser medirostris*) are an anadromous fish found in coastal waters along the entire eastern Pacific Ocean. Green sturgeon spawn in least three rivers along the west coast: Klamath River, Sacramento River, and Rogue River. After they enter the ocean, they appear to make a northern migration and concentrate in coastal estuaries, particularly the Columbia River estuary and coastal Washington estuaries.

There are two Distinct Population Segments (DPSs) of green sturgeon along the west coast, divided by whether their spawning site is north (Northern DPS) or south (Southern DPS) of the Eel River in Northern California." In 2006, the southern DPS (sDPS) of green sturgeon was listed as threatened under the Endangered Species Act (ESA).

The sDPS fish are encountered as bycatch in fisheries along the West Coast, including the California halibut bottom trawl fishery. California halibut trawlers are typically small vessels making day trips, serving live or fresh markets. The impact to the species is difficult to understand given the lack of information on the effects of catch and release on green sturgeon in these fisheries.

To address this question, this collaborative partnership has implemented a study on the post-release survival of green sturgeon incidentally caught in the California halibut fishery.

Genetic analysis of tissue samples taken by observers when compared to observer data shows that, of vessels covered by WCGOP, the highest concentration of southern DPS green sturgeon bycatch is on California Halibut trawl vessels landing near San Francisco Bay.

### **Methods:**

Observers put great effort into sampling green sturgeon. Aside from the challenges of working on small vessels with limited space and completing their regular catch sampling duties, observers must extensively sample each individual fish. This can be difficult and is time consuming in the race to return the fish to sea, without further harm.

As an ESA listed fish, high priority is given by observers in sampling green sturgeon and immediately releasing in good condition. They collect fork length, weight, presence/absence of scute markings, PIT tags, fish condition, and tissue samples from all sturgeon, as well as collecting sex and fin ray samples from dead fish. Additionally, all fish are photographed and PIT tagged if not already present.

Observers insert a PIT tag under a specific scute to all incidentally caught green sturgeon unless numbers are overwhelming. In that case they subsample.

Implementation of Satellite tagging began in 2015 to determine post release mortality and gain behavioral insights.

Incidentally caught green sturgeon are randomly selected and tagged by observers or fishermen, when no observer is present, and when tags are available. These satellite tags provide temperature, depth, acceleration and location (when at the surface). The tags are programmed to pop-off the fish and resurface after a time period and transmit via satellite. Efforts are made to retrieve each tag to gain the most complete data.

### **Results and Discussion:**

Since 2014 WCGOP observers have PIT tagged more than 200 green sturgeon. Six fish have been recaptured to date, but this has been attributed to releasing them while the vessel had the net in the water and was fishing; they were recaptured on the very next haul after being tagged.

Observers have deployed at least 72 satellite tags since 2015.

Data is evaluated and then, using a statistical classification tree method along with the locations data, a story is developed for each tag and each fish is assigned survived or deceased.

Problems with retrieving data from the satellite tags, such as poor transmission of data, time gaps in data, no or bad locations data, or early release from the fish have made interpreting the data a challenge. Recovery of the physical tag helps to get a complete data set in a timely manner.

Twenty-eight (28) tags have been recovered to date by the public. Recovered tags are re-charged and re-deployed.

**Conclusion:**

Efforts to understand post release impacts on Green Sturgeon are ongoing. WCGOP observers will continue to sample and deploy tags while collaborators work towards completing data analysis and updating fishermen.

Observer participation is critical in a project like this and shows just one of the many types of research in which observers are an invaluable resource.

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**Abstracts of presentations that did not provide Extended Abstracts**

**Electronic Monitoring As A Compliance Tool In The U.S. West Coast Groundfish Catch Share Fishery**

**Dave Colpo and Courtney Donovan**

**Pacific States Marine Fisheries Commission, OR, United States**

The U.S. West Coast groundfish trawl fishery, consisting of approximately 100 vessels, transitioned to an Individual Fishing Quota (IFQ) fishery starting in 2011. As a regulatory requirement, 100% at-sea human compliance monitoring was implemented to monitor discards of IFQ species for vessel quota debiting. Human monitors may reduce flexibility in the fishery, increase costs, decrease safety and sometimes eliminate the opportunity to fish if monitors are not available on short notice.

As an alternative, Pacific States Marine Fisheries Commission (PSMFC) and the NMFS West Coast Regional Office, working with the fishing industry and Archipelago Marine Resources, Ltd., began pre-implementation exploration of an Electronic Monitoring (EM) program in 2012. In 2014 the Pacific Fishery Management Council (PFMC) approved four Exempted Fishing Permits applications to allow participating vessels to fish with EM equipment on board in lieu of compliance monitors in the 2015-2016 fishing seasons. Based on the success of this work NOAA Fisheries expects to publish the final rule for EM use in the fixed gear and whiting fleets in the fall of 2016 with regulations in place in 2017.

This presentation provides more detailed background information including cost and methodologies of the EM program.

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**Affordable real-time satellite data for fishery observer technology: a case study examining the development and at-sea testing with the Pacific Islands Regional Observer Program (PIROP) eReporting Project.**

**Mathieu David**

**CLS America, DC, United States**

THORIUM is a satellite data communications solution that provides a fast, reliable, cost effective link for onboard fisheries observers to send and receive data using Iridium Short Burst Data (SBD) technology.

THORIUM was developed by CLS America, which has been in business for more than 30 years providing innovative solutions to fisheries and administrations around the world (including NOAA). The system is used at a large scale to monitor catches, gather positions, and ensure the sustainable management of fisheries resources by providing a real-time reporting platform.

CLS America worked closely with the Pacific Islands Regional Observer Program (PIROP) to implement a full electronic solution for their data reporting needs. The pilot project adapted a full set of paper forms into 32 unique electronic forms. By working directly with experienced observers, THORIUM was developed to augment the onboard observer data collection and workflow processes; and time-consuming and cumbersome steps (GPS location, timestamps, list look-up, etc.) have been simplified, thus improving the quality and timeliness of observer data. During the pilot project, 4 observers did a full trip using THORIUM and in all instances reported that they would prefer THORIUM to traditional paper-based data collection.

SBD technology allows for fast and affordable transmission of the electronic data. Having the forms sent in real-time reduces errors, and removes a lot of the post-trip validation and debriefing work (which provides a source of cost savings to programs). If a debriefer has a question about an observer's submissions, they can at any time contact the observer to get more information directly through THORIUM. The observer is also able to easily get in touch with NOAA in cases of a security issue, which can profoundly increase at-sea observer safety.

The new THORIUM X product is an all-in-one satellite tablet, easy to manipulate, and offers the full SBD capability. During its design process, CLS America took into consideration the specific needs of onboard fishery observers. Utilizing innovate satellite technology is the future of fisheries dependent data collection.

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**In Reach satellite communication device in the IATTC Observer Program**

**BRYAN BELAY**

**MRAG Americas, FL, United States**

MRAG Americas Inc. currently operates the IATTC transshipment observer program, first established in 2009. The Program was introduced to monitor transshipment operations between carrier vessels and Large Scale Tuna Longline Vessels (LSTLVs) on the high seas within the IATTC Convention Area (eastern Pacific). MRAG has recently started issuing IATTC Transshipment Observers with the InReach satellite communication device to enable independent observer communications from the vessel. The inclusion of the InReach devices in the observer's safety gear provides the ability for the observer to communicate directly with MRAG staff in real time using the Iridium satellite network.

Previously, IATTC Transshipment Observers relied on their host vessel's facilities to communicate with MRAG and IATTC during deployments. Apart from the obvious concern about sending sensitive information that might implicate a vessel being observed, we had concerns about routine messages not being transmitted in a timely way. In addition, the combination of an ageing fleet of Longline and carrier vessels and a diversification of flag states participating in the fishery has raised additional safety and regulatory concerns.

This presentation provides overview of the InReach device's capabilities, how we use them and summarizes the benefits they have brought to the IATTC Transshipment observer program. We highlight resultant changes to program safety and effects on observer deployment logistics and provide some insight into potential future uses of the devices.

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## **Data Quality Improvements Through Offline Data Entry And Real-time Error Checking**

**Neil Riley and Jon McVeigh**

**NOAA, WA, United States**

In 2011, Individual Fishing Quotas (IFQs) a type of Catch Share program, was implemented in the U.S. West Coast groundfish trawl fishery. The IFQ program requires reliable and timely observer data to be reported daily for fisher and management quota tracking purposes. To respond to this demand the West Coast Groundfish Observer Program (WCGOP) developed a new offline data entry application, created new data delivery procedures and improved data quality control measures to provide accurate data to end-users in near-real-time for the first time. The offline data entry is a mirror of the web based data entry application and which is stored locally on the observer's laptop. Offline data entry allows observers to enter their data at-sea while performing simultaneous data validation. This trip error checking process is accomplished through an Oracle Advanced Queue that executes a stored set of SQL statements that are run in the background. Real-time error checking allows the observer to correct all data entry errors prior to submitting their data. Once in port, data can be uploaded immediately from the laptop error free to the master database and therefore available for immediate delivery the review by WCGOP staff. The sync upload process allows the user to retrieve any database updates and new error checks. This poster depicts how offline data entry and real-time data validation has improved data quality and reduced delivery times for inseason data users.



## **Automated valves for measuring discards in Demersal fisheries**

**Ruben Verkempynck, Michiel Dammers and Pieke Molenaar**

**Wageningen IMARES, Noord-Holland, Netherlands**

The Dutch large cutter fleet operating in the North sea consists of three segments: a beam trawl, twin-rig, and nephrops fishery. Cutters within this fleet differ in vessel length overall (23m-40m), engine power (223kw-1491kw), beam length (4m-12m), mesh size (70mm->120mm), haul duration (1.5-6hours), catch quantity (up to 4000kg per haul), and catch processing time (30-45 minutes). The high quantities of catches per haul can only be processed in an efficient way through semi-automatic sorting and processing machinery on board of the fishing vessels.

These high catch volumes subsequently result in high discard rates. The beam trawl fishery is responsible for the biggest quantity of discards. In the period of 2011-2013, an average of 56000 tonnes per year were discarded. For the biggest beam trawl vessels discard rates reach up to 74%. These rates are exceptionally high and in the 'danger zone' where small uncertainties in the estimation have a disproportionately large effect on raised discard quantities.

In the Dutch discard monitoring programme the total catch volume per haul is estimated by the skipper and the scientific observer. There are several methods to quantify the catches of the cutter fleet in the North sea. These methods and their pros and cons are presented in this paper. The total volume of discards from each haul is then calculated by subtracting the weighed total landings from the estimated catch volume.

Several of these methods are evaluated here and analysis has shown that catch estimations vary substantially between methods. To prevent these inaccurate estimations a solution for the cutter fleet in the North sea can be found in the use of automated discard valves. A solution to accurately weigh all the catch that would fall through the discard valves. The valves are designed to fully automated measure quantities falling through the shaft. It opens and closed two separated programmed valves so that all fish, benthos and debris is measured in weight. The first sketches are fresh from the drawing board and funding is almost complete to make the first prototype.

## Session 7. What are the challenges with integrating Electronic Monitoring / Electronic Reporting technology into fishery monitoring programs?

**Leader: Howard McElderry**

As Government leaders and fishery stakeholders increasingly promote the use of high technology in fisheries monitoring systems, managers must now incorporate such systems into existing data collection programs, while maintaining (or perhaps modifying) management goals, data needs, funding sources and regulations. The objective of this session was to explore recent practitioner experiences with these integration challenges. We identified those observer programs that are best suited for using electronic technologies to meet their needs and those barriers that influence the implementation of fully operational Electronic Monitoring/Reporting programs.

The following Table helps to distinguish the different steps along the implementation pathway. Fully implemented EM programs are fully integrated into the fishery management system:

Programmatic Development	EM Program Stage	Logistical Development
<ul style="list-style-type: none"> <li>• Scale - A few volunteer boats</li> <li>• Data use - Demonstration</li> <li>• Management pathway - undetermined</li> <li>• Costs - unknown</li> <li>• Timeline - 1-2 years</li> </ul>	<p><b>Proof of Concept</b></p> <p><i>Goal: Adaptive development of new technologies</i></p>	<ul style="list-style-type: none"> <li>• EM Hardware - Custom construction</li> <li>• Vessel responsibilities - Limited/informal</li> <li>• Review software - Under development</li> <li>• EM Acceptance - Unknown</li> <li>• Data review protocols - Under development</li> </ul>
<ul style="list-style-type: none"> <li>• Scale - a few volunteer boats</li> <li>• Data Use - Program design</li> <li>• Management pathway - Initial management objectives defined</li> <li>• Costs - Gathering cost data</li> <li>• Timeline - 1-2 years</li> </ul>	<p><b>Pilot Program</b></p> <p><i>Goal: Standardized testing</i></p>	<ul style="list-style-type: none"> <li>• EM Hardware - System Components defined</li> <li>• Vessel Responsibilities - preliminary responsibilities defined</li> <li>• EM Acceptance - initially positive</li> <li>• Review software - Standardized and ready for initial testing</li> <li>• Data review protocols - Preliminarily defined</li> </ul>
<ul style="list-style-type: none"> <li>• Scale - A diverse portion of the fleet</li> <li>• Data Use - Fishery demographics used to enhance program design</li> <li>• Management pathway - Management objectives approved by Council</li> <li>• Costs - initially promising, now independently evaluated</li> <li>• Timeline - 1-2 years</li> </ul>	<p><b>Operational Testing</b></p> <p><i>Goal: Independent evaluation under operational conditions</i></p>	<ul style="list-style-type: none"> <li>• EM Hardware - Commercially available</li> <li>• Vessel Responsibilities - Preliminary Vessel Monitoring Plan (VMP) process</li> <li>• EM Acceptance - Mixed</li> <li>• Review software - Independent evaluation under operational conditions</li> <li>• Data review protocols - Defined</li> </ul>
<ul style="list-style-type: none"> <li>• Scale - All EM candidate vessels</li> <li>• Data Use - Gap analysis + limited use for fisheries management</li> <li>• Management pathway - Protocols for using EM data nearing completion</li> <li>• Costs - Start-up costs funded, long term costs-effectiveness deemed sustainable. Refinements to reduce costs being tested.</li> <li>• Time line - 1-2 years</li> </ul>	<p><b>Pre-Implementation</b></p> <p><i>Goal: Building scale/ finalizing program design</i></p>	<ul style="list-style-type: none"> <li>• EM Hardware - cost effective and commercially available</li> <li>• Vessel Responsibilities - Defined in VMP</li> <li>• EM Acceptance - Growing</li> <li>• Review software - Commercially available and cost effective</li> <li>• Data review protocols - Defined</li> </ul>
<ul style="list-style-type: none"> <li>• Scale - All EM candidate vessels</li> <li>• Data Use - Data routinely used to meet management objectives</li> <li>• Management pathway - Operational</li> <li>• Costs - sustainably funded, cost effective and decreasing</li> <li>• Timeline - 3-4 years</li> </ul>	<p><b>Mature</b></p> <p><i>Goal: Productive use of EM data</i></p>	<ul style="list-style-type: none"> <li>• EM Hardware - Cost effective and commercially available</li> <li>• Vessel Responsibilities - VMP feedback process operational</li> <li>• EM Acceptance - Mostly positive</li> <li>• Review software - Commercially available and cost effective</li> <li>• Data review protocols - Defined</li> </ul>

Source: [http://www.npfmc.org/wp-content/PDFdocuments/conservation\\_issues/Observer/EM/DraftCh3Imp816.pdf](http://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/Observer/EM/DraftCh3Imp816.pdf)

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## **Oral Presentations - Extended Abstracts**

### **Use of Electronic Monitoring in U.S. Commercial Fisheries, 2016 -2019**

**Jane DiCosimo**

**National Marine Fisheries Service, Office of Science & Technology, National Observer Program, Silver Spring, MD, USA**

Fishery dependent data for stock assessments and quota monitoring are collected by fishery scientists deployed as observers in commercial fisheries around the U.S. Observers are employed by third-party contractors and are responsible for collecting catch information onboard fishing vessels and at onshore processing plants. Regional observer programs, implemented through NOAA Fisheries' regional offices or science centers, are responsible for training, briefing, debriefing and general oversight of observers, as well as for quality control/quality assurance of the data collected by observers. NOAA Fisheries staff processes the data collected and uses it to manage and monitor fish stocks.

Fishery-dependent data collection programs often include a combination of methods and techniques including on-board observers and dockside monitoring, as well as the use of electronic technologies, including electronic (video) monitoring (EM) and electronic reporting (ER). While observers are reliable sources of catch and bycatch information, they can be expensive to deploy, and may be logistically difficult to place on small vessels, either in remote locations or where the fishing fleet operates from a large number of dispersed ports. Despite this, EM programs cannot replace all data collections conducted by observers, including, and most especially, biological sampling.

Given its potential utility in situations where observers cannot be deployed, EM has become an increasingly useful alternative tool for monitoring commercial fishing activities; however, the potential uses of EM need to be determined by the specific monitoring requirements in each fishery. EM systems can be deployed on fishing vessels to collect information on, for example, fishing location, catch, catch handling, fishing methods, protected species interactions, and mitigation measures. It has been particularly useful as a tool for compliance monitoring or verification of self-reporting and can provide useful information on catch or bycatch quantity and composition.

As part of an overall fishery monitoring program, NOAA Fisheries and its regional fishery management council partners jointly determine whether EM can meet the monitoring goals of a particular fishery. Federal regulations currently require EM in several fisheries and NOAA Fisheries, and under its Policy on Electronic Technologies and Fishery-Dependent Data Collection of May 2013<sup>11</sup> encourages councils to consider EM to complement and improve existing fishery-dependent data collection programs, where appropriate. EM may

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<sup>11</sup> <http://www.nmfs.noaa.gov/op/pds/documents/30/30-133.pdf>

ensure that our joint efforts are aligned with management goals, data needs, funding sources, and mandates. Careful analysis may determine if EM is the most cost-effective approach to fisheries monitoring.

If EM is determined to be an appropriate tool to meet intended management goals, managers should design the EM program to consider the following key elements:

1. Interest in the program by fishery participants and management entities, including whether potential participants meet minimum threshold requirements to implement EM programs to justify the costs of implementing a new monitoring program;
2. Program costs and cost allocation between NOAA Fisheries and the fishing fleet; and
3. Program design elements, such as vessel monitoring plans, sampling rates, observer coverage in the fleet, integration of electronic data into management and stock assessments, data confidentiality, data storage, law enforcement protocols, etc.

EM programs for bycatch monitoring are required in four Alaska groundfish fisheries and the Atlantic Highly Migratory Species fishery (Table 1). Alaska EM programs include the use of flow scales for approximately 60 at-sea catcher/processors (C/Ps) and motherships that are required to weigh catch and bycatch at sea. Improved catch estimation was necessary because of the implementation of large-scale catch share programs. Catch share programs require NOAA Fisheries to provide verifiable and precise estimates of quota harvest. Because catch share programs limit vessel operators to specific amounts of catch, vessel operators may have an incentive to underreport catch and then fish beyond specific catch limits. These electronic technologies are used in the American Fisheries Act walleye pollock fisheries and Amendment 80 groundfish vessels. Those vessels also are required to use EM to monitor the flow of catch across the scale. Collectively, these advancements in technology provide precise and accurate groundfish catch estimates.

The first mandatory, fleet-wide implementation of EM occurred in 2015 in the pelagic longline fishery to monitor and verify Atlantic bluefin tuna catches (landings and dead discards). Individual bluefin quotas (IBQs) in the Atlantic and Gulf of Mexico Highly Migratory Species catch share program was implemented in 2015 to increase individual accountability of fishermen and ensure that the pelagic longline fishery stays within its quota. The ability to monitor and verify all bluefin tuna catches (landings and dead discards) is critical due to the high value of individual bluefin tuna and because these fishermen must have IBQs to fish for other species with this gear.

Eight new EM programs are proposed for implementation in the Northeast, the West Coast, and Alaska between 2016 and 2019. Examples of nearly developed EM programs from each region are summarized here. In the Northeast, the Atlantic herring and mackerel fisheries would use EM as a compliance tool to monitor catch retention and identify discard events, such as cod end “slippage” or when fish escape the gear before making it into below deck storage. This program is being considered as part of an Industry-Funded Monitoring Omnibus Amendment by New England and Mid-Atlantic Councils. In the groundfish fishery,

to improve catch monitoring and accountability, the program designs being considered are the “audit model” and the “maximized retention model.” The audit model would use EM to verify discards reported by a captain on a vessel trip report (VTR). A subset of EM video data would be reviewed and compared to the VTR based on a set of pass/fail criteria, with the goal of using the VTR as the catch record. Under the maximized retention model, vessels would be required to retain most fish species (e.g., allocated groundfish stocks), be allowed to discard others (e.g., protected species), and EM would be used to ensure compliance with discarding regulations.

The West Coast Pacific whiting fishery also would use EM to monitor “slippage.” The whiting fishery would use EM in place of observers for catcher vessels in the Pacific whiting fishery and fixed gear vessels in the shorebased Individual Fishing Quota (IFQ) fishery to meet the requirements of the Trawl Rationalization Program for 100-percent at-sea observer coverage. The EM program would establish an application process for interested vessel owners, performance standards for EM systems, requirements for vessel operators, and a permitting process and standards for EM service providers. Vessel operators would submit logbook reports which would be used initially to debit discards from IFQ vessel accounts and cooperative allocations. The video would later be reviewed by an analyst to determine an estimate of discards to use to audit the logbook reports. A logbook audit model for both fixed gear and whiting vessels is proposed for implementation because NOAA Fisheries acknowledged the value of the logbooks for communication between the vessel operator and the video reviewer about system malfunctions, for data quality assurance, and for aligning discard estimates. Initially 100 percent of the video would be reviewed to audit the logbooks, but NOAA Fisheries may modify this percentage over time based on performance formerly used by observers.

A proposed Alaska program would integrate EM into the Observer Program to monitor at-sea fixed gear groundfish and halibut fishing activity in the partial coverage category. Annually, the regional fishery management council and NMFS would determine what deployment model is appropriate for the EM selection pool through an annual deployment plan (ADP). Decision points may include whether there is to be an EM selection pool, and if so, the gear or operational types, or vessel sizes in the EM selection pool, the EM selection rate and selection mode, and primary service ports for EM. In contrast to auditing a portion of EM video with self-reported logbooks NMFS, through its EM service provider(s), would census EM trip data for catch accounting purposes. An iterative process would be used through the ADP and annual report to refine sampling protocols for EM to meet catch accounting and stock assessment needs in these hook-and-line and pot gear fisheries. Unique to this EM program is the use of reviewed EM data for use in catch estimation for catch accounting and fishery management.

NOAA Fisheries is developing national guidance to facilitate implementation of proposed EM programs. The agency recognizes that the design of EM programs benefits from active collaboration by regional fishing fleets, councils, observer provider companies, observers, and other interested partners. Such collaboration will ensure that proposed EM programs are 1) cost effective; 2) provide accurate and timely data; and 3) engage a sufficient percentage of the fleet. National guidance will address:

1. Data confidentiality;

2. Data storage and retention requirements;
3. Cost allocation;
4. Cost accounting;
5. Minimum thresholds for participation;
6. Performance and evaluation standards; and
7. Video review and auditing.

The cost of designing, implementing, and maintaining EM programs (including installation and data storage costs, as well as data review and maintenance) varies widely, depending on the identified purpose and ultimate use of the data gathered. For some compliance monitoring programs, EM may be a cost-effective tool. EM programs however may be more costly for total catch accounting, such as identifying fish size and weight. NOAA Fisheries has funded more than \$20 million for EM design and implementation. Congress appropriated \$7 million in 2016 to implement EM and ER in U.S. commercial and recreational fisheries. The Congressional appropriation is expected to continue to support EM (and ER) implementation in the future.

**Table 1. Electronic monitoring programs in US commercial fisheries (implemented between 2008 and 2015 and proposed between 2016 and 2019).**

<b>Year in Effect</b>	<b>Alaska</b>	<b>West Coast</b>	<b>Northeast</b>	<b>Atlantic Highly Migratory</b>
<b>2008</b>	<b>Bering Sea and Aleutian Island (BSAI) non-Pollock Trawl Catcher/ Processor</b>			
<b>2011</b>	<b>American Fisheries Act Pollock Catcher/ Processor + Mothership</b>			
<b>2012</b>	<b>Central Gulf of Alaska Rockfish Trawl Catcher/Processor</b>			
<b>2013</b>	<b>BSAI Pacific Cod Longline Catcher/ Processor</b>			
<b>2015</b>				<b>Atlantic Highly Migratory Species</b>

				<b>with pelagic longline gear onboard</b>
<b>2016</b>			<b>Groundfish Sectors (Gillnet, Otter Trawl)</b>	
<b>2017</b>		<b>Pacific whiting; Groundfish Fixed Gear</b>	<b>Atlantic Herring/ Mackerel Mid-Water Trawl</b>	
<b>2018</b>	<b>Small boat, fixed gear halibut and sablefish; Groundfish fixed gear</b>	<b>Bottom Trawl</b>		
<b>2019</b>		<b>Drift Gillnet</b>		

## **Electronic Monitoring in Northern Fisheries**

**Brett Alger<sup>1</sup> and Nichole Rossi<sup>2</sup>**

<sup>1</sup>**NOAA, NMFS, Greater Atlantic Regional Fisheries Office, MA, United States**

<sup>2</sup>**NOAA, NMFS, Northeast Fisheries Science Center, MA, United States**

The National Marine Fisheries Service's (NMFS), Greater Atlantic Regional Fisheries Office (GARFO) and Northeast Fisheries Science Center (NEFSC) are investigating the utility of Electronic Monitoring (EM) technology as a monitoring tool in Northeast Fisheries. The NMFS is researching acceptable monitoring alternatives to explore the most advanced technology available to meet industry coverage levels and needs (e.g., real time data to manage catch allocation or increase the monitoring of catch accounting). If approved by NMFS, EM may be an important means of supporting full catch accounting for fisheries monitoring. EM has been used for catch monitoring and reporting compliance in fisheries worldwide. After years of pilot projects and workshops, implementation of EM has been limited in the United States.

There have been regional and national workshops to explore the technology and capabilities of EM, examine how EM can meet scientific and management needs, and understand the legal requirements, data integration, and costs of implementing EM. In the Northeast, there have also been several pilot projects to address some of the many challenges to implementing EM. From 2004-2006, the Cape Cod Commercial Fishermen's Alliance (CCCFA) and Archipelago Marine Research Ltd. (AMR) tested EM systems on longline and gillnet vessels and compared EM and observer data. Beginning in 2010, NMFS and

Archipelago conducted a more comprehensive study in three phases. Phase one identified baseline metrics for detecting fishing events, counting fish, and identifying species. Phase two addressed issues such as weight estimation and expanded species identification methods through catch handling. The third phase tested catch handling methods to simulate an operational EM program. Understanding legal requirements, data integration, coordination among stakeholders, and costs are some of the challenges. Despite challenges, interest in EM remains high and the NMFS in the Northeast Region continues to explore EM as a monitoring tool, working collaboratively with the industry to investigate EM for both the New England groundfish and Atlantic herring mid-water trawl fisheries.

In 2010, the National Marine Fisheries Service (NMFS) implemented Amendment 16 in the New England groundfish fishery, which revised and expanded the sector management system and established annual catch limits and accountability measures for each stock in the fishery. A sector is a voluntary group of limited access permit holders, and each sector has different compositions of vessel size, gear type, geography, and/or business relationship. Sectors are allocated quota for 15 of the 20 groundfish stocks, and are exempt from numerous regulations, such as trip limits. The sector system allows for more efficient fishing operations and catch utilization (e.g., reduced discards) by providing vessels with flexibility in harvesting the sector's allocation. In order to reliably estimate sector catch and monitor sector operations, Amendment 16 included new requirements for the fishing industry to implement and fund an At-Sea Monitoring (ASM) program. The need to balance the financial viability of sectors with the expectation to have the fishing industry fund ASM has precipitated several efforts to explore electronic monitoring (EM) as an alternative to ASM.

There are two uses of EM in the New England groundfish fishery currently being explored. The "audit" model uses EM to verify industry reported discards on vessel trip reports, while the "maximized retention" model requires vessels to retain select fish species (e.g., allocated groundfish stocks), while discarding others (e.g., protected species), and EM is used to ensure discard/retention compliance. NMFS is working with The Nature Conservancy, the Gulf of Maine Research Institute (GMRI), and groundfish sectors to explore the audit model in 2016 using 20 day-trip vessels. NMFS will also be working with the Environmental Defense Fund and GMRI to explore the maximized retention model in 2017 using larger offshore trip vessels.

As part of the Greater Atlantic Region's Electronic Technology (ET) Implementation Plan, the Councils and NMFS are considering implementation of EM in the Atlantic herring and mackerel mid-water trawl fisheries to improve catch monitoring and accountability. In addition, NMFS is working with the fishery management councils to develop an Industry-Funded Monitoring (IFM) Omnibus Amendment to develop standards for fisheries which require monitoring above what NMFS supplies. A particular interest in the Amendment is increasing monitoring for the Atlantic herring and mackerel mid-water trawl fisheries due to concerns about bycatch of groundfish, river herring, and shad as well as more accurate accounting of Atlantic herring catch. For these reasons, there is strong stakeholder support, including the commercial fishing industry and environmental advocates, to establish an efficient and cost effective EM and portside sampling program for mid-water trawl fisheries. The Atlantic herring fishery may have limited discarding when the contents of the net are pumped directly from the codend in the water, along chutes, and into the hold of the vessel.



Therefore, the operation of the fishery lends itself to using EM to verify all catch are retained. NMFS has developed a project with the goal of deploying EM on mid-water trawl vessels and establishing technical specifications, required data elements, and roles and responsibilities of various program entities.

Study results demonstrate there are inherent challenges with the EM system, including: equipment maintenance and vessel infrastructure and power requirements, consistent and reliable identification of catch to the species level, data integrity, and enforcement of program requirements. While these challenges restrict the utility of EM, they do not completely preclude the use of this tool as an effective monitoring instrument in fisheries management. When supplemented by other data collection methods, modified catch handling, feedback mechanisms, and successful strategies that increase data alignment, EM may be an effective data collection tool for Northeast Fisheries.

Depending on program design, EM has the potential to reduce the expenses associated with monitoring groundfish sectors. However, moving away from human observers has its trade-offs, the types and quality of data can be different between EM and observers. Simply stated, EM may be a suitable replacement to human observers, provided EM has the ability to identify species, and verify weights and counts of discards in the New England groundfish fishery. Balancing management data needs with the costs of a comprehensive EM system that satisfies monitoring requirements remains an ongoing endeavor.

Currently, GARFO and NEFSC are building the database infrastructure and processing tools for data collected from EM video footage, conducting comparative analysis to the existing catch monitoring systems in the fishery, and addressing the final legal and logistical hurdles. NMFS is focused on program design and infrastructure, including; data integration, reporting, catch methodologies, data alignment, efficiencies in species identification, performance standards for EM providers, data storage requirements, cost drivers, and to address legal and logistical hurdles associated with an operational program. Our exploratory work will help inform the New England and Mid-Atlantic Fishery Management Councils, and NMFS, in the EM approval and implementation processes.

Through this experience, NMFS has acquired knowledge on the strengths and challenges associated EM, effective and non-effective operational approaches, management systems that would benefit from EM, and advantageous system requirements. For example, EM technology may be successful in certain management strategies such as full retention fisheries or may be a valuable resource if used in combination with self-reporting as an audit or validation tool. With a complete understanding of the technology, fisheries managers can tailor EM to meet fishery needs and determine the most appropriate application for EM in fisheries monitoring.

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**The Challenge of Electronic Monitoring Integration: Understanding the data and data exchange myths and challenges.**

**Andrew Fedoruk**

## Archipelago Asia Pacific, ACT Australia

All monitoring programs are supported by a variety of generated data in order to meet their objectives including compliance, science, management, regulatory, and other stakeholder needs. Electronic Monitoring technology and capability is evolving and being customised to an ever increasing range of data needs that are being requested by regulators, science, and industry. In order to understand the nature of the data collected, the various large categories of data can be categorized as:

- **Program Specifications:** An overview of the needs of the program and the data collection regime used to support them. It includes a broad spectrum of details of the regulatory framework to the monitoring scheme (methods, rates, sampling design) and the data collection protocols.
- **Vessel-specific Data:** This would be where the “fixed” aspects of the vessels are documented including vessel characteristics (such as size), gear types, and other static parameters.
- **Trip-based Data:** There are a number of data types that can be associated with a fishing trip. Mostly these include details such as trip start and end dates and locations or any trip specific gear or vessel configurations. But this would also include trip-level catch (i.e. at offload), compliance, or sample data.
- **Event-based Data:** The data collected here are typically around the gear specifics, date/time and locations, and usually some level of catch reporting (anything from presence/absence of particular species of concern through to full catch enumeration).

Linking the Program Specifications information to the monitoring program’s data is important to consider as the changes in management rules in the fishery or the data collection requirements are not always transparent to the end users of the data. This is especially true as the users of monitoring program data are often other agencies, researchers, or stakeholders not directly involved in the operations of the fishery. Changes in data, especially in multiple year data sets are often best understood when analysed in conjunction with the management framework. For example, bycatch rules or closures can directly and dramatically affect catch and CPUE which would be discernible in the catch records but the underlying causes need to be understood at the management level as well.

Integrating any new data source of any of the into an existing data system can be a significant challenge, and E-Monitoring data are no exception. Data changes, driven through either changes to program design, or the addition of new elements to a program are always a unique challenge. This is especially true if data are being stored in older or more rigid systems/structures.

A logical starting point, with the idea that E-Monitoring data are essentially equivalent to observer data, is to add E-Monitoring data directly into existing data systems. However, this generally is a problematic approach as there often are differences in the data collected, especially for things like metadata, but even in the core data. Maintaining E-Monitoring data as an independent data source allows for greater flexibility in terms of data structures based on data collected, but also allows for easier change management (as changes do not impact

on other data types) and ease of sharing out of data to other stakeholders. Further, it is also important to consider the impact on all program elements when adding a new data collection element. That is, in supporting the data collection requirements as a whole, do all data sources work together in a complementary fashion that allows for efficient and meaningful data interpretation? For example, do fisher logs collect data in the same units as other data sources which allows for direct data comparison? That is, if fisher logs report on a daily basis, or using weights, whereas other data sources use different effort units (events) or collect lengths or pieces, data collection protocols need to be evaluated and possibly modified to ensure an efficient program.

Linking data from different sources is an important step in allowing for meaningful comparisons of data from different sources or for supplementing data sources with complementary data from other sources. One of the most common approaches to linking, is what is referred to here as horizontal linking: essentially linking directly between data sets (for example Fishing Log to EM; Observer to EM; Observer to Fishing Log). This would be similar at the event level where individual events are linked to each other (Figure 1). Indirect linking, with the various data sources linked not to each other, but through header or other independent linking tables is referred to here as a vertical linking structure (Figure 2).

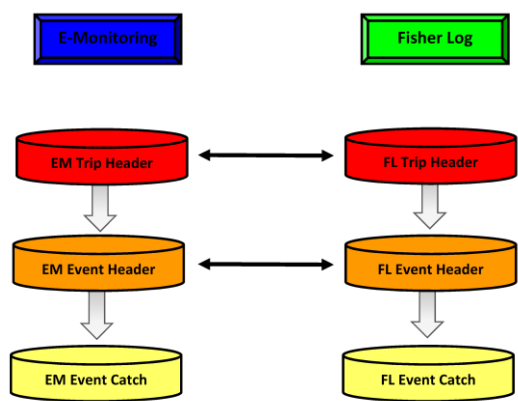


Figure 1. Direct or “Horizontal” linking.

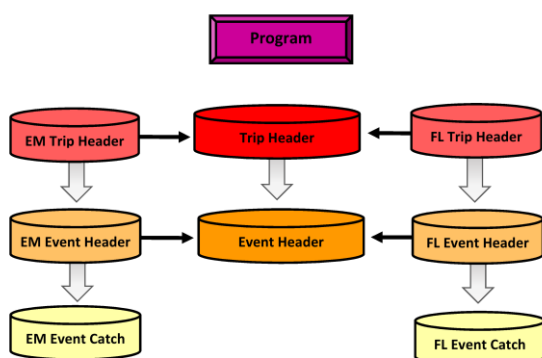


Figure 2. Indirect or “Vertical” linking.

The horizontal linking approach can be problematic at two basic levels: data management and process management. At the data management level, having direct links between data sources that are subject to interpretation (as in the case of date matching) and changes (fisheries data is often updated or corrected). In contrast, the vertical approach allows for a number of considerations: ease of data management (especially change management) but

also creates a flexible structure that allows any data set at that level (trip or event) to be added relatively simply to the data schema (compared to having to add new foreign keys or make significant data structure changes to accommodate new data).

At the process level, there are some very significant program design considerations that should be planned and invested in. Essentially, this revolves around how linkages or relationships between data are initially formed. In many programs, this has historically been done at the data entry point, or through some other data process (most often comparing data sets by parameters like date and time).

Forensic linking of data using parameters such as date and time are not particularly reliable. For example, skipper-entered fisher logs may have different dates associated with them when compared to Observer or E-monitoring data. These outliers and errors can consume a significant amount of time to resolve. In the end, even when an alignment is achieved, there is little ability to confirm the veracity of the link. This can lead to mismatching of catch data when comparing data.

In order to avoid these time consuming stages in the data process, it is preferable to push the links to an automated process that occurs at the point of data collection. For example, an ideal model would be where the trip and even header details are created by on-board E-Reporting software (inherent in the E-Monitoring or Fishing Log software) and then the data are associated with the correct headers or keys as they are collected (or entered). That is, a skipper would mark in the system that an event is occurring (say with setting of gear), or in the case of EM, triggers could create the record. When entering fishing log data, the skipper would be entering against that key, establishing the link in a structured, real-time manner that isn't subject to post-processing interpretation. An intermediary step would be that one system generates a unique identifier that is used on other records. For example, if an E-Monitoring system produces an event number, that number should have a corresponding field in the skipper's log for manual entry. That way, that linking is predetermined at the data entry stage using that key, and the events will (subject to transcription or data entry errors) be linked without any further analysis or processing even if dates and time are other linking data are not accurate or useable. Either method ensures that data are useable from very early on in the interpretation process, costs are significantly reduced, and there are fewer false matches.

In summary, some points for consideration when incorporating E-Monitoring data into existing programs include:

- Create dedicated databases to consider the unique elements of the data source rather than trying to incorporate into existing structures,
- Invest in the review and potential modification of other aspects of the program to ensure that all data can work together with maximum benefit and efficiency,
- Build data structures that do not use direct linkages between data types to ensure maximum flexibility in terms of data management and in adding new data types or structures to the existing data schema,

- Build systems that allow for linkages to be formed as early in the data collection process as possible, ideally in an automated fashion. Forensic linking can be time consuming and result in errors and delays in data availability.
- 

## **Open Discussion Session**

### *Question*

Unidentified from New Zealand - What was the improvement in data accuracy with self-reported data after the implementation of EM?

### *Response*

M. Hooper – In the West Coast Trawl fishery, submitted logbook data and EM data were within 20%... surprisingly close.

A. Fedoruk – Anecdotally speaking, self-reported data improved with EM

### *Question*

Steve Kennelly (Australia) - I am concerned about the loss of intrinsic connection between management, fishermen, and other stakeholders that contribute to an effective data set. Please elaborate.

### *Response*

G. Silva – In that scenario, EM is not as effective.

### *Question*

Isaac Forster (CCAMLR) - Have you been able to fully integrate a complete data set yet?

### *Response*

A. Fedoruk - Almost, but only within a data model being used in Canada.

### *Question*

Josh (Hawaii) - Interested in potential challenges of implementation of EM. How did you set/meet standards? Specifically those involved with the chain of custody, security, etc.

### *Response*

M. Hooper – Must emphasize the importance of establishing clear goals before attempting implementation. Further, communication and involvement of stakeholders early and throughout the process is paramount.

A. Fedoruk – Such variables conform to data standards from individual contracts.

*Question*

Alec Woods (New Zealand) – Is there evidence of improvement with public trust after the integration of EM?

*Response*

C. Burns – There is a risk of the opposite. There is concern that the implementation of EM will produce potentially incriminating/damaging data that may ultimately work against the fishermen and their available stocks

H. Mclachlan – In the UK, the public instills more trust in the supply chain. That is to say the consumer trusts his fish monger, as he trusts the whole saler. EM has little impact on the “public” trust of the fishery.

*Question*

Unidentified – Why is the implementation of EM such an immediate priority?

*Response*

J. Dicosimo – There is an overwhelming belief, by the industry, that EM is a more cost effective method of monitoring and data collection.

A. Fedoruk – EM is capable of accessing fisheries and geographic locations that observers cannot safely or efficiently. Further, EM facilitates increased coverage where observers may not be available.

G. Silvia – There has been a rapid improvement in technology that has made the implementation of EM easier and more reliable.

*Question*

Wes Ericson (Fisherman – B.C. Canada) - If EM is a cheaper and more practical method for collecting information, why is the industry not absorbing a larger portion of the R & D costs associated with launching a provisional program?

*Response*

J. Dicosimo – That is possible in places where fisheries are willing and ready. However, that is subject to a large amount regional and cultural specificity.

G. Silvia – Practical in theory but, very difficult with a depressed fishery

*Question*

Phil Bert – How can the management minimize bias in fisherman behavior as a result of EM implementation?

*Response*

J. Carlson – There will always be bias on fishermen’s behavior as a result of any monitoring. However, it is not economically realistic to change behavior over an extended period of time – say a season, year, or longer.

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## **Poster Presentations – Extended Abstracts**

### **Development Of An At-Sea Hand Held Data Transfer Application For Longline Observers**

**Michael P. Enzenauer, Simon Gulak, Riverside Technology, Inc.**

**John K. Carlson, NOAA Fisheries Service, Southeast Fisheries Science Center**

#### **Introduction**

The NOAA Fisheries Service-Southeast Fisheries Science Center has three programs that monitor catch and bycatch on longline vessels in the western North Atlantic. With the introduction of the Individual Fishing Quota Programs such as those for groupers and tilefishes<sup>12</sup> and additional longline gear restrictions<sup>13</sup> in the Gulf of Mexico, there is an increased interest in reducing the time and resources required to make data collected in the field accessible by end users. Initially, a pilot project developed a tablet application to fast-track the availability of observer data from reef-fish vessels in the Gulf of Mexico. The Apache Cordova programming ecosystem was used to allow deployment on multiple platforms, but this was found to be too resource intensive for the test platform (Apple iPad 2), resulting in slow transitions between data forms. At-sea data transfer was also not successful due to the irridium network data speeds. Further development began in 2015 with the goal of streamlining data entry and testing of several data transfer networks. Learning from these trials, important developments for the data application, utilization of technological benchmarks, and widespread troubleshooting are being incorporated.

#### **Methods**

The Initial application architect, Elemental Methods, was awarded a contract refine the application to overcome problems found during the development stage. The first phase tested the applications original design against other application environments to improve speed and stability. Modifications to the navigation and entry log pages were also adjusted. Parallel development with other Southeast Fisheries Science Center laboratories aided in the develop of the application on a broad scale.

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<sup>12</sup> NMFS. 2009. NOAA Announces an Individual Fishing Quota (IFQ) Program for Groupers and Tilefishes in the Gulf of Mexico and Other Changes to Commercial Reef Fish Regulations. Fishery Bulletin. FB09-048. Available online at [http://sero.nmfs.noaa.gov/fishery\\_bulletins/bulletin\\_archives/2009/documents/pdfs/fb09-048\\_ifq\\_groupers\\_and\\_tilefishes.pdf](http://sero.nmfs.noaa.gov/fishery_bulletins/bulletin_archives/2009/documents/pdfs/fb09-048_ifq_groupers_and_tilefishes.pdf). Accessed May 29, 2013.

<sup>13</sup> NMFS. 2010. NOAA Fisheries Service Publishes Final Rule to Change Bottom Longline Regulations Affecting the Eastern Gulf of Mexico Reef Fish Fishery. Fishery Bulletin. FB10-026. Available online at [http://sero.nmfs.noaa.gov/fishery\\_bulletins/bulletin\\_archives/2010/documents/pdfs/fb10-026\\_fr\\_gulf\\_reef\\_fish\\_amend31.pdf](http://sero.nmfs.noaa.gov/fishery_bulletins/bulletin_archives/2010/documents/pdfs/fb10-026_fr_gulf_reef_fish_amend31.pdf). Accessed May 29, 2013.

## Results/Discussion

Field testing is still on-going but many changes to the application have already proven to be successful and encouraging, especially with speed and stability. Excluding high definition aesthetics and the transition to native android platform revitalized the application offering a simple but powerful application. The animal log was the only form that has undergone a complete transformation. This new log is designed around the original observer animal log with tiles to select any data field for a given animal and input data upon selecting it. This offered a quick and flexible transition for the observer to input information quickly and then return to the summary page (Figures 1-2). Selecting the right tablet device is crucial as glare and water on the screen still pose an issue, more insight from other programs will help determine our choice of tablet device and for future field trials. Initial testing of the satellite data transfer did not have the necessary upload speed to send the data. Current satellite technology should offer a capable device for our data transmission and will become apparent once field testing of the new satellite devices begins (Figure 3).

**Figure 1.** Revised Animal log

Species	Sex	Age	Weight	Length	...
110	MALE	0	1	120	...
100	SEX	1	1	120	...
100	SEX	1	1	120	...
107	SEX	4	1	120	...
100	SEX	2	2	120	...
100	SEX	2	2	120	...
104	SEX	1	1	120	...
100	SEX	1	1	120	...
100	SEX	2	2	120	...
100	SEX	2	2	120	...

**Figure 2.** Example of an Animal Entry Tile



es for field te



Inmarsat Isat  
Hub iSavi

RedPort Optimizer  
Firewall

Globalstar Sat-Fi  
Satellite Hotspot  
With antenna

The application has also undergone multiple security checkpoints to remain protected. However, security threats are constantly evolving making it rather difficult to develop when the conventional paper data collection method is more secure. Real-time quota monitoring especially under a catch share program is the end goal, but currently not available. The future field testing will provide more insight for areas of improvement and flexibility with the application, devices and data pathways will evolve until all goals of this project are fulfilled. Overall, the tablet computer and integrated data application has the potential to reduce costs and could have far-reaching implications for observer programs globally.

**Marel Scale Internal Bluetooth Data Acquisition: Make it small! Make it portable!**



**Eric Brasseur**

**West Coast Groundfish Observer Program, Pacific States Marine Fisheries Commission,  
Newport, Oregon, USA**

Introduction:

The West Coast Groundfish Observer Program is developing an electronic data collection system with the goal to improve data quality and data turnaround times for reporting.. The program currently uses Marel M1100 scales that observers currently use for weights. To facilitate electronic weight collection we have asked Marel scales to develop a wireless Bluetooth module that can be incorporated into M1100 scales that use battery power, currently 2 d-cells. Previously this option was only available for externally powered scales due to the high power requirements of early bluetooth devices. This will allow us to maintain the portability of our current data collection system and decrease the possibility of transcription errors while introducing a new electronic data collection system.

Observers currently read weight values from a Marel M-1100 digital platform scale and write them down on waterproof data sheets. The scales provide fast, accurate weights by compensating for the motion of the vessel and with the addition of bluetooth module the scales can communicate directly with a data collection device. The next step is the introduction of a tablet to collect the data. The observer could continue to read the values from the scale and enter them manually, allowing the possibility for transcription errors. The possibility of completely eliminating those errors is a goal for all data collectors. We took a look at the technology already use in NOAA fishery surveys to find possible solutions.

NOAA surveys have been using cables and wireless networks (consisting of bluetooth and/or WIFI) to collect data at sea. The NMFS Hake Survey is run on a dedicated NOAA vessel equipped with a wet lab, power and wired network. The survey scales, computers, monitors and length boards are physically plugged into the ship's network and power. All data goes directly into a database as it is taken. The protected environment and proper maintenance prevent most corrosion issues. The system is not portable but very reliable.

The West Coast Trawl Survey uses a portable WiFi communication box. Scales and length boards are physically plugged into the box to provide power and allow for wireless communication with a laptop and a database computer located in the vessel house. The wifi box consists of a medium pelican case with a 12 volt battery, serial port box and Wi-Fi router, connected to an EFMB, a large and a small platform scale, a barcode scanner and e-calipers. The system can last for several days without being recharged. The box is fairly heavy and has limitations due to cables and potential corrosion. It is best used when a permanent sampling station can be set up for the duration of a trip, something observer rarely have the luxury of.

The PSMFC Bycatch Reduction Gear Testing Group uses a bluetooth communication box with A scale and length board physically plugged into the box to provide power and allow for Bluetooth communication with a wireless laptop. The box consists of a medium pelican case with a 12 volt battery, Bluetooth module and charger, connected to an EFMB, and a large platform scale. The system requires less power and is a bit lighter than the wifi version. It could provide a good solution for observers but still has limitations due to cables

and potential corrosion and introduces yet another piece of gear for an observer to bring aboard.

Taking these examples to the next level, the WCGOP will soon field test a M-1100 scale with an internal bluetooth module paired directly to a tablet computer. To date we have only been able to run limited bench tests in the office.

#### Methods:

The M1100 platform scale used by the WCGOP runs on 2 D-cell batteries that will power the scale for approximately 80- hours of continual use, which equates to 8-12 days of use at sea on one set of batteries. Observers are advised to always bring at least 2 additional sets of batteries. The initial prototype M11BLU caused a 20% increase in power consumption when tested by Marel, reducing the battery life from approximately 80 hours to 64 hours, 6-10 days of normal use at sea.

The bluetooth module, M11BLU, is a combined battery power supply for M1100 scales and a Bluetooth 4.0 BLE to RS232 bridge module. This replaces the current power board and cable connections. The Bluetooth module is based on the Bluegiga™ BLE113 module with integrated chip antenna that is certified CE, FCC, IC, South Korea and Japan qualified. The power supply unit for the system (M11BLU and M1100 scale) is capable of utilizing a DC supply of 1.0V to 6.5V to generate the 5V supply needed for the M1100 scale.

An M1100 platform scale with the M11BLU installed and a standard M1100 scale were tested side by side. New batteries were installed in both scales. The settings were altered so the scales would remain on until physically powered off. The normal setting is for the scales to turn off after 20 minutes of non-use. Weights were taken on each scale using the record button to transmit data via bluetooth for the M11BLU and to mimic cable transmission for the non-upgraded scale. Communication range was also tested for the bluetooth scale.

Improvements in the power supply portion of the M11BLU actually decreased power consumption when the Bluetooth module was not transmitting, powering the scale for up to 90 hours. During normal use (taking 30 weights every hour) the power consumption increased and reduced battery life to 64 hours.

#### Results:

	M11BLU	M1100
Range	100 Feet unobstructed	3 feet visual only
Transmission Speed	Instant	N/a
Battery life (left on no weighing)	90 hours	80 hours

Battery life (left on and weighing)	64 hours	75 hours

Benefits, cost and future testing.

The bluetooth module effectively added wireless communication to the M1100 scale with minimal loss in battery life. When connected to a tablet with data collection software, observers will be able to transmit weights directly to the software instead of copying them from the scale, eliminating potential transcription errors. No extra equipment will be required and there will be no increase in weight. Since no cables are required there will be no failure due to corrosion and no need for additional scale maintenance.

The M11BLU costs \$500 per unit. It can be installed by the user with a little knowledge or during the annual scale service at a Marel office. Future testing will verify that the bluetooth connection with the tablet will be automatic once incorporated into data collection software and that a stable connection persists after scale wakes from sleep mode.

## **Overview of the observed and unobserved data, and some aspects on the potential use of the electronic monitoring systems (EMS) in the tuna purse-seine fishery**

**Marlon H Román**

### **Inter-American Tropical Tuna Commission**

The Inter-American Tropical Tuna Commission (IATTC) was created in May 31<sup>st</sup>, 1949 in agreement between USA and Costa Rica to maintain the tuna populations in the Eastern Pacific Ocean (EPO). A substantial part of the tuna population is extracted by purse-seiners, and this fishery occupies a vast portion of the EPO. Purse-seiners catch tunas according to their association: sets on a free school of tunas, sets on tunas associated with dolphins, and on tunas associated with floating objects. The main species caught by this fishery is the yellowfin, the skipjack and the bigeye tuna. Also, several non-target species are incidentally caught by this fishery (bycatch). The IATTC Observer Program started in 1979. The observers were assigned to purse-seiners greater than 363 metric tons carrying capacity (Class 6) to collect data related to fishing activities. The focus of the data collecting was marine mammal involvement in the tuna purse-seine fishery and vessel activity. Along the years, new data variables have been incorporated into the database, and the taxonomic resolution of the IATTC bycatch database has evolved from taxonomic group of individuals to identifications down to species. Since 1992 observers from different National Programs started collecting purse-seine fishery data on board class 6 vessels, and the observer coverage was nearly 100%. The IATTC observer database keeps data collected by observers since 1979.

The tuna purse-seine fishery is also carried out by purse-seiners less than class 6. These smaller vessels are rarely observed. They account for about 15% the tuna captures in the EPO, and concerns about the increasing trend in the number of FO by both class 6 and < 6 vessels since about 2005 has prompted the need for a review of the data available for Class < 6 vessels for the purpose of fisheries management. The tuna catch and effort data for small purse-seine vessels come almost exclusively from vessel logbooks, and as available, cannery unloading records (DOCUMENT SAC-07-07f.i).

Non-target species, including sharks, manta rays, and turtles, are caught incidentally by large purse-seine vessels during normal fishing operations. The majority of these species are caught with greater frequency, and in greater amounts, in floating-object sets, but species like whale sharks and Mobulid rays are most commonly captured in unassociated sets. Small purse-seine vessels fish on unassociated schools of tunas and on tunas associated with floating objects, and their fishing effort occupies areas also fished by class 6 vessels (DOCUMENT SAC-07-07f.i). Given that the fishing areas of small and large purse-seine vessels overlap, incidental bycatches of non-target species may also occur in unassociated and floating-object sets made by small purse-seine vessels. Logbook data for small vessels, however, may not provide full information on species composition of the retained catch for non-target species (SAC-07-INFC(d)) and they do not provide information on at-sea discards of tuna and non-target species. In some cases, Electronic Monitoring Systems (EMS) may be able to provide information on bycatches when data from onboard observers are not available (Restrepo et al. 2014). Experiments with EMS, using high-definition video, have already taken place in tuna purse-seines (Ruiz et al. 2014), and have proven efficient for identifying and quantifying bycatches of large-bodied species on the main deck as well as on the well deck. High-resolution video can also provide information on body size and release efforts. However, although promising for large-sized species, medium- or small-sized species, such as dorado (*Coryphaena hippurus*), are problematic to monitor with EMS because they can come aboard mixed with the target species catch (Ruiz et al. 2014)

For more than two decades the purse-seine fishery on floating objects by large vessels has been dominated by sets on fish-aggregating devices (FADs). The similarity of the characteristics of floating objects involved in sets by small and large purse-seine vessels is unknown. Detailed information on floating-object characteristics is collected by observers aboard large purse-seine vessels; it includes the type of floating object (natural or FAD), its dimensions and materials, any sensing equipment carried by the object, its origin and, for FADs, information on deployment and removal. This information is important for proper management of the floating-object fishery. For example, these data are used to estimate the level of FAD fishing effort, including the number of FADs deployed annually within the EPO. As for sets on unassociated sets, the areas of operation of small and large purse-seine vessels fishing on floating-objects also overlap (DOCUMENT SAC-07-07f.i), and therefore the fishing dynamics of small vessels on FADs may be similar to those of large vessels. The area where both small and large vessels make floating-object sets is characterized by high levels of FAD interactions by large vessels. However, the differences in operational range between small and large vessels may lead to different fishing strategies for small vessels (DOCUMENT SAC-07-07f.i). These uncertainties need to be clarified, and it is possible that implementing EMS could provide useful information in this regard. FADs, which are large objects, would not be difficult to monitor by EMS. Also, FAD interactions, such as deployments and removals, could easily be recorded by EMS.

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## Operationalizing Electronic Monitoring Systems In New England Groundfish Sectors

**Amanda BARNEY, Mr Mark HAGER**

### **Ecotrust Canada**

Ecotrust Canada, the Gulf of Maine Research Institute (GMRI), The Nature Conservancy (TNC) and the Maine Coast Fisherman's Association (MCFA) have been collaborating since 2013 to operationalize an Electronic Monitoring (EM) system to verify area fished and regulated groundfish discards by species, for the purposes of monitoring sector utilization of annual catch entitlement (ACE) in the New England groundfish fishery. The overarching goal is that video generated discard reports can be used to verify fishermen's self-reported discards entered in an electronic logbook (eLog).

The EM System collects video captured on 3-4 digital cameras, with a capture framerate of 15fps, and sensors including GPS and hydraulic pressure sensors to monitor fishing events. Video reviewers identify each discarded fish to the species level, and measure lengths of each discarded fish using a measuring strip marked in centimeters adhered to the tray (gillnet) or the rail of the boat (trawl) (figure 1) in order to calculate fish weights using an approved length-weight key.



Figure 1. Screenshot of a captain of a trawl vessel measuring Witch Flounder, *Glyptocephalus cynoglossus* in view of dedicated camera before discarding. To see video clip go to [gmri.org/our-work/fishing-industry-innovation/electronic-monitoring/what-em](http://gmri.org/our-work/fishing-industry-innovation/electronic-monitoring/what-em)

For the first three years we compared the following data between EM, logbook, and the ASM/Observer program: date, time and location of hauls, and ACE-managed discarded species' weights and piece counts per haul. Year three results speak to the quality and utility of data being captured by the EM systems and of the data analysis software developed for this project. A major cause of data discrepancies was due to different groups (EM provider, Observer program or harvester) identifying individual fish to different taxonomical levels, based on varying programmatic protocols. Another source of data discrepancies was insufficient protocols for identification and measurement of problematic species, such as halibut, which were too large for the measuring strips.

Many challenges were faced in the first three years of this work. Some were largely inside the project's control, such as developing usable fish handling techniques and training participating fishermen to use them. Most challenges however were strongly influenced or controlled by external drivers, such as: maintaining participation from fishermen; operating a new program without federal standards and guidelines; and recognizing that numerous changes were needed to federal systems to accommodate a new data stream.

Project partners worked diligently to overcome these challenges. For example, in the first 2 years (FYs 2013 & 2014) of the project on-board catch handling protocols were not specific enough nor were there tight enough feedback loops to address some issues. This led to discrepancies between data sets (see figure 2 for results from 2014). In year 3 (FY2015, figure 3) the protocols were revamped, and vessel monitoring plans included more specific catch handling details. For example the protocol: "All ACE groundfish are to pass over a measuring strip before being discarded" was adjusted in Year 3 to "All ACE groundfish must

be placed by the captain or crew parallel to the measuring strip for at least one second without hands covering the head or tail of the fish”.

Strengthening the feedback loop between video reviewer and fishermen also helped improve alignment. An online, live chart of each vessels results was used for project staff to be able to spot check each vessels performance, and provide additional critique via the feedback form. The two figures below show improved alignment from year to year between the EM reports and the fishermen’s eLog entries which resulted from improving on deck catch handling protocols and feedback mechanisms. Although most species align more closely than previous years some species such as halibut continue to have poor alignment. This is due to a combination of halibut being too large for the camera views and crew discarding them before passing over the measuring strip. Project partners have continued to refine protocols and feedback in FY2016.

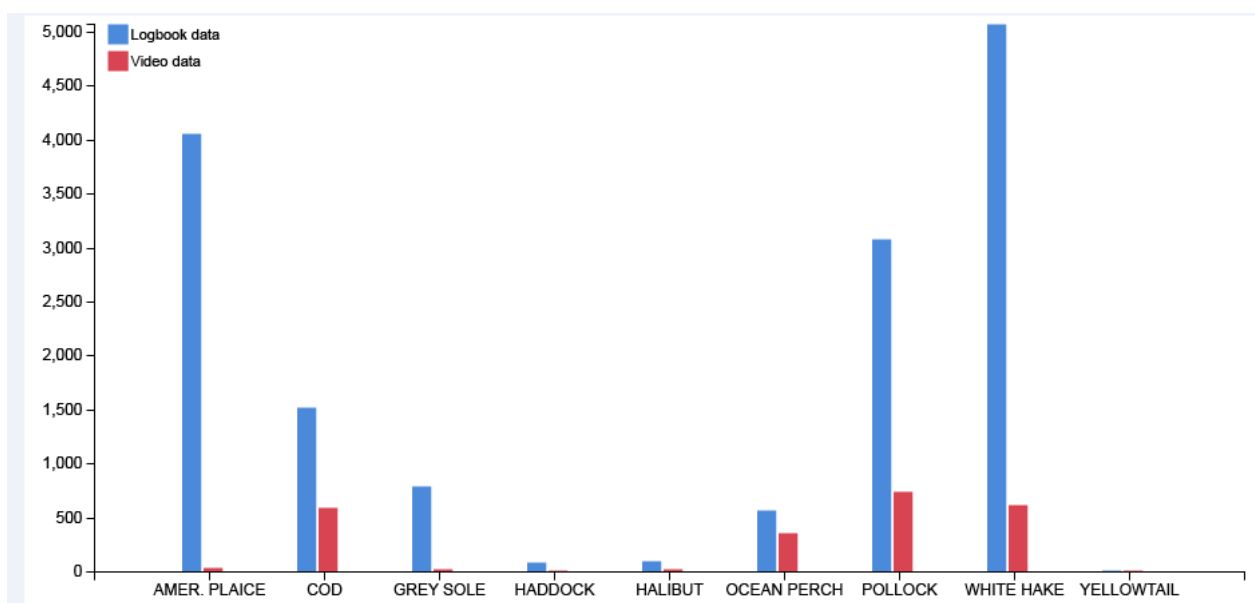


Figure 2. Combined discard weights for all reviewed hauls in FY2014.

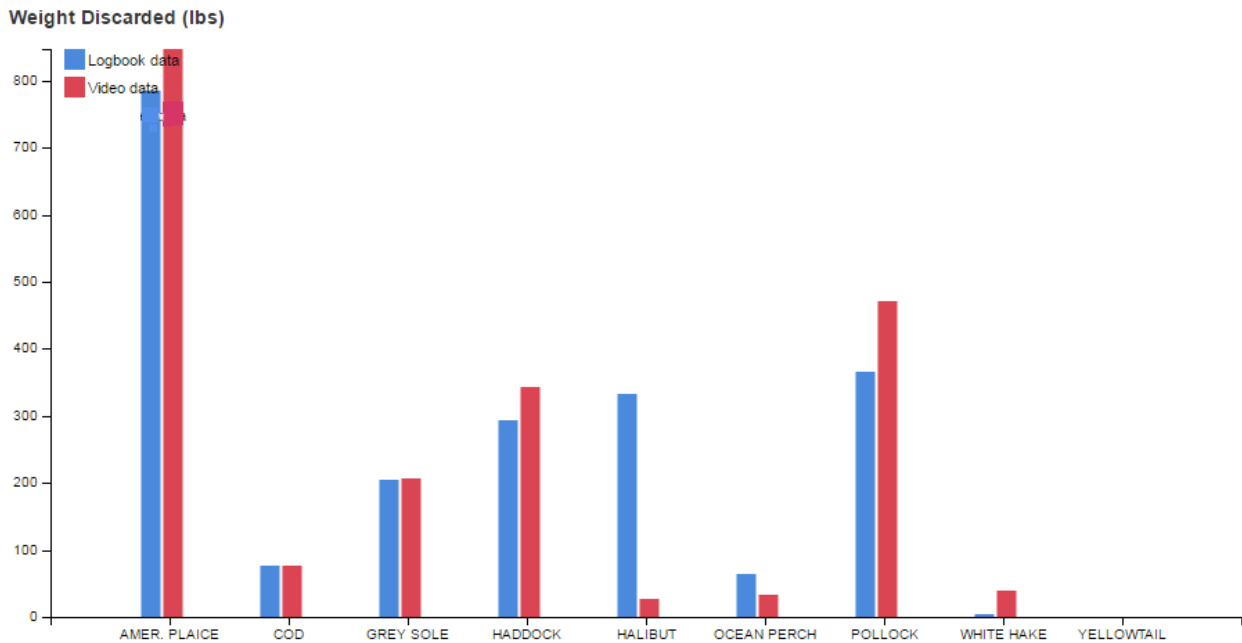


Figure 3. Combined discard weights for all reviewed hauls in FY2015.

Fishermen’s participation was a major challenge. Participation in the EM program was strongly driven by the regulatory environment in which New England fishermen work. A fisherman’s willingness to use a new monitoring system is impacted by quota limits and choke stocks, observer coverage rates, and the economics of running a small business.

Lastly, operating a new program while it is being designed presents a host of problems. EM program standards still need to be developed and approved, and federal data management systems, auditing procedures, and related federal regulatory tools need to be modified, which requires federal agency time and resources, both of which are fully subscribed already. The project partners have been meeting and collaborating with staff from the NOAA Northeast Fisheries Science Center and Greater Atlantic Regional Fisheries Office regularly throughout this project. Frequent communication and a willingness to work together to solve problems has been critical.

Based on our experience, we recommend that anyone undertaking the implementation and/or operationalization of EM ensure the following:

- Willingness of industry to use EM, and appropriate drivers/incentives for individual participation
- On deck methodologies need to be thorough and consistently followed
- Standard protocols for identification of fish, and determination of lengths or weight estimates need to be precise and used by all parties (video reviewers, fishermen, Regulating Agency)
- Feedback loop between fishermen and technicians regarding video collection is essential and needs to be quick enough to ensure collection of useable data



- Ongoing communication and collaboration with agency that will use the data is essential

In conclusion, project partners have encountered a variety of challenges in implementing new technology into an aging fishing fleet. This project has evolved considerably with successes and challenges over the course of four years, and the partners continue to work towards full implementation of EM in the New England Groundfish Fishery. Funding provided by The Gordon and Betty Moore Foundation and the National Fish and Wildlife Foundation have made this work possible and continue to allow project partners to work towards broad scale implementation of EM in the New England groundfish fishery.

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### **Abstracts of presentations that did not provide Extended Abstracts**

#### **Implementing EM in the West Coast Groundfish Trawl Fishery--Working the Process and Partnerships**

**Melissa Hooper and Stephen Freese**

**NOAA Fisheries, WA, United States**

In 2010, the Pacific Fishery Management Council implemented a catch share program in the West Coast groundfish fishery that included a requirement for industry to obtain and pay for 100-percent dockside and at-sea observer coverage to ensure full accountability for all catch of allocated species. In the first years of the program, NOAA Fisheries (NMFS) subsidized the cost of observers for industry, but this aid has been declining and in 2015 industry took on the full costs of observers. The industry has been increasingly concerned about monitoring costs and looking at electronic monitoring (EM) as an alternative. For several years, the industry and West Coast fishery managers have been developing EM as a potential alternative to observers that would allow vessel owners the flexibility to choose the monitoring system that would make the most operational and economic sense for their individual business. In 2015, NMFS, the Pacific States Marine Fisheries Commission, and industry and NGO partners, deployed EM systems in the groundfish fishery on an operational scale to test the full functionality of this monitoring tool for catch accounting. NMFS and industry participants negotiated rules and procedures, catch handling protocols, and integrated the program into the monitoring system for the catch share program. The results of the project showed that EM can be an effective tool for monitoring a commercial fishery and the program became the first in the US to use EM data for catch accounting. The Pacific Fishery Management Council and NMFS used the project results to inform regulations that will make EM an option for a portion of the fleet in 2017 and all vessels in 2018. This talk will discuss the program design and results, the successes and challenges, and the partnerships that made it possible.

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## **Development Of Video Electronic Monitoring System To Estimate Smalltooth Sawfish And Other Protected Species Interactions In Shrimp Trawl Fisheries**

**John Carlson and Elizabeth Scott-Denton**

**NOAA Fisheries Service, United States**

NOAA Fisheries began placing at-sea observers on commercial shrimping vessels in 1992 in the US southeastern region to identify and minimize the impacts of shrimp trawling on federally managed species. Analysis of bycatch data relative to smalltooth sawfish, a federally-listed endangered species, indicated the level of take was higher than mandated. However, the level of "take" of smalltooth sawfish had high levels of uncertainty due to the rarity of sawfish captures combined with low levels of observer coverage. A priori analysis indicated the sample size required to observe a sawfish with a coefficient of variation (CV)=0.3 was 11,380 tow hours/year that results in a cost of about \$1,000,000 to increase observer coverage in the eastern Gulf of Mexico. In light of the costs associated with observer coverage and given the rare event of capturing a smalltooth sawfish, increasing observer coverage to refine the take estimates of smalltooth sawfish may not be practical. We explored the use of electronic monitoring to provide a valid alternate to increased observer coverage. Preliminary testing on a contracted commercial shrimp trawl vessel found the system performed well in capturing video for a total of 109 hauls over 62 days at sea. The hardware held up for the duration of the trips with no water ingress to the deck components and there was only one significant gap that may have been caused by a system component malfunction. While no sawfish were observed, many sightings of dolphins occurred which suggests interactions with other protected species could be captured with these systems. Pairwise comparison of video vs that collected by observers found little difference in monitoring of larger species of teleosts and elasmobranchs. Despite some positive preliminary results, in order for implementation to occur there is a need to further test this system and expand coverage to areas outside southwest Florida.

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## **Addressing Some Of The Barriers To Acceptance Of Remote Electronic Monitoring In European Fisheries**

**Helen McLachlan**

**WWF - UK, United Kingdom**

In 2014 the new European Common Fisheries Policy (CFP) came into force and with it the landing obligation, or discard ban. This requires fishers to land, retain, record and count against quota, all commercial fish species, and is being phased in over the period 2015-19. This represents one of the biggest operational shifts in European fisheries and will present a number of challenges including the details of how it is applied, and then monitored for effectiveness. Both will be key for the landing obligation to be successful. Flexibilities will

likely be adopted, which will require monitoring systems to be capable of supporting these and providing evidence of where things are working - or not.

To inform the debate and to address some of the commonly held misconceptions held about Electronic Monitoring, such as cost and how data is collected and reviewed, WWF commissioned the report, *Electronic Monitoring in Fisheries Management*. The report reviews the alternative methods available for monitoring and enforcement and compares the cost and coverage of the different methods, using the UK as a case study. The report concludes that only a remote electronic monitoring (REM) system equipped with video technology (CCTV) can provide high levels of assurance of effective monitoring of activities at sea. It also concludes that this technology offers the cheapest option for effective monitoring at sea and that it can offer higher coverage levels than others, at a lower cost. If adopted widely REM would create a uniform European approach to monitoring and importantly a level playing field for fishermen. It would also have the additional benefits of increased data and the ability to demonstrate real problems, and best practice.

WWF released the report throughout Europe and are currently in dialogue with different European countries' on their actions to meet the landing obligation and their views on monitoring and enforcing it effectively. This presentation will provide an outline of the report, the advocacy surrounding it and some of the challenges experienced in gaining acceptance for REM in European fisheries.

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## **MAN V's MACHINE - MONITORING AUSTRALIAN FISHERIES 2016**

**Chris Burns**

**Australian Fisheries Management Authority, ACT, Australia**

The Australian Fisheries Management Authority (AFMA) has independently monitored inshore and offshore fisheries using human observers since 1979. Over the past 7-8 years the development of technologies as well as the evolving data needs prompted AFMA to investigate the potential for Electronic Monitoring (EM) to be used alongside human observers to meet the data collection needs. EM technology was trialled in Australia's prawn trawl, tuna longline, shark gillnet and demersal longline fisheries between 2010 and 2015. The results of these trials identified that EM could provide an effective monitoring tool to complement existing observer functions. From July 2015 AFMA implemented an EM program in the tuna longline and shark gillnet fisheries with EM systems now installed on 75 fishing boats.

Throughout history fears inevitably arise when human functions are threatened by technology. The Australian experience highlights that despite the total shift from human observers to EM in two of AFMA's larger fisheries the need for a human based observer program remains crucial. The driving force for monitoring in the tuna and shark fisheries is wildlife interactions and logbook data validation which is highly suited to EM. A fundamental need for human observers remains in fisheries where management decisions are underpinned by biological information.

The implementation of EM has proven to present many challenges around access to video footage by third parties, identification of previously unknown issues and identifying and linking common events across different data sources. There are significant opportunities for observers to play a greater role in supporting EM including data review and undertaking more engaging sampling and extension roles as EM covers some of the more mundane binary monitoring functions.

Key challenges for the future monitoring programs include clearly defining data needs and integration with other data sources such as vessel monitoring system (VMS) data and electronic logbooks. Careful planning of monitoring and data requirements are required to balance EM and human observer program integration.

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### **Comparing the Costs of Human versus Electronic Monitoring: Issues, Case Studies, and Economic Analysis**

**Gil Sylvia, Michael Harte and Christopher Cusack**

**Oregon State University, OR, United States**

There are growing efforts to substitute electronic fisheries monitoring for human monitoring in order to reduce costs, especially when the fishing industry must bear the majority of the costs. Decisions, however, to select the best approach are complicated by a range of factors including: the goals of the monitoring program; the type of fishery; which organization bears specific costs; the distribution, forecasts, and uncertainty over future costs; the effect of scale on costs; and, the efficiency of the relevant institutions and collaboration of the participating organizations. In order to address these questions we are conducting a study to understand the issues and costs of human observers and electronic monitoring systems. The study includes a review of the fishery monitoring and observing literature, interviews with selected organizations, and case studies featuring key aspects of economic and financial costs. The background research and data collection are being used to design a financial "tool" to compare costs of human observers versus electronic monitoring systems. The tool incorporates major cost categories including administration, training, data collection, storage, and analysis. The model is organized according to the category of costs (e.g., fixed, annual, or variable including trip, and/or haul). The tool allows the user to allocate costs across time to various sectors (e.g., government, industry, private organizations), to use scale factors for selected cost categories, (e.g., volume equipment purchase discounts), to make alternative predictions for future costs, and to build in considerations of "opportunity costs" associated with real world fisheries. A number of base scenarios are being built as well as a range of assumptions that can be adjusted to reflect specifics of a given fishery. The graphical and tabular outputs allow the user to compare the total costs over a five to ten year period as well as annual and trip or haul costs, and ratios of key cost categories. We will present our preliminary research findings as well as the design and use of the economic model and will encourage conference participants to share ideas for improving the value and usefulness of this approach.

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## **The Challenges And Lessons Of Electronic Reporting In The Pacific Islands Regional Observer Program: Setting Goals, Determining Priorities, And Evaluating Feedback In Early Development And Testing**

**Joshua Lee**

### **NOAA NMFS PIRO Observer Program, HI, United States**

In September of 2014, the Pacific Islands Regional Observer Program (PIROP) began early development of an electronic reporting project with the following three goals: 1) to develop a mobile application to augment observer data collection; 2) to improve the timeliness and accuracy of observer data; 3) to reduce program expenses through the successful implementation of goals 1 and 2. Since that time, PIROP has successfully moved from early development to at-sea user testing with observers and program staff. Early user feedback has been promising, and PIROP is seeking to continue the development of the electronic reporting system.

The prevailing assumption is that transitioning to electronic reporting will be costly, and as such, funding will present the primary challenge toward implementation. However, while questions of funding are critical, the identification and mitigation of programmatic challenges during the early development of a project are equally important to achieving adequately operational systems. PIROP has identified the following programmatic challenges throughout the development and testing process: effective goal setting and prioritization, communicating program specifications and requirements to outside development teams, ensuring the quality of data, forming consensus amongst a multitude of program stakeholders, and meeting the requirements for data security, enforceability, and archiving. Additionally, the existing horizontal structure of observer program organizations contributes to a lack of centralized access to information, which can often impede results that conform to agency standards, and prevent projects from moving forward. (e.g. data encryption, chain-of custody, etc.).

PIROP has had early project success, in part, due to three strategies. Firstly, setting goals with achievable outcomes by clearly defining objectives and key results (measurable). Secondly, determining program priorities through ongoing outreach to stakeholders. Stakeholders' involvement during the developmental stages is essential in identify critical requirements that may otherwise prevent a project from moving forward. Lastly, evaluating user feedback through clearly defined metrics. Testing with real users in real environments produces a wealth of information concerning usability, functionality, compatibility, and reliability of a system. When properly executed through these strategies, testing will provide feedback that can steer development and eliminate uncertainty prior to implementation.

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## **Open Oceans - How the digital sharing culture supports healthy fisheries**

**Jared Fuller and Morgan Wealti**

## **Saltwater Inc., AK, United States**

Saltwater Inc. is an industry leader in the design and implementation of fishery and marine mammal observer programs, and an innovator in the use of electronic monitoring (EM) for data collection. The open-source movement, which promotes collaborative development of computer source-code by multiple independent sources, will likely be among the most transformative ideas shaping the 21st century. We believe that the establishment of *open standards* for onboard EM data collection systems, and the use of *open-source* data review software, are critical to the long-term success - and sustainability--of EM programs.

A key constraint to effective EM implementation is the cost of data review. Operational implementation of EM requires not only collecting hours of video and sensor data, but also the ability to efficiently extract from that data the meaningful information needed to manage a particular fishery. Without *open standards* that define data collection specifications of onboard EM systems, service providers will continue to collect data in formats that can be interpreted only by their own - often proprietary - review software. If clear, open standards were defined, data acquisition software would necessarily reflect those standards and the data collected by one service provider could be easily viewed using third-party software.

Saltwater is, and has been, committed to open-source software for EM data acquisition and review. We are pioneering the development of open-source review software and promoting the development and application of open standards. We believe that open-source software avoids the limitations and expense associated with proprietary code, encourages collaboration and innovation, and will speed the development of cost effective review solutions. An open EM ecosystem would allow for more flexible program design, and reduce redundancy and promote cost saving by encouraging collaboration. The end result is a more transparent, cost-effective, and innovative environment for data collection and fisheries management.

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## **Humans and Technology - The two pronged approach to better fisheries monitoring**

**Morgan Wealti and Jared Fuller**

**Saltwater Inc., AK, United States**

Observer programs have expanded throughout the years as the pressures on our fisheries and oceans have grown and the demand for data has grown with it. Yet while the need for data has increased, with quotas being cut and monitoring costs being transferred to industry, there is an increasing need to find ways to collect that data more cost effectively. As in many fields, one approach is to find effective ways to use technology.

As technology has advanced in recent years, cameras, sensors, satellites and computers have resulted in new ways to collect fisheries data. Yet while the use of technology - especially electronic monitoring (EM)-- has picked up steam, observers and some observer providers have been leery of the shift.

Saltwater has been involved in the observer business since its inception, and we are also innovators in the use of EM. Saltwater's experience as an observer provider gives us a depth of understanding that has helped define our approach to EM. Observers understand fisheries, data requirements, and day-to-day operations onboard a fishing vessel, as well as what it takes to work with representatives of both industry and government agencies. At Saltwater, observers - and former observers-- are at the heart of the design and implementation of our EM program. They work for Saltwater as EM technicians, data reviewers and program managers.

Saltwater's vision is not to take away observer jobs with EM, but to find ways to bring the skills of observers to the development and implementation of EM programs. Our mission is to provide high quality fisheries data, and we believe that the best approach in the years to come is to combine the skills and talents of observers with the benefits of technology, making the most of each of their unique contributions.

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## **Fishery Dependent Electronic Log and Remote Data Entry**

**Lara Erikson**

### **IPHC, WA, United States**

Since the 1920s, the International Pacific Halibut Commission (IPHC) staff has collected logbook information from the fishermen participating in the commercial fisheries for Pacific halibut in U.S. and Canadian waters. IPHC staff has also collected biological information and structures from Pacific halibut landed in these fisheries. IPHC fishery-dependent sampling data collection methods have been based on a pencil and paper technology throughout the majority of this time. With recent advancements in the field of ruggedized computing, the IPHC is exploring ways to integrate the new technology to enhance this data collection program. The primary impetus for this is to create a process that will eliminate or reduce the need for post-collection data entry and increase the efficiency of data editing. Consequently, the data will be provided to the end users (i.e., stock assessment and research scientists) earlier than in the past, allowing more time for data analyses. This process also provides greater precision, verification, and timeliness in the collected log data.

In 2015, an electronic tablet was provided to IPHC port samplers in each staffed Alaskan port and Bellingham, Washington, for entry of fishing data from the IPHC logbooks directly into the remote data entry (RDE) application. Samplers were tasked with entering data from as many of the logs they collected, as priorities and time allowed, during the course of their regular port sampling duties.

Modifications and enhancements to the application are still in progress. In 2016, RDE of log data continues to be a regular part of the IPHC port sampling program's log collection protocol. A review of the development, testing, and application of this electronic remote data entry system is provided along with detailed pros and cons, enhancements, accuracy assessments, and a path forward.

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## **Exploring a Cooperative System between Electronic Monitoring and Onboard Fisheries Observers in the Alaskan Groundfish Fisheries**

**Christopher Noren**

**Alaskn Observers Inc, CA, United States**

Increasing observer coverage in the Alaskan Groundfish small boat fleet coupled with limited space as well as improved technological advances have triggered a large industry push towards electronic monitoring (EM) as an alternative to onboard observers. Proponents of EM cite the increased costs of observers to the small boat industry and the potential for high quality, 24 hour data collection with cameras. Opponents of EM replacement of observers note that cameras can be more easily circumvented than observers, technological limitations for species identification, and the inability to collect specimen data. While both methods have limitations, a cooperative system between these two programs would allow for the highest quality data and management of the groundfish fisheries. This system would use EM as a passive monitoring system to gather overall catch data and provide evidence of fisheries violations while observers would focus more on specimen collection and biological sampling. In this system, EM would allow for large scale and constant monitoring of basic catch data and general regulatory compliance while observer coverage would decrease to alleviate the economic pressure on the small boat fleet and their role as compliance officers, which is a contentious issue on both sides, would also decrease. Observers would take on a role more similar to a field technician, collecting biological data such as otoliths and stomach isotopes that EM cannot account for giving NOAA fisheries biologists both high levels of catch data from EM and a deep pool of secondary resources to assess year classes and ecosystem regime changes.

My presentation would briefly touch on the current EM technology available as well as its advantages and limitations. Then present the pros and cons of both onboard observer coverage and EM before presenting a cooperative synthesis of both systems.



## **Session 8. How do we best monitor recreational and pay-for-hire (charter) fisheries?**

**Leader: Andrew France**

It has become increasingly acknowledged that recreational fisheries form a very significant component of the catch of many fish stocks throughout the world. But, whilst commercial fisheries have a long history of being monitored, recreational fisheries have had far less scrutiny. As the size (and impact) of recreational fisheries is gradually increasing throughout the world, such a lack of robust data concerning their catches, bycatches and impacts is of significant concern for the management of fish stocks. This session investigated the best way(s) to monitor, observe and quantify the impacts of recreational fisheries, including those that involve charter boat fleets, and how to incorporate recreational fisheries monitoring data with data collected from commercial fisheries.

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### **Oral Presentations - Extended Abstracts**

#### **How do we best monitor recreational fisheries and pay-for-hire (charter) fisheries**

**S. Phillip Bear**

**IAP World Services, NOAA Reef Fish and Shrimp Observer Program, Galveston, Tx, U.S.**

The effects of recreational fishing activities can have a significant impact on the environment in addition to impacts derived from commercial fishing activities. Monitoring these impacts from recreational fisheries present unique challenges significantly different from observing commercial fisheries. First, recreational fishermen are often not required to report their catches to any monitoring agency. Second, the logistics of implementing a system of monitoring can be difficult because of the unpredictable schedule of recreational fishermen utilizing private watercraft and departing from a wide range of ports. For-hire recreational charter fisheries, or charter vessels, also present a challenge for monitoring, although significantly less so than private recreational fishing because of the license and permit requirements and that they often adhere to a schedule. Finally, the data collected could not be limited to hook and line fishing, but also include cast-netting, spearfishing, crabbing, and lobster hunting.

Perhaps the best method of collecting information is interviewing fishermen at public boat ramps or docks and measuring retained catches with permission of the fishermen upon their return from a fishing outing. Data on fishing gear and bait used, along with the general location and environmental factors could also be collected. However, there are several downsides to the dockside interview method. For instance, some fisherman may not wish to reveal details about their fishing trips, specifically locations and techniques used. Other fishermen may simply not wish to cooperate at all or make proper identification. Many species have subtle distinguishing characteristics that make accurate identification

unreliable from these fishermen. For example, the gag grouper (*Mycteroperca microlepis*) and the black grouper (*Mycteroperca bonaci*) inhabit similar waters and the common names are interchanged among fishermen.



Black grouper (*M. bonaci*) source: Fishingtripkeywest.com



Gag grouper (*M. microlepis*) source: marinesciencecenter.com

It would also be reasonable to assume that some fishermen would not be forthcoming about interactions with wildlife such as gear entanglements with protected species such as sea birds, mammals, turtles, or other protected species. Another data collection method from fishing piers could be more accurately accomplished since the observer would be present to make firsthand identifications, observe environmental conditions, and wildlife interactions. The number of individuals actively fishing could be counted at random intervals to get a sample of the fishing effort occurring. A randomized selection process could be used to determine times and locations in which surveys are conducted to minimize bias. Coordination and cooperation with local enforcement agencies may also assist in acquiring data from recreational fishermen. Enforcement officers that conduct routine checks of catches to ensure compliance with size and retention limits could record their findings regarding species, size, location, and gear utilized and submit them to observer programs. Also, if feasible, observers could accompany the enforcement officers to collect the data.

Competitive fishing tournaments also provide simplified opportunities for data collection of recreational fisheries. Collecting data on these tournaments is crucial since they often target a specific species. Many tournaments adhere to strict rules and regulations in regards to locations fished, gear utilized, duration, and number of persons fishing which greatly simplifies data collection. Observers can be present at the weigh-ins of these tournaments to obtain accurate measurements and collect samples. Cameras could also be utilized for data collection, especially with catch-and-release style tournaments. In tournaments where fish are retained, the camera system would be useful in data collection

of fish released, either because the fish were not within the retention size limits or were a non-targeted species. In both instances, the cameras could also record potential interactions with wildlife. Catch and release style tournaments provide more of a challenge but can still be monitored feasibly by utilizing cameras, designated survey boats, or simply recording the measurements taken by tournament participants.

Monitoring of for-hire charters could be achieved most effectively in either of two methods: cameras with interviews or having an observer on the vessels. Smaller vessels with limited space for persons on board could be monitored via cameras that could be placed in strategic locations to get a clear view of the fish that are captured and perhaps even record interactions with wildlife such as birds, dolphins, sea turtles, or protected species. The species and condition of the fish upon capture and release could be determined by trained persons who would review the recordings. Other important details that could affect the release mortality could also be noted, such as handling tactics, duration of fight, and release techniques. On each vessel, measuring boards with incremental markings could be used by placing the fish on it and the persons reviewing the recordings could determine an accurate estimate of the fish's length. This would also be effective for fish that are discarded. For fish that are retained, a biologist could meet the boat when it returns to port to obtain accurate measurements and collect biological samples. For both instances of retained and released fishes, a GPS unit could record the locations being fished. The observer would also collect data on the type of fishing gear used, how it was used, specifically depth of water and the depth of fishing, fishing technique (trolling, drifting, on anchor), and the type of bait used. For larger "party boat" style charters, it would be feasible for a trained observer to accompany the boat on trips to obtain accurate data of catches, wildlife interactions, gear used, locations, and environmental conditions. The observer on board would obtain accurate measurements and reliable identification of fish caught in addition to the condition and fate of the fish caught. The observer could also provide reliable, first-hand data on interactions with wildlife. This method would not be entirely different from the techniques used by reef fish observers deployed on vertical line vessels in the Gulf of Mexico. The selection process to carry an observer would best be achieved by random selection of permit numbers, as vessels that partake in party boat style charters are required to be licensed. The same method would apply for boats that would utilize the camera method in lieu of an observer because of space limitations. Another advantage to monitoring charter boats is that they often operate on a schedule, departing and returning from trips at predetermined times.

Monitoring of recreational fisheries would not be limited to hook and line techniques nor exclusively to targeting of finfishes. Spearfishing, crabbing, cast netting, lobster hunting, and collection of bivalves (oysters, clams, scallops, etc.) all have potential impacts on the health and populations of the targeted species. Perhaps the most effective means of collecting these data would be, as with private recreational hook and line fishing, to conduct interviews and examine catches at public boat ramps and docks. Data can also be collected from scuba diving charters. Measurements can be taken on the catches from the trips when the boats return to the dock and further details can be collected via an interview. Since many dive charters operate on set schedules, making arrangements to sample and survey the catches could be relatively easy. Spearfishing tournaments could also be monitored in similar fashion to that of hook and line style fishing tournaments.

Further data on impacts of recreational fishing can be determined from the data collected on the fisheries providing live and frozen bait to bait shops. The bait sold to recreational fisherman are often lower trophic species such as mullet, menhaden, herring, shrimp, crabs, squids, etc. The harvesting of these species wouldn't only affect the forage species population, but could also secondarily affect the upper level predator species by reducing their available prey. The effects of discarded bait, namely baits that are processed or come from sources outside the area in which the bait is being used could also have an impact on the environment, such as transmitting parasites or pathogens.

A final aspect of the impacts of recreational fisheries is that of discarded fishing materials. Discarded or lost fishing line often entangles wildlife causing serious harm and even death to the animals ensnared. Lost hooks, lures, and rigs can also ensnare wildlife and are even more harmful when ingested. This is especially high risk if there is still bait on the lost hook. Lost weights, which are often made of lead, are extremely toxic to the environment, and even more so when ingested. Additional environmentally harmful litter comes in the form of plastic packaging for hooks, weights, lures, and a vast array of fishing gear. While determining exactly how much lost or discarded fishing tackle enters the environment is problematic, collecting the data on gear used, as well as number of the fishermen using the waters could provide at least an estimate of the quantity of these items. Data and input collected from recreational fishermen, tackle supply shops, and manufacturers could be utilized to find a solution to these problems.

While recreational fishing activities can have numerous impacts on wildlife and the environment, monitoring these impacts is feasible. Utilizing cameras combined with interviews for docks, boat ramps, piers and small charter operations or observer placement for fishing tournaments and larger charter vessels could allow a more accurate assessment of these impacts. These data, compiled with data on commercial fishing operations would provide a means to implement new regulations to ensure a healthy environment.

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## **Canada's Internet Recreational Effort and Catch ("iREC") Survey: 3 Years In**

**Rob Houtman and David O'Brien**

### **Fisheries and Oceans Canada**

In July 2012, Canada initiated the 'iREC' survey, an internet survey to provide estimates of recreational effort and catch in tidal waters of Canada's Pacific Region. This recreational fishery is large and diverse, with 300,000 licence holders able to fish year-round, inshore and offshore over the entire British Columbia coast, with a variety of fishing methods and many target species. Established recreational monitoring programs (creel survey and logbook) did not cover all areas or months and only cover angling from a boat. Other fishing methods not covered by these methods include angling from shore, shellfish trapping by boat and from shore, beach digging and hand picking, and very rare methods such as fishing while diving. The primary objective of the iREC survey was to provide reasonable quality effort and catch estimates covering all months, areas, methods and species, providing

separate estimates of total effort and catch for each combination of month, management area, fishing method, species and fate (kept vs released).

Each month, random samples of three groups of licence holders are selected and contacted by email explaining that they are required (by licence condition) to complete the survey regarding their catch and fishing activities in that month. The three groups sampled are licence holders who bought i) annual licences prior to the survey month, ii) annual licences during the survey month, and iii) term licences; licence holders sampled from the first group are emailed at the beginning of the survey month, while those sampled from other two groups are emailed at month end. To ensure resulting catch estimates represent the total catch of all licence holders, adult participants are asked to report not only their personal catch, but also that of any Juveniles (licence holders < 16 years of age) fishing with them. Participants are provided a personal survey link that allows multiple entries throughout the month. Reminder emails after the survey month end prompt fishers to use the survey link to complete the survey by confirming that all fishing information has been completed or that the participant did not fish. Personalized survey links support analysis that is stratified by licence type; licence types are distinguished by residency (Canadian or not), age category (adult or senior), and licence term (annual, 1d, 3d, or 5d). To minimize survey fatigue, licence holders can only be selected for one monthly survey per year.

Survey completion rates to date have increased during the course of the survey, with average monthly completion rates increasing from 27% in 2012 to 36.2% to date in 2016, consistent with improved survey design and increased awareness and understanding of the survey. Overall, the precision of the catch estimates derived through the iREC survey to date are similar to that for estimates derived through conventional creel surveys.

The figures below provide examples of the large number of estimates produced by the survey. Figure 1 shows the estimated total number of days fished, by month and fishing method, in the entire tidal water area of British Columbia; since conventional surveys do not cover the entire area even in summer months, the insight provided by this figure is completely novel. Figure 2 shows a 'heat map' of the estimated kept halibut catch, in pieces, by month and Management Area, for 2013 through 2015; in the heat map, white cells are estimates of zero catch, with relative size of catch estimates increasing from pale yellow through orange to an annual maximum in the red cells. While conventional methods provided estimates for some of the cells in this figure, the iREC survey provides estimates for all month-area combinations and thus a basis for total catch accounting. Overall, the results of the iREC survey agree reasonably well with expectations and comparable estimates from conventional surveys.

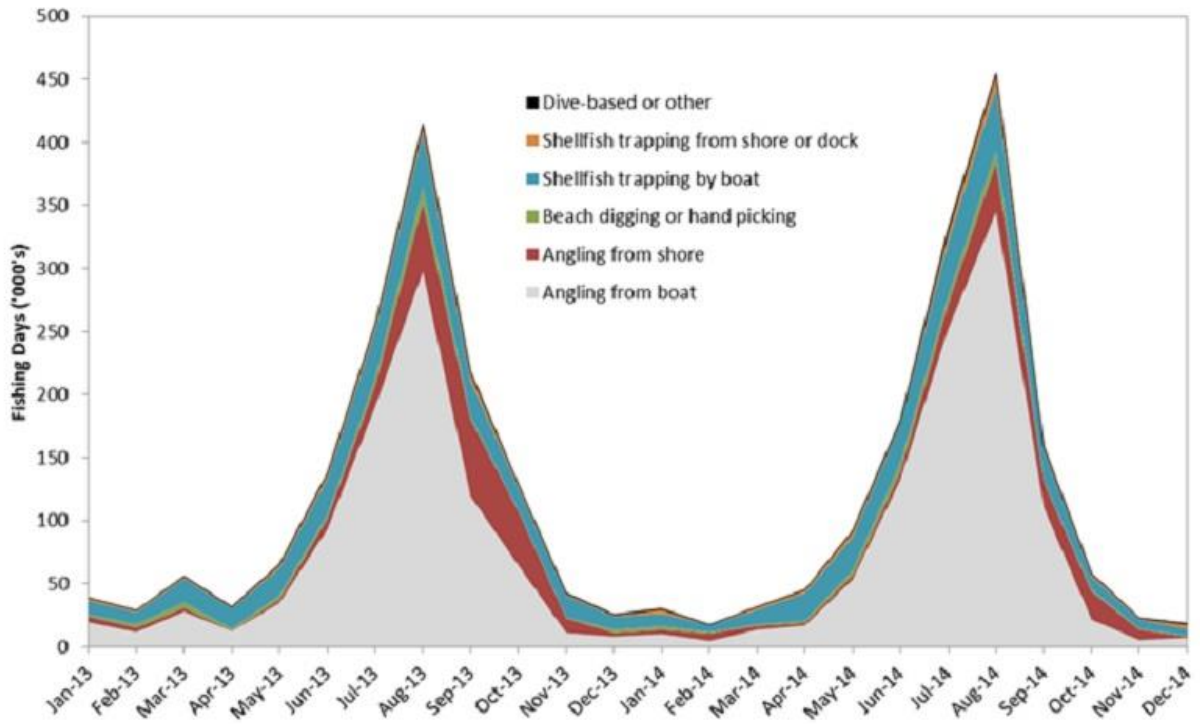


Figure 1. Total fishing days, by month and fishing method, for 2013 and 2014.



licensing , which provide a data collection card for the fishers to send in. The for-hire fishery has had similar efforts in attempt to collect quality data, from vessel surveys to a more recent requirement of electronic log books that must be submitted weekly, or the for-hire vessel is prohibited from fishing.

These efforts to collect fisheries data from the recreational and for-hire fisheries are well thought out but are subject to various types of bias and apathy on the part of the fishers. Collection of data from these fisheries is of great importance, as a significant proportion of quota is allocated to them. For example in the Gulf of Mexico red snapper fishery the recreational and for-hire fishery is allocated 49% of the total catch, which is around 6.8 million pounds. This allocation is limited to a season of 10 days for recreational fishers and 45 days for the for-hire fishers. This short season causes a lot of animosity towards fishery managers from both classes of fishers, as the season runs irrespective to weather, as well as the seeming abundance of red snapper in many areas of the Gulf of Mexico, which would suggest a longer season. Many, if not most of the recreational fishers are not aware of the significance and effort put into rebuilding the fishery, particularly red snapper, most of the for-hire vessels are aware of the significance of these efforts but may have trouble explaining them to their customers.

There is much potential for the use of observers in both of these fisheries, that could do much to reduce bias in data, as well as putting a human face on fisheries management, which could perhaps alleviate some of the current animosity towards fisheries managers and their stock rebuilding plans. Observers in the for-hire fishery could be placed on vessels in a initially voluntary program.

Observers on for-hire vessels could collect data which could be compared to that received from the electronic logbooks currently in use, allowing comparison between self-reported and objectively collected observer data. Observers on for-hire vessels could also show the captains and crews of those vessels how to accurately collect viable and unbiased data, which might improve the information collected through the electronic logbooks. Data collected by these observers would be of significant in ground-truthing the data collected from electronic log books currently used in the for-hire fishery. These observers could also act as ambassadors of fisheries management to the for-hire boats' customers, who more than likely have no inkling of the current efforts to manage the fishery, thereby promoting conservation and rebuilding of fish stocks to new groups. Trips that carried an observer could reward the vessels' customers with shirts or some other items to further promote fisheries management. Carrying an observer on chartered trips might also be a selling point for the for-hire vessels, as they could claim participation in good fisheries management techniques. It would be possible to develop some sort of certification for this that the for-hire business could reference on their advertising, which could further promote the idea of observed for-hire fishing.

Potential roles for observers in the recreational fishery could also be developed on an initially voluntary basis. This could be done by adding a check box to licensing forms asking participants if they would consider taking an observer fishing with them at some point. Another method to generate interest in placing observers on recreational vessels would be interacting with the various fishing groups and associations. Collaboration with these groups could amplify interest and awareness of observer coverage among recreational



fishers, and allow them to contribute to the collection of better fisheries data which would lead to better fishing, which is in their best interest. Placement of observers on recreational vessels could also improve current data collection methods by showing the fishers how and what data needs to be collected and reported in a hands on way.

A second role for observers in the recreational fishery would be coordination with various fishing tournaments, where a large number of people target various types of fish in a short time period. Data collected from tournaments might offer a rare insight into fish stocks in a restricted area. Observers could also improve these contests by documenting catches, and promote catch and release of certain fish with scientific and verifiable documentation of what was caught. Participation in fishing tournaments by observers would also be a useful tool for promotion of fisheries management techniques and data collection as well as and awareness among recreational fishers of them.

Placement of observers on recreational and for-hire boats would have to take into consideration the safety of the vessel to the observer. Many if not most recreational vessels do not have the full complement of safety gear required on commercial vessels. Some for-hire vessels have this equipment, as they may fish commercially as well, which also implies that they have the necessary US Coast Guard safety inspection required of vessels taking a fisheries observer. Perhaps by deploying observers in the for-hire and recreational fleets, a greater level of safety among the vessels may be obtained, as well as greater awareness and prevalence of life saving equipment, such as epirbs, life rafts, and firefighting equipment. The high cost of some of this gear to the vessel owners, particularly life rafts and epirbs, could be minimized by deploying the observers with these items if necessary.

Observer collaboration with recreational and for-hire fisheries could be a significant factor in promulgating and popularizing the collection of data and reporting it in a timely manner to fisheries managers, so that such self-reporting of data from fishing trips becomes as common as buying bait and ice. Recreational fishers and for-hire businesses are concerned about the health of the fisheries and the marine environment, and are in many cases frustrated by seeming over-regulation. Developing a relationship between recreational fishers and fisheries managers, through the deployment of observers would be a powerful and empowering technique to facilitate better relations between them. It is interesting that recreational and for-hire fishers are allowed and encouraged to self-report data for fisheries management purposes. For some reason this is not sufficient for the commercial fisheries, as it is easily manipulated and subject to many types of bias, which makes this information unreliable for management purposes. Observers could be a significant asset in improving and developing data collection from these fisheries, through un-biased collection of quality fisheries data.

I would like to thank the national observer program for sponsoring me to come to this conference. It is an honor to address you today. Seeking observer participation for these conferences is a great and empowering idea, and gives one sense of inclusiveness in the process of fisheries management.

## Canada's Internet Recreational Effort and Catch ("iREC") Survey: Next Steps

David O'Brien<sup>1</sup> and Rob Houtman

### Fisheries and Oceans Canada

After three years of continuous operation, the internet recreational effort and catch (iREC) survey has demonstrated that an internet-based survey can produce reasonable estimates of effort and catch in a large recreational fishery for a fraction of the cost of alternative methods (See *Houtman & O'Brien*, this session). An internal review by Fisheries and Oceans of the iREC methods in 2015 highlighted two key next steps for the program: the use of concurrent creel survey estimates to bias-correct the iREC estimates and additional research to evaluate the influence of non-response bias in iREC data.

There are bias concerns with 'fisher-dependent' data, meaning data provided by anglers with no independent verification, such as the reports collected in the iREC survey. Some of the bias sources that likely apply to iREC data include: avidity bias (only avid anglers report), prestige bias (reports are inflated), strategic bias (reports are modified to influence management), recall bias and bias due to species misidentification. Across all sources, the magnitude and direction of overall bias in iREC survey estimates is unknown; although, many of the potential bias sources consistent with fisher-reported data lead to an expected positive bias. The source of bias we are most concerned with for the iREC survey could be termed 'non-response bias', or a positive bias resulting from people who did not catch anything failing to report their fishing activity through the survey. Likewise, it is possible that people who did not fish are less likely to initiate the survey process.

Recreational effort and catch are independently estimated in the peak fishing times and areas using a creel survey. The creel survey in British Columbia is a combination aerial-access site survey design where effort and retained catch are collected in a fisher-independent manner. Having two concurrent estimates of catch and effort allows for the development of correction factors for one estimate type to the other via regression. Because the creel survey includes fisher-independent data it is assumed to be more accurate than the iREC survey. As such, we use it as the dependent variable in our 'bias-correction' regression (e.g. Fig. 1) allowing conversion of iREC estimates to presumably less biased creel-equivalent estimates. As the creel survey generates only estimates of recreational catch and effort, we use type 2 regression methods to address the uncertainty in the dependent variable of the iREC – creel survey regression. We argue that this 'bias-correction' is an appropriate way to address cumulative bias across all sources in the iREC survey data.

After three years of data collection, it appears that there is a generally small and variable positive bias in iREC estimates relative to creel-based estimates (Fig. 2) for commonly captured species. Although there is considerable pressure to reduce creel survey coverage as a cost saving measure in the future, our data to date suggests that creel surveys are required for ongoing iREC bias-correction.

Although a bias-correction approach appears appropriate to address bias, we have conducted a telephone survey of licence holders who were invited to the survey but failed to report. This survey quantified the impact of non-response bias by comparing fishing

behavior of non-responders to that of iREC respondents. To date, we have found no evidence for non-response bias in terms of fishing activity or catch (Table 1), but plan to continue these telephone surveys in the future.

Having complete annual estimates of effort and catch across all marine recreational fisheries in British Columbia has raised interesting management challenges. Firstly, catches in times and areas not previously surveyed have complicated the management of species where catch is managed to an annual quota, as annual catches are now higher than previously estimated. Secondly, estimates of recreational catch for species for which none previously existed can potentially result in costly re-examination of management methods.

Table 1. Comparisons of catch estimates from iREC respondents and a sample of licence holders who failed to respond to the iREC survey, but provided fishing information during a subsequent telephone survey. We found no statistical differences between catch estimates of these two groups (two sample K-S tests), suggesting that non-response bias is insignificant for iREC estimates.

Test	Sample size		Estimate mean		P value
	iREC	Telephone	iREC	Telephone	
Chinook kept	3,359	251	0.91	1.18	0.987
Chinook released	3,359	250	0.71	1.24	0.776
other salmon kept	3,359	247	1.14	1.12	0.817
other salmon released	3,359	247	1.28	1.44	0.964
Halibut kept	3,359	252	0.19	0.45	0.991
Halibut released	3,359	252	0.08	0.20	1.000

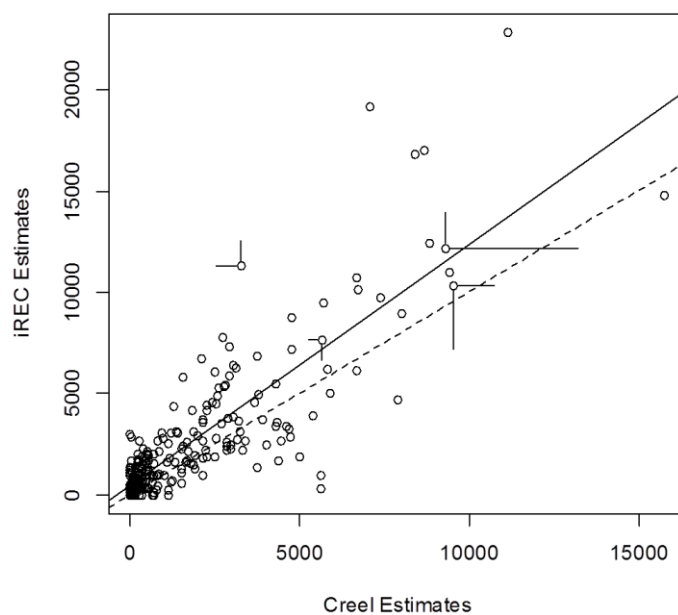


Figure 1.) An example regression of iREC estimates of retained Chinook salmon (*Oncorhynchus tshawytscha*) on estimates obtained from the creel survey. Each data point

represents an iREC and creel survey estimate for the same area and month. The dotted line represents a 1:1 relationship, and the solid line is the fitted regression line. Example error bars (+/- 1 SE) are provided for four points to highlight estimate precision in both the iREC and creel survey data.

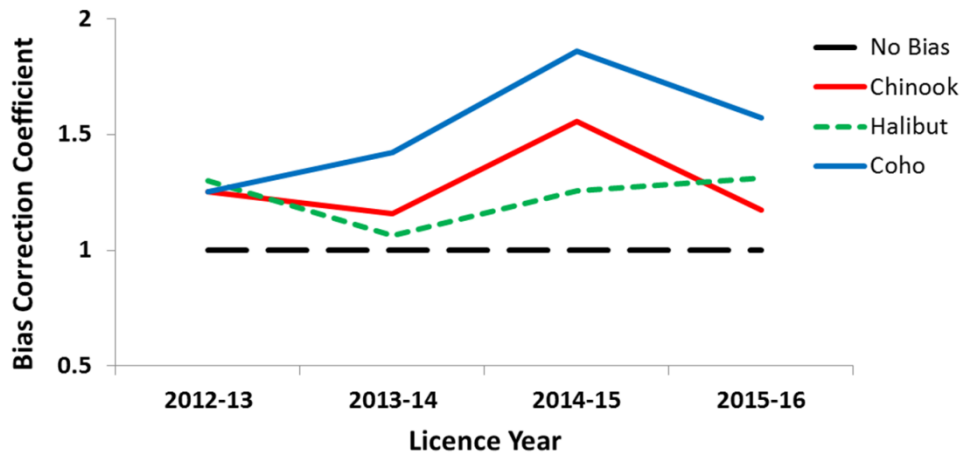


Figure 2.) The ‘bias-correction coefficient’, or slope of a type II regression with a zero intercept, between iREC and creel survey data for three fish species over four licence years. The black dotted line would be the expected trend if there were no differences between iREC and creel survey estimates (no bias). Over these three species, there was a pattern of a positive bias of iREC relative to creel survey estimates. In addition, the bias-correction coefficients tended to vary from year to year suggesting that ongoing ‘bias-correction’ of iREC estimates to creel survey estimates is required.

### **Surveying Angler Expenditures for Commercial Passenger Fishing Vessel trips in Non-US waters from San Diego.**

**Charles Villafana, NMFS West Coast Regional Office, Long Beach, CA.**

**James Hilger PhD, NMFS Southwest Fisheries Science Center, La Jolla, CA.**

**Rachel Mahler, NMFS Southwest Fisheries Science Center, La Jolla, CA.**

San Diego is home to a large fleet of Commercial Passenger Fishing Vessels that primarily target Tuna, yellowtail, dorado, and wahoo outside of the United States EEZ. These trips range from day trips to over 14 days away from port. The anglers on these trips come from all over the world to Southern California. Every five years the National Marine Fisheries Service conducts a National Angler Expenditure survey to estimate the economic contribution of recreational fishing in all coastal states. However, since this is typically a survey of State fishing license holders, the anglers on these trips are not included. (No California fishing license is required if the trip only fishes in Mexican waters). Developing a survey to estimate the expenditures of this sector of the recreational fishery has been a challenge. In 2015, partnering with the Sportfishing Association of California, National Marine Fisheries Service conducted a pilot study on various methods to survey these

anglers. In 2016, NMFS is conducting a year round survey using in person interviews to gather information on angler expenditures in the Non-US CPFV fleet.

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## **Open Discussion Session**

### **John Carlson (NMFS)**

#### *Question*

Why isn't MRIP deploying surveyors on charter boats? Especially party boats and vessels within the existing recreational program.

#### *Response*

Charles Villafana: It could be an issue with funding. There is coverage, but at a low rate.

Patrick Carrol: There is a strong lobby in the SE United States for it.

### **Wes Erikson (British Columbia Fisherman)**

#### *Question/comment*

Why not make the completion of the surveys a condition of acquiring a fishing license? Also noted the idea of electronic licenses being easier and more convenient than paper licenses, adding that with smart phones and technology it would be easier to confirm and cannot be lost as easily.

#### *Response*

Rob Houtman: It is a licensing requirement in Canada, but enforcement is difficult. It has been tried in the commercial range, and enforcement was an issue.

Stefan Sawynok: It is challenging because of the large number of licenses issued.

### **Unidentified**

#### *Question*

Is there a potential for double counting with the Creel and iREC surveys? How do you reduce bias?

#### *Response*

David O'Brien: The Creel and iREC surveys are two different surveys. There is a potential to cross-reference the information from the two surveys.

### **Unidentified from Indonesia**

### *Question*

Are there specific log book and license qualifications for recreational fishing?

### *Response*

Rob Houtman: There are specific types of licenses based on what fish/fishery is covered. There are no logbooks for recreational fishing, but they are supposed to fill out the electronic survey.

David O'Brien: There is a training program for Creel surveyors, but no certifications.

### **Dean Baigent (MPI, New Zealand)**

#### *Comment*

In New Zealand, recreational fishermen are not required to report, but charter boats are. Also mentioned certain party boats having permits for serving alcohol.

### **Unidentified Question**

If there were incentives or punishments in order to help increase the level of survey response, wouldn't that generate a bias in the data collected?

### *Response*

David O'Brien: This is a question that has not been explored, but is a concern.

Rob Houtman: This is something that would be difficult to avoid. Pressing for survey response has the ability to give bad data, and it would be an issue that would require delicate handling.

Stefan Sawynok: The best incentive for recreational fishermen to provide survey information would be taking the information they provide and using it to in turn give them a better picture of fish stocks and fishing trends so they can be most successful when they fish. They help themselves by providing the information that keeps the fisheries productive.

Phil Bear: There is an inherent bias in information collected by survey even without incentives or punishments. Misreporting and misidentification of species is something to consider.

### **Dennis Hansford (NMFS)**

#### *Question*

Is satisfactory bycatch data being collected from the surveys?

### *Response*

David O'Brien: There is some concern about truth in reporting bycatch, especially when the bycatch includes protected/prohibited species. The data is as good as we can get given difficulty in obtaining data otherwise. Retained bycatch is included in the Creel Survey.

Stefan Sawynok: Questions of bycatch and mortality are included in the survey but it still remains a source of difficulty within the self-reporting scenarios. Bycatch is being reported. In Australia, they have had reports of fishermen catching turtles, crocodiles and even a pig. They are asked to, and have provided photo evidence of their bycatch.

### **Unidentified**

#### *Question*

Is there bias correction?

#### *Response*

David O'Brien: There is bias correction that includes both positive and negative interactions.

### **Unidentified**

#### *Question/comment*

Mentioned that bycatch is more a term related to the commercial fishing industry and the definition makes it unusable on the recreational side of fishing. The idea of getting released catch data, which can include undersized and undesirable species, seems more appropriate. Is there release mortality data being collected?

#### *Response*

Stefan Sawynok: There is a pilot project on release mortality in Australia. It is a large project that involves education and outreach, sharing the results with the public to help them develop better fishing practices to reduce mortality in catch.

David O'Brien: The Creel survey is designed to capture released catch data. There are a lot of studies on release mortality and they are looking into that data, using all sources to get a statistical estimation of mortality.

Charles Villafana: The Identification component of the for released fish is somewhat weak within the survey response, but mortality is recorded.

### **Roy Morse (N. Pacific Observer Program)**

#### *Question*

There can be similar salmon species identification characteristics. Did the surveys account for misidentification of Chinook salmon?

#### *Response*

David O'Brien: The Creel surveys are conducted by observers that are trained in fish identification. The iREP data is self-reported, so it can be a major source for bias, and has been listed as such.

### **Bo Whiteside (West Coast Groundfish)**

#### *Comment*

There is a three part collection system for surveys. They have phone surveys, mailed out surveys and in person interview. The Oregon Department of Fish and Wildlife created a mail survey that gets sent with \$2 for coffee to allow the respondent to complete the survey while enjoying a cup of coffee. It seems to have increased the response rate.

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## **Abstracts of presentations that did not provide Extended Abstracts**

### **Public Private Partnerships in Fisheries Data Collection**

**Stefan Sawynok**

#### **INFOFISH AUSTRALIA, QLD, Australia**

In the past only government had the resources to collect large scale data on any fishery. Now thanks to technology, particularly mobile and echo sounder technology, the private sector is catching up and will streak ahead in the coming decade.

There are public-private partnerships in the infrastructure industry to build roads and other key public infrastructure. Fisheries managers should consider a similar approach.

Recreational fishers are voluntarily collecting data at an ever increasing rate with ever increasing sophistication. In fact, the most successful private sector operations - FishBrain and Insight Genesis rely on crowdsourced data to drive their business model. The former tracking fishing spots and the later underwater topographical maps. With new entries such as ScreamingReel (social network for fishers) and Track My Fish (real time monitoring of fisheries) the data collection space in recreational fishing is only going to get more competitive in the years ahead.

One of the advantages of the private sector networks is they are building a global footprint. They can track fishers not just in a region but across state and country borders. While this technology is new, the amount of data collected is growing very rapidly as almost all of these technologies have a payback to the fisher. If they didn't fishers wouldn't use them.

There are some challenges to integrating private sector data into public sector applications, including data quality, coverage and sampling methods. These are largely addressable through either tweaking of the technology or education of the fishers. There are other issues such as privacy considerations but again these are addressable through a variety of means.

As an example of what is coming, in the 2015 Net Free Zone debate in the Fitzroy River (Central Queensland, Australia) both recreational and commercial fishers relied on data collected by fishers over government sources in forming their arguments. Both sides felt the data was not only more credible, it was more useful.



There is a real chance that recreational fishers will end up knowing more about the status of an area than government. Public-private partnerships can potentially help fisheries managers keep up.

## Session 9. How do we observe and monitor artisanal fisheries?

**Leader: Chris Burns**

Artisanal fisheries, especially in developing countries, are usually large, diverse, changing and are vital sources of food and jobs. They also take a significant share of fisheries resources, and can therefore cause tension with industrial fisheries. These fisheries also have (at least some) discards and incidental catches, which usually go unmonitored. Due to cultural issues and the idiosyncrasies of artisanal fishers, an important factor in the success of any monitoring program relies on observers' communication skills with them. In this session we explored (using a series of case studies): ways to establish the objectives, design and operational logistics of monitoring programs in artisanal fisheries; satisfactory levels of observer coverage in them; the relative cost-benefits of various ways to conduct monitoring programs in them (using, eg. observers and/or electronic systems); and the training and logistical support needed for observers working with artisanal fishers

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### **Oral Presentations - Extended Abstracts**

**Rockfish Wanted, Dead or Alive:**

**An Overview of the Oregon Nearshore Fishery**

**Scott Leach**

**NOAA Fisheries OR, United States**

**Pacific States Marine Fisheries Commission, OR, United States**

Some of the smallest boats observed by the West Coast Groundfish Observer Program (WCGOP) participate in the Oregon nearshore fishery. This state permitted fishery is comprised of two types of permits; Black and Blue Rockfish permit and the Black and Blue Rockfish permit with a nearshore endorsement.

These permits differ in allowable catch, both species diversity and quantity. The Black and Blue Rockfish permit allows fishermen to retain a quota of Black and Blue Rockfish per two month quota period and 15 lbs of bycatch per trip period. The Black and Blue Rockfish permit with nearshore endorsement allows

fishermen to target the same quota of Black and Blue Rockfish, but also allows for retention of cabezon, kelp greenling, and other nearshore rockfish. The same two month quota period applies to nearshore endorsed permits.

The vessels participating in this fishery target their quota with multiple gear types, sometimes even using multiple gear types on the same trip. The most common gear type is rod and reel, the same gear used by sport fishermen targeting nearshore species. Other gear

types commonly used include cable gear and longline gear. Less frequently used fishing methods include stick gear, trolling and traps.

Permit holders in the OR nearshore fishery are allowed to fish any coastal Oregon waters open to commercial fishing between zero and thirty fathoms. Most trips occur in a single day near their port of origin. Of the 112 nearshore permits 81 primarily fish out of one of three ports in Southern Oregon: Port Orford (50 permits), Gold Beach (15 permits) and Brookings (16 permits). Of the remaining permits, 26 fish out one of three ports located in Northern Oregon: Garibaldi (5 permits), Pacific City (16 permits) and Newport (5 permits). The remaining permits fish out other ports or are not actively participating in the fishery.

Vessels participating in the OR nearshore fishery range in size from 12 - 43 feet in length. The average length is currently 24.78 feet. The WCGOP selects all vessel over 18 feet in length for observer coverage. Vessel are randomly selected for one two month quota period each year. Although all permits associated with vessels over 18 feet are selected for coverage, safety issues sometimes lead to vessel exemption.

Some exemptions in this fishery include, weather, vessel space constraints and vessel exceeding weight capacity.

With an average size of 24.78 feet, wind, wind waves and swell significantly impact safety aboard these vessels. In addition to at-sea conditions, these vessels also face the obstacles such as, bar crossings, craning into the ocean or launching through the surf to access the ocean. Before taking a trip observers must verify that the conditions will allow for safe passage to the fishing ground and back and that at-sea conditions will allow for a safe trip. For most trips, this isn't an issue but sometimes vessel operators will embark in conditions that exceed the observer's safety tolerance. In these circumstances, the observer documents the conditions to justify the trip exemption.

On vessels as small as 18 feet, space can also be an issue for observers. With varying deck size, large totes to contain the catch and multiple gear types, sometimes there is simply no room for the observer and their gear. When space becomes an issue, observers will take pictures documenting the conditions, as well as, writing up how another person on board would be a safety hazard. Exemptions relating to space constraints most commonly result when another person on board would limit the vessel operator's ability to access vessel controls or taking another person would not allow space for gear to be safely set and or retrieved or fish to be safely landed.

Boats built for commercial fishing are designed to handle the weight and volume of fish caught. However, many vessels employed in the Oregon nearshore fishery were originally intended for recreational use. As a result, observers in the WCGOP sometimes encounter overloaded vessels, especially those 18 - 20 feet in length, carrying totes full of water to keep the catch alive. If an observer suspects a vessel may be overloaded, they will use volumetrics to determine the weight of water and weigh the gear to get an estimate of equipment weight. This plus the weight of people, and outboard motor for vessels with an outboard can then be compared to the vessel capacity placard. Pictures of the vessel, capacity placard, gear and the calculations are then used to justify the exemption.

Small boats commercially fishing the open ocean present many challenges to observers. Greater susceptibility to environmental conditions such as wind, wind waves and swell, space constraints, and weights limitations all factor into observer safety and data collection in the OR nearshore fishery. Navigating these challenges depends on cooperation and positive working relationships between observers and fishermen. WCGOP observers live in their assigned ports, ensuring that they know, understand, and

become a part of local fishing communities. This proximity fosters working relationships that allow both fishing and the collection of fishery dependent data, thus providing the best available data for the management of the nearshore fishery.

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## **DEVELOPING A LOW COST ELECTRONIC MONITORING SYSTEM FOR SMALL SCALE FISHERIES**

**Mike Osmond<sup>1</sup>, John Wang<sup>2</sup>, Joel Barkan<sup>3</sup>, Blanka Lederer<sup>3</sup>, Jacob Isaac-Lowry<sup>4</sup>, Sarah Alessi<sup>4</sup>, Yonat Swimmer<sup>2</sup>**

**<sup>1</sup>WWF – US, <sup>2</sup>NOAA NMFS – Pacific Islands Fisheries Science Center, <sup>3</sup>Ocean Discovery Institute <sup>4</sup>FlyWire Cameras**

### **Introduction**

Overfishing and bycatch are two major problems faced by many global fisheries, particularly small-scale fisheries in developing countries. As one of the first steps, fisheries managers need to quantify catch rates and bycatch interactions by placing fisheries observers on commercial fishing vessels. These observers record catch composition data, including catch rates, species information and bycatch interactions. This data is then available to help inform management decisions, and potentially compliance purposes.

The implementation of observer programs carries with it a range of issues. Placing observers on fishing vessels requires funding, observer availability, safety concerns, and time for training and sea time. Some nations have less-strict standards for their observer programs, while fisheries in other nations have no observer coverage at all. In particular, many developing countries lag in the capacity to gather catch data, especially for small-scale coastal fisheries. As a result, management agencies struggle to make informed decisions.

To address these issues, the use of electronic video recording systems to monitor vessel catches is becoming more widespread and sophisticated. Along with increased sophistication comes substantial cost, resulting in an advancement that can be very difficult and challenging to implement in developing countries and associated small-scale fisheries (SSF). As such, this initiative seeks to use low cost video technology to provide catch information that can then be used as a basis to appropriately manage these fisheries and potentially help them perform at a sustainability level consistent with the Marine Stewardship Council (MSC) standard.

### **Description**

The project is working to develop and test low cost electronic monitoring (EM) systems that could be used to augment observer coverage in SSF to collect fish catch data and to also collect interaction rates with endangered, threatened, and protected (ETP) species such as sea turtles. Such systems would be extremely valuable to both international fisheries as well as domestic SSF. For example, the gillnet SSF off the coast of Baja California has almost no observer coverage, but recent studies indicate that these fisheries interact with huge numbers of the critically endangered loggerhead sea turtle (*Caretta caretta*). Similarly, the gillnet fishery off the West coast of Borneo (Kalimantan) has no observer coverage, but recent efforts by WWF-Indonesia indicate that the fishery near the town of Paloh interacts yearly with hundreds of threatened green sea turtles (*Chelonia mydas*). Having a more complete understanding of this bycatch rate is critical not only to local fishery management, but also to the conservation of the international populations of these turtle species. Thus assessing this bycatch rate and compiling a catch composition of the current fishery are important first steps. This system is not designed to be a primary enforcement or compliance tool, but rather a way for managers to gain an understanding of the impact that many of these fisheries may be having.

In order for a video monitoring system to work successfully in small-scale fisheries, two primary issues need to be addressed: 1) Will the electronic monitoring system in this project produce fisheries data comparable to an onboard observer program? 2) What data management protocols and processes are needed to ensure that high-quality fisheries data is produced? It is important to note that our initial goal of assessing the fisheries has a different set of protocols and processes than if the EM systems were used for compliance or enforcement goals.

A pilot program initiated in 2015 provided a promising start. WWF collaborated with NOAA Fisheries and Flywire Video Systems in the development of an EM system specifically aimed for use by small-scale, coastal fisheries. This initial design was tested in the Gulf of CA in Mexico and West Kalimantan in Indonesia where the researchers have developed relationships with the fishing communities through comprehensive trials with a net illumination project designed to reduce turtle bycatch. These testing arenas provided important feedback to the ongoing development of this EM technology. Initial prototypes tested in West Kalimantan, Indonesia had equipment failures, inadequate design, and poor weather (i.e. fires in Indonesia) that hampered data collection, but provided much needed insight into critical modifications to improve the robustness of the system.

Based on this vital feedback a newly redesigned and redeveloped system was tested in the Gulf of CA, in particular In Bahia de los Angeles. This is an area where established relationships with the gillnet fishing community, a research base, reasonable access, and favorable weather conditions make for a suitable and easily managed testing arena where developments in the system can easily be monitored. Using this gillnet fishery, a test between onboard observers and the EM systems provided impressive results. There was no statistically significant difference between the catch data or bycatch data recorded by an onboard observer and that determined from later examination of the video recording. The overall time spent to obtain catch data with the EM system was 60% less than using an onboard observer and this includes the time spent reviewing the video footage.

This shows the potential of low cost EM systems as a data collection tool in similar data limited small-scale fisheries in developing countries, particularly where they are trying to achieve a sustainability standard that requires credible catch data. The cost of this system is less than one tenth of currently existing sophisticated EM systems, with the target cost of the system being ~ \$750 USD. The costs associated with video review and data storage are also considerations that would be taken into account by any government-operated program, but any observer program will have these costs associated with it. More sophisticated monitoring systems and even observer programs utilizing human observers start with costs that are exponentially higher than this system. These high costs are a major reason many countries are unable to implement observer programs.

The fisheries, which do have coverage, are often high income earning, such as tuna fisheries, and can bear the cost. The fisheries in which we have been working to develop this equipment, have no observer coverage at all, but their impact on the marine biosphere can be just as great, simply because of the sheer number of fishermen involved in these SSF. Hardware improvements, including, reducing the battery requirement may reduce the cost even further, making the system a realistic proposition for purchase by governments or fisheries management agencies looking to improve data collection and understanding of the fisheries in their waters.

During recent meetings with the leadership of Indonesia's Ministry of Marine Affairs and Fisheries they expressed support and a desire to actively participate as a collaborator in this project. They indicated a desire to expand the trials of the EM system and were interested in their use in other fisheries, as well as the potential to manufacture the system in Indonesia. The system has been developed to operate with off the shelf components, and in-country manufacture will avoid developing countries having to import the systems from the U.S., potentially contributing to reducing the cost. By having the Indonesian National Observer Program as collaborators in the project, the project now has a research site that has national level partners, Indonesian NGO partners on the ground, Indonesian university academics guiding the project, a fishing community onboard with the program, and individual fishermen invested in the research. This could certainly provide an opportunity to develop a protocol for working with governments, including the development of an applicable legal and regulatory structure required to implement an electronic monitoring program and the uses to which the data could be applied.

Future development will focus on increased ruggedness of the system, increased programming capabilities, use of scalable battery systems with options to tie the battery into existing vessel power systems or use of solar power systems, and optional add-on capabilities (e.g. GPS, Wi-Fi, LCD). In addition, a software platform will be developed to help manage and capture the video and GPS data in order to help with video data processing.

The modified systems will then be field tested with existing programs in both Indonesia and Mexico, with the potential to also examine its application in other countries.

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## **Open Discussion Session**

### **Toby, West Coast Groundfish Observer Program:**

Has the use of drones to monitor smaller vessels unable to accommodate EM or human observers been investigated?

- Scott Leach – No.
- Mike Osmond – No, does not see drones as a feasible option to meet data needs, eg, catch composition and wildlife interactions.

### **2. Unidentified, Denmark:**

Question specifically for Etienne Klein, are there any concerns in using a device for both monitoring and safety reasons?

- Etienne had left by this stage, no further input from the panel.

### **3. Sarah Bryan, Environmental Defence Fund:**

Complemented Mike Osmond on his work and asked if there had been discussions with the West Coast Regional Office in relation to applying similar monitoring strategies to the west Coast Drift Gillnet Fishery?

- Mike Osmond – Reasonable chance a grant will be made available to work in this space.

### **4. Unidentified, National Marine Fisheries Service, South East Fisheries Science Centre:**

Question for Mike Osmond, has much resistance been encountered from any of the operators you are working with in Mexico and Indonesia?

- Mike Osmond – Has not encountered any resistance from fishers he is working with, this cooperation is aided by the fact that the parties have worked together in the past on projects to reduce bycatch.

### **5. Unidentified, A.I.S:**

Question for Mike, where can the report from the study in which EM and human observers were compared be found?

- Mike Osmond – Paper is in the process of being peer reviewed and submitted for publication.

### **6. Howard McElderry, Archipelago Marine Services:**

Comment directed to Mike Osmond – The technology implemented in your program makes a lot of headway in reducing the entry cost of EM. However, it also raises some concerns (capturing gaps and understanding biases) when this low cost program is compared to a more comprehensive system. Offer of caution that the events your viewers are seeing aren't just the events that the fleet wants to be seen.

- Mike Osmond: All the areas of concern raised have been investigated, the regions in which this program is implemented are countries/fisheries that don't have the capacity to implement more sophisticated monitoring systems. Small scale fisheries make up a significant proportion of the worlds fishing effort and in most cases there is no information being collected and the agencies trying to manage these fisheries have no data in order to make informed decisions. With this taken into account any monitoring regime that can be implemented will be beneficial.

#### **7. Steve Kennelly, IC Independent Consulting:**

Commented that due to its scarcity any data that can be collected from small scale/artisanal monitoring programs are of huge benefit to the FAO Global Discard Report.

#### **8. Ernesto Altamirano, IATTC:**

Commented that it is important to recognise that good observers can come from various backgrounds and may not have to be formally qualified biologists. Ernesto followed up this comment with two questions directed to Mike Osmond.

- i) Can you provide some information on the engagement of high school students in your monitoring program in Mexico?
  - ii) What involvement has the Mexican Government had in the implementation of your program?
- Mike Osmond –
    - i) Like to mention the Ocean Discovery Institute in San Diego, it is the mission of the institute to bring science to underserved communities by encouraging kids to become involved in science. The institute has field research centre in Bahia de los Angeles and invites young people there to get hands on marine science experience.
    - ii) Mexican Government gave a grant to another NGO to investigate the Loggerhead Turtle bycatch issue in the Gulf of Mexico, the grant was used to buy 50 cameras we produced. Further to this the Mexican Government has not had a lot to do with our specific program.

#### **9. Unidentified, Alaskan Observer, TechSea:**

Commented that her experience has highlighted that the role of an observer is also that of an educator, providing information to fishers and the wider community on the science of fisheries and the importance of monitoring.

#### **10. Andrew France, Ministry for Primary Industries, New Zealand Observer Program:**

New Zealand Observer Program has been in operation for 30 years and it has never been a prerequisite of employment that an observer have a university administered qualification, many of our observers do but it is not essential. Many of our very good observers come from the fishing industry.



### **11. Julian Hawkins, IQMI:**

How do we do a better job at getting the message out about best practices for monitoring/reporting?

- Mike Osmond – Considers his organisation (WWF) working to this outcome with people on the ground throughout the world. Government also has a large role to play in spreading the word and those attending IFOMC.

### **12. John McVeigh, North West Science Centre, NOAA Fisheries:**

Question directed to Mike Osmond, can you expand on your software development, are you likely to achieve further reductions in review time and will the software become publicly available?

- Mike Osmond – Funding has only recently become available for further software development, will be looking at species identification technology and an increased ability to compress, metadata, tag and archive video will result in efficiencies in data review.

### **13. Unidentified, Pacific Islands Region Observer Program:**

Can the panel share any experiences in the establishment of the regulatory basis to support ongoing monitoring programs for artisanal fisheries?

- Mike Osmond – Important for us to work with governments who have the framework in place to make use of the data collected.
- Sandra Andraka – We think the government have to run the programs, we are assisting the fisheries agencies in order for them to be in control of their own monitoring programs.

### **14. Katie Beacham, Pacific Monitoring Compliance Panel:**

Three questions directed to Mike Osmond.

- i) Are the fishers you are work with obliged to report any of their operations, e.g. logbooks?
  - ii) Are the cameras you use easily transferable and can they be manipulated by operators (easy to turn on and off during a trip?)
  - iii) Do the cameras you use have a field of view that covers the entire boat?
- Mike Osmond –
    - i) No reporting.
    - ii) The cameras are easily transferable and are able to be turned on or off by fishers, however this action would be easily identifiable as the system has a running time stamp.

- iii) No, field of view does not cover the entire boat, maybe a bit wider than a GoPro. This tends to not cause a problem as all fishing activities we monitor are occurring in a small area on the boat that is easily covered by the cameras we utilize.
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## **Poster Presentations – Extended Abstracts**

### **Newport Beach Dory Fleet: The History of an Artisanal Fishery**

**Toby Shewan**

**Alaskan Observers Inc**

#### **INTRODUCTION**

Artisanal fisheries fill a niche in the commercial fishing world that is often overlooked. Historically, people have sought out fresh, affordable, locally sourced seafood and the same holds true today. Consumer's attitudes as well as fishing regulations are constantly changing and artisanal fisheries have to adapt accordingly in order to remain successful. A recent shift in consumer's tastes has placed much more value on how, where, and by whom their food is caught. Artisanal fisheries find themselves at the forefront of this movement and are quickly becoming an increasingly appealing alternative to more common large -scale fisheries.

The Newport Beach Dory Fleet has been in existence since 1891 and began as a marketplace where fishermen could sell their fresh daily catch directly to the public. It is an asset to the community economically, but also culturally and historically, being one of the oldest operating fishing fleets and markets in California as well as being recognized as a historical landmark. The traditional sharp bow, flat bottomed dory boats have slowly been replaced by more efficient modern boats but the small size of the fleet and the longstanding relationships formed between fishers and their customers maintains the appeal of the small, low impact fishery.

Newport Beach and the Dory Fleet have been evolving side by side for well over 100 years. There have been many ups and downs for the fleet over the years, yet it has persevered and maintained its appeal as an artisanal fishery.

#### **METHODS**

After looking at the rich history of the fleet and conducting interviews with dorymen as well as their customers I have determined the success of the fleet, as well as the success of any artisanal fishery, lies in three major components.

1. The fleet's ability to stay true to a core business model. In the case of the dory fleet this business model is simply to provide fresh, locally caught fish, at an affordable price directly

to the public. The dory fleet market provides a niche market for local, fresh fish that otherwise could not be procured. As long as the fleet is able to bring in freshly caught local fish the customer base will be ever present.

2. Longevity of the fleet depends on its connection to the community. Long-standing relationships are formed between fishers and their customers and over the years an equally strong bond has formed between the fleet and the City itself. Loyal customers return to the market because they have formed relationships with the fishers and trust the product that is being sold to them. As a community, Newport Beach understands the fleet is an asset to tourism, local business, and community heritage and likewise has stood behind the fleet on numerous occasions

3. This artisanal fishery has remained successful due to their ability to adapt, whether it be to fishing regulations, environmental changes or changing consumer tastes, the dory fleet has found a way to stay productive.

I have created a brief timeline of the historical events that have shaped the dory fleet over the years and will discuss how these three components that make up a successful artisanal fishery have helped keep the fleet moving forward.

#### TIMELINE

**1891-** A group of dorymen sublease a section of beach property from the McFadden's who had been granted a lumber operations lease. This same area of beach was once the location of a Native American fish trading post and its appeal lay in its close proximity to the Newport Submarine Canyon that was carved along with the Newport Bay and the ancient Santa Ana River which provided calm waters close to shore. Small dory boats would row out before dawn, pull gear, and await the mornings westerly winds to sail them home after a few hours at sea.

- The fleet's business model of providing fresh, local, affordable fish was born and will become the fleet's identity, separating them from other commercial fishing operations.

**1902-** Business at the dory fleet is steady and dorymen build a marketplace on north side of the pier

**1925-** 50 fishermen total in Newport Beach

**1941-** Commercial Mackerel fishery booms and number of commercial fishing vessels jumps to over 400.

**1950's-** Mackerel fishery peaks with 9 boat landings and 3 fish canneries. In its heyday the fishery produced 275,785,048 one pound cans of fish in one year. By the end of the decade, whether it be from pollution from the growing population, industrialization, or overfishing the fish began moving farther out to sea. Canneries began shutting down and the vessels moved on to more productive fishing grounds

- Fortunately, these vessels were not in direct competition with the dorymen as they were still focused on selling their fresh, local, daily caught fish directly to the public. The small sized, low impact fishery did not suffer the massive increased fishing effort

the commercial mackerel fishery faced and was able to sustain itself where the mackerel fishery failed.

- They were also well established at this point with a solid, faithful customer base which helped the market thrive.

**1967-** The City of Newport Beach shows its commitment to preserving the fleet by signing documents ensuring their rights to the land near the pier.

- The city realizes the cultural, historical, and economic importance of the fleet and begins embracing the fleet as an integral part of the community. A foundation is laid for an ongoing partnership between the fleet and the city which will serve the dorymen greatly in the years to come.

**1969-** Newport Beach further supports the dory fleet declaring it a Historical Landmark

**1989-** Dorymen and their families rebuild the fleet market constructing the boardwalk, fishermen's lockers, and the wooden stands for weighing and selling fish.

- The updated marketplace maintains the nostalgic feel of the outdoor market and solidifies it as a fixture of the community and local economy.

**1990-** Massive oil spill occurs in neighboring Huntington Beach two miles from shore when an oil tanker tried to moor at an oil pipeline. The damage to the coastline was extensive and business at the dory fleet slowed down immensely. Customers were afraid of the potential for contaminated fish and many stopped coming.

Several dorymen could not last these slim times and ended up moving on. The financial losses were too great for some to continue. A class action lawsuit was filed on behalf of several dory fishermen. Payouts were made, but for many it was too little and much too late, as the checks came sixteen years after the oil spill in 2006.

- It was a slow few years after the spill and the only reason the remaining members of the fleet were able to scrape by was the few longtime loyal customers who still came down to the beach to buy fish.
- Loss of productive fish areas become an inconvenience but the adaptability of the fleet to seek out new fishing areas, as well as targeting different species, allows the fleet to sustain itself until the demand for fish returns after the spill.

**2002- June 2-** Federal Government institute restrictions on some species of bottom-dwelling rockfish. Regulators ordered a halt to commercial fishing off much of the California coast for many varieties of Rockfish, commonly sold as red snapper. This restricted the take of any rockfish from a depth greater than 120ft and also placed restrictions on the take of sablefish.

A large part of the dory fleet depended upon the catch of sablefish as well as thornyheads, which was a major source of revenue. Such restrictions could have put many of the fleet out of business. The dorymen argued that stocks of thornyheads and sablefish were not under the same pressure that the other rockfish species were subjected to and should therefore be exempt of these new regulations.

- It was not just the dorymen who were concerned about these new regulations. The city of Newport Beach decided to get involved too and sent a letter on the dory fleet's behalf to the National Marine Fisheries Service as well as to the Pacific Fisheries Management Council.
- Newport Beach mayor Tod W. Ridgeway professed his support of the fleet by saying "If the changes allow six or seven families to continue their livelihoods it will benefit the city tremendously. The dory fleet has economic and historical value. It is critical to our image."

**2002-July 25-** Federal regulators lifted restrictions for the two types of fish the dorymen have depended on for years. The National Marine Fisheries Service lifted the West Coast ban on thornyhead, as well as size limits for sablefish caught south of Point Sur near Monterey Bay. NMFS said fishing for thornyhead was mistakenly prohibited in June when the government took emergency action to halt commercial fishing for popular varieties of rockfish commonly sold as red snapper.

- This is a great example how how the fishermen and the community came together to overcome impending hardships in the form of new regulations. The fleet and the community depend on each other culturally and economically and in this case their cooperation turned out to be mutually beneficial. "The restrictions have been lifted and the corrections made. This will help the dory men, big time" John Devore, groundfish manager for the Pacific Fisheries Management Council.

**2012-** Marine Life Protected Area created in waters off southern California which have historically been fished by the dorymen.

- Critical fishing grounds are lost and the fleet again must adapt to these new changes. Dorymen had to downsize, cut down on expenses, and run fewer boats in order to keep their business going.

**2014-** City of Newport Beach allocates \$50,000 for maintenance and repairs to the dory fleet market.

- The city of Newport Beach continues to embrace the fleet as an integral part of the community.

**Present-** The dory fleet market is thriving and many say business is as good as it's ever been. Lines of faithful customers anxiously await the day's fresh catch before the sun rises weekend after weekend.

- It is still the only market in the area offering locally sourced fish that were caught within hours of their sale. A recent trip to a local high end fish market offered fish that were not as fresh, and with no options for local fish. The closest product to being local was from Mexico and the closest domestic product available was from Washington State.

A new generation of customer has begun flocking to the market and much of this can be attributed to social media. Customers can see what species of daily catch will be available

on the fleets website [www.Doryfleet.com](http://www.Doryfleet.com) and there is a twitter account @doryfleet which promotes the business as well.

- Over the years an influx of new ethnic groups have assimilated into the fabric of the community and the fleet has done much to adapt in order to accommodate these new customers. Many species of smaller boney fish that would typically be passed up by many customers are embraced and enjoyed by the new ethnic patrons.
- Species that many other commercial fishermen consider unmarketable discard find a demand at the dory market. Customers also have the opportunity to obtain as much of the fish as they desire. Some customers take home fish heads for making soup and stock, others prefer the offal for various traditional dishes from their homeland.
- Many of these new ethnic customers feel a connection to the fleet because it is reminiscent of the open air, port-side, fresh fish markets they remember from their homeland. They also form strong bonds with their fishermen and get more individualized attention compared to other markets.

#### **How the West Coast Groundfish Observer Program covers these vessels**

- Newport Beach dory vessels that are covered by our program are either limited entry zero tier or California near-shore permitted.
- Our goal is to provide the same coverage of these vessels as would be provided any other vessel fishing under these permits. This ensures unbiased data pertaining to each of these fisheries.
- There are some limitations in covering these vessels, due to their small size, which affects the way these vessels are observed and sampled as well.
- Safety issues must be taken into consideration also when observing these small vessels which typically fish at night.
- There are differences in the type of observer gear that is used when observing the fleet.

#### **Coverage**

- Vessels are randomly selected for observer coverage.
- Some vessels are unobservable due to safety concerns of vessels being overloaded with the extra weight of an observer. This loss in data is made up for by using landing receipts and port sampler data to fill in the gaps in coverage.

#### **Observing and Sampling**

- Small size of vessels limits the amount of sorting and sampling area available to an observer. Discard is typically weighed as it comes up because there may not be any place to allow fish to accumulate. Larger species discarded must be visually estimated as it may not be safe nor feasible bringing species aboard to be sampled and weighed.

- All sorting and sampling must be done in one small area of the boat because of the need to keep the boat balanced with equal body weight distribution while fishing.
- Fishing at night poses limitations on visibility that must be accounted for.

### **Safety Concerns**

- Observers may need to help launch the vessel through the surf which poses many risks of injury.
- Many of the vessels motor to and from fishing grounds at a high rate of speed often times going well over 20kts in the darkness of night.
- Upon returning to the beach the vessel beaches itself by motoring at a high rate of speed directly onto the beach. Observers must be prepared to brace themselves for the beaching of the vessel.

### **Gear**

- Hip waders may be needed when assisting in the launch of the vessel.
- Spring scales are used to weight fish rather than larger electronic scales due to size and weight limitations aboard dory vessels.
- Headlamps are also needed when fishing at night.
- Head to toe slickers and a waterproof hat are also of use because even small waves will get you wet on open vessels of this size.
- Immersion suit must be close at hand and PFD and EPIRB must on your person at all times. Personal VHF radios may also be kept on one's person and are highly recommended.

### **CONCLUSIONS**

The Newport Beach Dory Fleet's core business model of providing fresh, locally caught fish, sold directly to the public continues to be one of its main selling points. It is a service that is just not offered anywhere else in the area. Over its existence this artisanal fishery has stuck to their business model and it has proven effective in maintaining the appeal of the fleet. Adapting their product and services to cater to each of their individual customers' palates sets them apart from other fish markets in the area. It is the fleets ability to adapt to changes in regulations and environmental factors that has kept them going. Along with the closures and changes in regulations the fleet has endured comes sustainability, which has become a major selling point of the market. There is a sense of community associated with the fleet, due to the long standing relationships formed between the fishermen and their customers, which has kept the business successful over the years. Newport Beach itself has shown its appreciation of the fleet and has went out of there way on numerous occasions to assist the dory fleet in remaining alive and prosperous.

## California Artisanal Fisheries: Monitoring Small Vessels in the Live Nearshore Fishery

Michael Lindley

Alaskan Observers Inc.

A significant portion of ex-vessel seafood value in California comes from small boats participating in the California Nearshore Fisheries (Fig. 1), usually delivering their product to market alive, requiring extra care of retained species. These Nearshore vessels are typically smaller, ranging in length from human-powered 3m kayas to 15m boats at the largest. This artisanal fishery uses hand-operated or lightly mechanized gear like pole and reel gear, short (3-5 hooks) cable gear, hand lines, limited longlines (<150 hooks), traps, and even spearguns. Gear is set and retrieved several times a day and most fish are landed the same day, ensuring the freshest product to consumers who have come to depend on these daily deliveries. Distances from port to the fishing grounds are much shorter than deeper-water fisheries, so fuel expenditures are naturally lower. Because gear and fuel costs are low, it takes fewer capital resources to participate in the live Nearshore Fishery than other fisheries that have recently been the focus of on-board monitoring. Lower costs of entry makes this fishery available to small operators who may have a regular “day job” and fish only on the weekends or during good weather.

While large-scale deep water fisheries have come to accommodate and even expect monitoring, these smaller-operation participants in the California Nearshore fisheries have largely had little or no expectation of Federal observer coverage, both because their small vessels are naturally difficult to work on and also because the fishery is state regulated.

Historically, there were jurisdictional barriers that prevented federally sanctioned observers from collecting data on the vessels operating inside state governed waters. Most of these fisheries target federally managed species, especially rockfish (*Sebastes spp.*). In California, although these species may be federally managed, the State issues two distinct Nearshore permits: a “shallow” Nearshore permit that allows the retention of grass rockfish, gopher rockfish, black-and-yellow rockfish, kelp rockfish, china rockfish, rock and kelp greenlings (*Hexagrammous spp.*), California scorpionfish (*Scorpeana guttata*), cabezon (*Scorpaenichthys marmoratus*), and California sheephead (*Semicossyphus pulcher*). The “deep” Nearshore permit allows the sale of black rockfish, blue rockfish, brown rockfish, treefish rockfish, copper rockfish, and quillback rockfish. Lingcod (*Ophiodon elongatus*) and shelf *Sebastes spp.* can be landed by both permit holders, and in fact, many fishermen have both permits, eliminating bycatch that they could otherwise sell. There are even a significant number of fishermen who have neither permit and only sell Lingcod and shelf rockfish.

With such a patchwork of regulations governing this fleet, it took novel cooperation between Federal and State managers to allow the West Coast Groundfish Observer Program (WCGOP) to cover the Nearshore Fisheries. Equally novel was the personal outreach from observers to establish relationships with individual fishermen to get compliance with coverage mandates.

The logistical challenges of actually boarding and working safely on these smaller Nearshore vessels where you could not carry large or heavy scales onboard required innovative

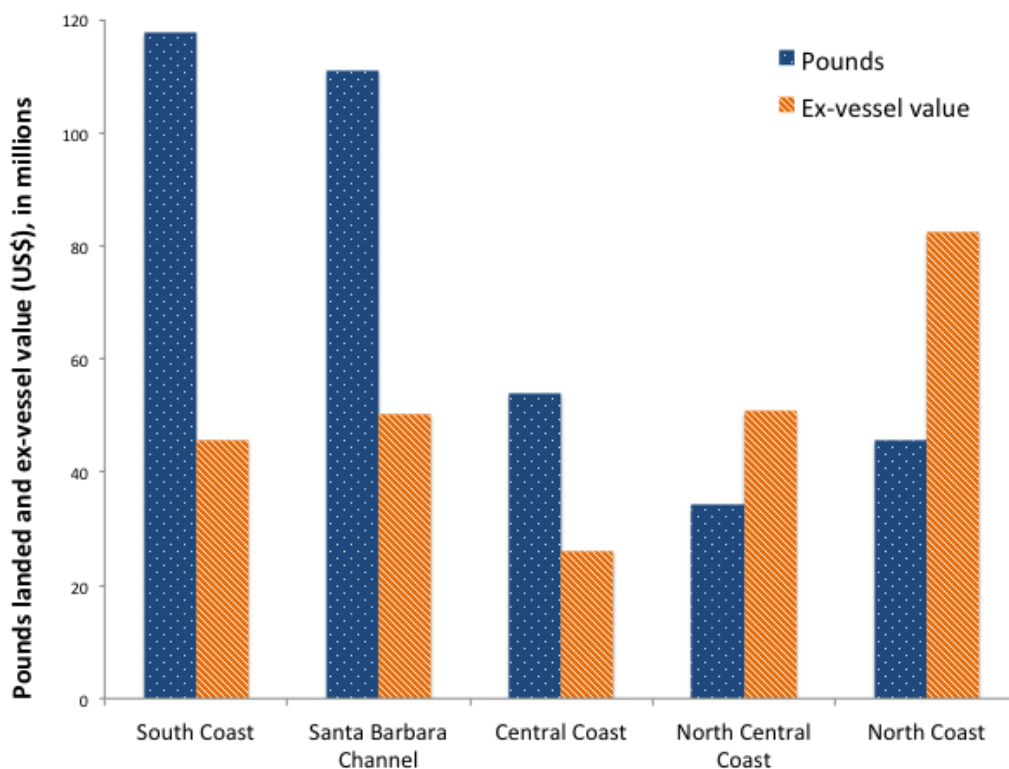


equipment and techniques to collect data. WCGOP issued brass handscales to observers instead of heavy (10-30 kg) platform scales which took up much less space and allowed a much smaller sampling area, which in reality is frequently just a meter of space on the gunwale of a skiff.

The Nearshore fleet only has to meet minimal safety standards due to their size, so the WCGOP also had to re-think observer safety training and how it equips observers for small boat work. Neither liferafts nor EPIRB's are required for vessels less than 12 meters in length by the United States Coast Guard (USCG, 2009). Again, WCGOP had to modify the equipment and training that its observers received. For example, because the eventuality is high that there won't be an automatically deploying liferaft to provide shelter, most Nearshore Fishery observers prefer to carry Personal Location Beacons (PLB's), which can be worn on the person at all times in a personal flotation device (PFD) pocket.

This poster will be a case study of how the WCGOP approached these challenges of jurisdictional and logistical barriers, while addressing the ever-present challenge of getting more coverage in hard-to-access artisanal fisheries.

Fig. 1



Source:

*Statewide Commercial Fishing Activity*. CA Sea Grant, 2013. Web. 01 June 1016.  
<<https://caseagrants.ucsd.edu/project/discover-california-commercial-fisheries/statewide-commercial-fishery-activity>>.

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## **The Tale of Two Trips: Unobserved vs. Observed Trips in the California Nearshore Fishery**

**John LaFargue and Jon McVeigh**

**NOAA Fisheries | Northwest Fisheries Science Center, West Coast Groundfish Observer Program, Seattle, WA USA**

There has long been talk about the “observer effect”, the bias caused by an observer being onboard a vessel. The decision on when, where, and how to fish can all be biased when a vessel is observed. A fisher can choose to fish in areas or with gear that may have a lower chance of interaction with sensitive species. Observed bycatch rates may not accurately depict true bycatch rates of the fleet as a whole.

As a first step to understanding observer bias in the California nearshore fishery, the average landing size by species group was calculated from landings from 2002- 2015. The year 2002 was chosen as a starting point since it was the first year after the state of California required minimum landings for the renewal of nearshore permits. The year 2015 was chosen as an end date for the series since it is the most current year we have complete data for. Next, the percent difference in landing weights was calculated by species groups between observed versus unobserved species groups.

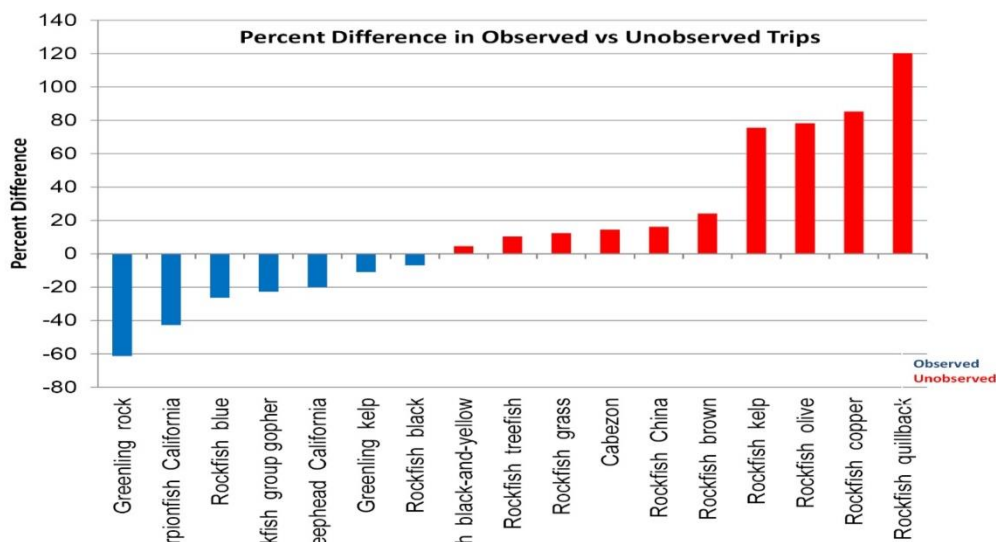
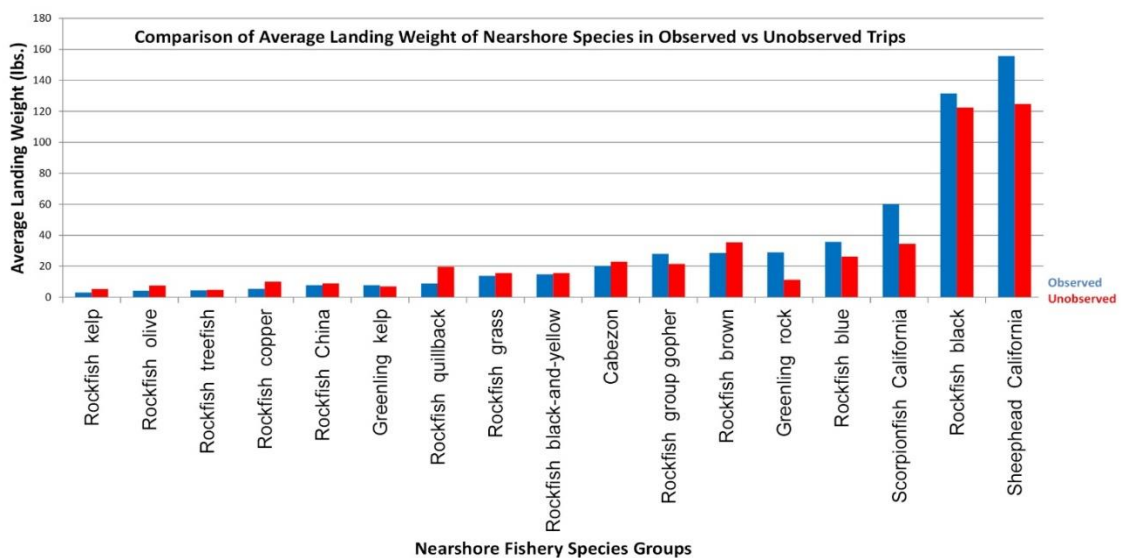
The average landing weights by species group showed there were higher landings in some species groups when observers were not onboard. In particular, many of the shallow water species (cabezon, gopher, black and yellow, grass, and kelp rockfish) showed these higher landing weights. This is most likely the result of fishers fishing shallower when observers were not onboard. Fishers in the nearshore fishery often fish in water less than two meters in depth, just outside the surf zone. These small vessels are much more maneuverable without the weight of the observer and gear and fishers may take more risks while fishing alone. Surprisingly, several other shallow water species groups (greenling and gopher) showed higher average landing weights while vessels were being observed.

Nearshore species groups are typically fished in deeper water (California scorpionfish, sheephead, and blue, gopher, china, brown, kelp, olive, copper, quillback rockfish) away from the surf zone showed roughly an equal split between observed versus unobserved for higher average landings. Looking at the percent difference between observed versus unobserved, several species groups stand out. Kelp, olive, copper, and quillback rockfish all have much larger unobserved landings percentage-wise. This may not be significant since all four species groups have low average landing weights. California scorpionfish landings show

a much larger percentage of weight for observed trips compared to unobserved trips. This is most likely caused by the small pool of larger vessels able to carry the observers most, if not all of the time. The elevated rock greenling percentage will need further investigation.

There is evidence that observer presence may influence some nearshore fishers in where or how they fish. The observer effect also appears to be target species dependent. From the raw data, it is apparent that individual fishers have an impact on the average landing weights. This fact alone could have management implications, considering the majority of landings may not be observed with less than 100% observer coverage. Further review of the data is needed to fully identify the trends. Producing profiles for individual fishers could give us a better understanding of effort, target strategy and potential bias. An analysis of the species composition of observed versus unobserved landings might also give further insight into potential bias.

Acknowledgements Special thanks to Mike Fukushima CDF&W, Yong-Woo Lee NOAA, Rebecca Hoch NWFSC and all the observers collecting data out on the water.



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## **Observations in the California Halibut (*Paralichthys californicus*) Trawl Fishery**

**James Grunden**

**WCGOP Ventura, CA**

### **INTRODUCTION**

California halibut are a large predatory flatfish of the family Paralichthyidae that inhabit the west coast of North America from the state of Washington to the Baja peninsula in Mexico. For millennia people have targeted these fish with fossil remains identified in Chumash midden sites along the southern California coast. After the arrival of Europeans, recreational and commercial fisheries emerged and targeted halibut using gillnets, hook and line, spears and trawl vessels. Concerns over the exploitation of the fishery were expressed as early as 1916, and since then, an evolving array of regulations and closures have been implemented to ensure the health of the population (Jow 1990). Since 2002 federal groundfish observers have been deployed on California halibut trawl vessels to collect data specific to the management of the halibut stock.

The trawl sector of the halibut fishery historically sold fish dead to local restaurants and at fish markets. Since the early 1990's, a live market emerged increasing the value of individual fish (Tanaka 2013). Today, particularly in southern California, the majority of halibut are delivered live to local businesses or at fish markets where fishermen sell fresh/dead fish directly to the public, maintaining artisanal qualities rarely seen in California's commercial fisheries. This poster compares California state trawl landings with West Coast Groundfish Observer Program data and scientific literature to outline the current state of the halibut fishery.

### **TRAWL HISTORY**

Trawling in California began in 1876 with the introduction of paranzella nets in San Francisco bay that were dragged across the ocean floor by two sailboats. Initially halibut were caught alongside target species like English and Petrale sole (Jow1990). By the early 1900's halibut became a target species as the trawl fishery expanded from Bodega Bay to San Diego. In the 1940's with the increased availability of combustion engines, the fishery transitioned to single vessels towing otter trawls throughout the state. Other technological advancements like hydraulic pumps, GPS and depth finders greatly improved the fishermen's ability to locate and exploit more fish.

Beginning in 1915 California state waters (inside 3 miles of shore) were closed to trawling in order to protect and manage near shore fish stocks. Since then state waters have rotated through a series of openings and closures to trawlers along the coast. Currently trawling is prohibited in state waters, except within the California Halibut Trawl Grounds (CHTG), which

was established in 1971 (Fig.2). The CHTG extends 1 to 3 miles offshore from Pt. Arguello to Pt. Mugu, with special restrictions regulating trawl gear configurations.

In the first half of the 20<sup>th</sup> century the halibut trawl fishery was concentrated around the San Francisco region. Since 1945 trawl landings in southern California surpassed landings in the north. In the 1980's higher landings transitioned back to the northern region and today the majority of halibut trawling takes place outside of the San Francisco bay area followed by the Santa Barbara Channel.

## METHODS

Landings data of halibut were submitted by the California Department of Fish and Wildlife (CDFW), and reflect only halibut caught by trawl gear from 1990 through 2015. The West Coast Groundfish Observer Program has deployed observers on halibut trawlers fishing in federal waters since 2002 and vessels fishing in state waters, at CDFW's request, since 2006. Observers collect a multitude of data specific to the fishery as well as interactions that occur with other parts of the ecosystem. Observers record the locations, times and depths of fishing effort as well as identify and record all retained and discarded species landed by the vessel. Length frequencies are collected from 5 randomly selected California halibut as well as 42 other groundfish species with otolith samples and sex information collected from priority rockfish species. Observer data helps scientist determine the locations of deep sea coral habitats by identifying specimens and collecting genetic tissue samples for analysis. Occasionally there are incidental takes of marine mammals, sea birds and threatened species by halibut trawlers. Observers document sightings and interactions with vessel gear in addition to recording tagging information and collecting tissue samples from dead individuals.

## DISCUSSION

According to historical data the highest landings of California halibut occurred back in 1917 with 3.5 million pounds landed and gradually decreased through the 1940's and 50's (Tanaka 2013). Landings from the early 20<sup>th</sup> century include all gear types and are not comparable with trawl fishery landings in Fig.3, but are presented in Fig.1 to illustrate the decline in overall landings since 1917.

Trawl landings since 1990 appear relatively stable and corresponding peaks are seen between landed and discarded halibut since observers began collecting data aboard halibut trawl vessels in 2002. The corresponding rises in legal and sublegal halibut suggests that the stock may be influenced by oceanographic conditions. This conclusion is reiterated in a 2011 stock assessment of halibut conducted by the California Dept. of Fish and Wildlife (CDFW).

Average lengths of sublegal halibut have increased since observers began recording them in 2007 and have fluctuated between 44 and 48cm since 2009 (Fig.4). The increase in average lengths coupled with the increases seen in total discards of sublegal fish suggests that healthy recruitment is taking place.

The 2011 stock assessment suggests that California halibut are composed of two regional stocks that are separated north and south of Pt. Conception. Since the 1980's the population north of Pt. Conception has increased to levels above the maximum sustainable yield, while the southern stock appears to be depleted to only 14% of its unfished biomass

(Tanaka 2013). The increase in the northern region is thought to be due to past El Nino events, where ocean conditions allow larval fish to settle out closer to shore and take refuge in protected areas where survival is significantly better. It was also noted that the possible causes for low biomass in the southern stock were the result of lost nursery habitat, poor water quality and a series of unfavorable recruitment years.

The assessment noted that California halibut are highly fecund and that recruitment is independent of biomass, meaning fishing pressure is not influencing the population at the current rate of catch. Despite the high reproductive potential of halibut and the assumption that depleted stocks result from poor ocean conditions, continued observations of the fishery and management actions may be needed to avoid genetic bottlenecks or the collapse of the fishery.

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- Tanaka, T. 2013. Status of the Fisheries Report an Update Through 2011. 16:1-16 California Halibut, *Paralichthys californicus*. California Dept. of Fish and Wildlife. Marine Region.

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## MONITORING ARTISANAL TUNA FISHERIES IN THE WESTERN AND CENTRAL PACIFIC

**Deirdre Brogan**

**Fisheries Monitoring Supervisor, SPC**

The Western and Central Pacific Ocean region is a vast area made up of 20 Pacific Islands Countries and Territories (PICTS) and producing around 50% of the world tuna catch. Since 2004 the tuna stocks in this area has been governed by the Western and Central Pacific Commission ([www.wcpfc.int](http://www.wcpfc.int)). Monitoring of the industrial tuna fisheries has, since the inception of the WCPFC consistently increased, improved and broadened in scope in accordance with each additional conservation and management measures.

The artisanal tuna fishery produces substantial catches in a number of the PICTs, but the level of monitoring has historically been low. Earlier studies have suggested that the total *value* of all artisanal fisheries in the Pacific islands area is equivalent to the value of the industrial tuna catch. However, substantive data to support this study remains scarce. In 2011, after a request from one island member country the Pacific Community<sup>14</sup> set up an artisanal tuna monitoring programme, and it was later expanded to other countries, mostly on request.

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<sup>14</sup> Pacific Community (SPC), Noumea, New Caledonia.

The objectives of the artisanal monitoring programme include documenting the total number of vessels (motor boats and canoes), obtaining an estimate of their annual catch and considering any effects the industrial tuna fishery has on artisanal fishers. Over-time, and in consultation with other groups, additional objectives were recognised and absorbed. For instance, fish aggregating devices (FADs) which accumulate pelagic species are increasingly deployed to provide fishers better access to these species and reduce pressure on the dwindling reef fish stocks. Capturing any such transfer of fishing effort was easily identified by the programme, either through regular monitoring or replication of the design at specific FAD deployment sites. Additionally, documenting the economic and socio-economic aspects of the fishery were added for example; participation rates (employment), sale or consumption of the catch, trip costs, and the contribution of the fishery to national food security, which was specified as a regional goal (4) by the Pacific Forum Leader's Roadmap for Fisheries.

Discarding in the artisanal tuna fishery is minimal, with most if not all of the catch taken back to shore for sale or consumption by the family. For this reason, and acknowledging that the vessels are always small and without cabins, the artisanal tuna fishery is monitored at the point of unloading. Much of the methodology, skill sets and learnings generated by the Pacific Island Regional Fisheries Observer (PIRFO) programme was found to be transferable; including the use of standardised data collection formats to easily replicate the programmes across national boundaries, species identification, biological sampling, supplies and suppliers, and data management practices and their associated tools.

Similar to artisanal fisheries in many parts of the world the total number of vessels involved in the fishery and the spatial location of their landing sites was generally unknown in the early days. To overcome this data gap a consultancy on the benefits and challenges of vessel registration in Pacific Islands and Territories was completed and is available from the Pacific Community's digital library

[http://www.spc.int/DigitalLibrary/Doc/FAME/Reports/Welch\\_2016\\_Registraton\\_System\\_for\\_SSFVs.pdf](http://www.spc.int/DigitalLibrary/Doc/FAME/Reports/Welch_2016_Registraton_System_for_SSFVs.pdf)

The artisanal tuna monitoring programme uses a stratified random sampling design with data collected from motor boats and canoes landing at busy boat ramps or defined beach sites. An integral part of the monitoring programme is estimating the number of the vessels that have completed a fishing trip on a daily basis. Logsheet, catch and effort data is collected regularly with a high response rate, while length sampling is done weekly.

New technology is boosting monitoring efforts. Of these the smartphone/tablet applications "Tails" may have the widest impact. The application electronically records the standardised data sets, removing the need for data to be entered; but its ability to compress and store data until an internet connection can be established and the data subsequently uploaded to the cloud-based database that is most appreciated. The alternative, shipping paper copies to and from remote islands, with un-reliable schedules is a challenge. Additionally, to enhance the knowledge around fishing areas some vessels will be tracked by AIS receivers. Em-trak © devices have been chosen, most especially for their integrated distress button, and trials are scheduled to take place after the conference.

This monitoring programme has now been established in seven Pacific countries and that number is likely to grow. An annual catch estimate for three countries has been established.

The data for one country has been fully analysed, although the report is currently only for internal use. It is expected that further analysis of the generated data sets and publication of the results will take place during 2017.

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## **Abstracts of presentations that did not provide Extended Abstracts**

### **Challenges and lessons learned in assisting in the development of observer programs in Central America**

**Sandra Andraka<sup>1</sup>, Alvaro Segura<sup>1</sup> and Michael Osmond<sup>2</sup>**

**<sup>1</sup>EcoPacific Costa Rica, <sup>2</sup>WWF United States**

The recognition of the importance of observer programs and their contribution as a valuable source of consistent data has been recognized by fisheries management agencies around the world. The requirement for effective implementation of these programs is becoming more widespread, including fisheries in Developing countries. This is the current situation for Central American countries that are Member and cooperating non-Member (CPCs) of the Inter-American Tropical Tuna Commission (IATTC) that are required to have a minimum 5% observer coverage of the fishing effort made by its longline fishing vessels greater than 20 meters length overall. Beginning with these fleets and expanding to smaller vessels in length overall, this requirement presents an opportunity to developing observer programs in fisheries with lack of data. Nevertheless, the development and implementation of a national observer program in those countries is complex due to capacity of fisheries management agencies, legal and financial issues, and the conditions of the fisheries, among others challenges. This paper presents the main challenges to developing the ability to implement observer programs that can operate on a self-sustaining basis in Central America countries, and lessons learnt in this process. Recommendations are made to guide these efforts in an effective and efficient manner according to the conditions in this Region.

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### **Sheephead : Modern Day Observing in Artisanal Fisheries**

**Steven Todd**

**WCGOP, CA, United States**

Artisanal fisheries in the San Diego, CA region pre-date discovery of the new world by millennia. From the ancient Kumeyaay civilization to our modern day society, these fisheries continue to provide jobs and food for the local inhabitants of the area. Although our fishing fleet has evolved beyond artisanal status to be defined by more modern standards that include power driven vessels, hydraulics, and high tech electronics, some gear types have



remained artisanal. The use of gill nets, hook and line, and fish pots are fishing techniques that have secured a place of importance in the archeological and historical timeline of fishing in the area, and they are still currently used. Fish pots continue to be the primary gear used to catch and deliver one of our dominant reef species to market, the California Sheephead (*Semicossyphus pulcher*).

Federal and California state guidelines dictate the management measures for this species. Participants in this fishery must possess a limited entry permit and must comply with quotas, closed seasons, closed areas, required safety gear as defined by the U.S. Coast Guard, and allow observer coverage for trips during a two-month trip period, selected by random means, during each calendar year.

Fish tickets, shore-side port sampling, and robust data collection, at sea, by observers in the West Coast Groundfish Observer Program (WCGOP) help to monitor and manage healthy stocks. While the target observer coverage rate is 20 percent in this fishery, actual coverage rates are less, with the difference attributed to waived trips for weather, observer safety, vessel size and condition, crew size, observer availability, and/or fleet avoidance.

As in any fishery, longevity of the management program and local observers serving the area foster open channels of communication with the fleet and further aid in their participation. Niche fisheries such as this one represent a puzzle of local activities that can only be assembled and better understood slowly and methodically.

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## **An Observer program's contribution to fisheries zoning and management in the Exclusive Economic Zone of Costa Rica for tuna and tuna-like species.**

**Alvaro Segura and Sandra Andraka**

### **EcoPacific, Costa Rica**

An Observer program's contribution to fisheries zoning and management in the Exclusive Economic Zone of Costa Rica for tuna and tuna-like species.

In Costa Rica in 2014 a new regulation was signed (Decreto Ejecutivo 38681 MAG-MINAE) for zoning and management of tuna and tuna like species fisheries in the Exclusive Economic Zone (EEZ). Four polygons are established with regulations for national artisanal longline fleets and foreign industrial purse seines fleet.

The aim of this work is to present the EEZ areas utilization by national artisanal longline fleets and their relation with the new polygons. Data were collected in observer program on board 83 boats, from May 2005 to June 2012, in 1693 sets. Fisheries were directed to mahi mahi (1135), sharks (285), tuna and billfishes (273). Capture by unit effort (CPUE) data are presented by fishery and by polygon, for both target and non-target species. These data were obtained in collaboration with longline fishing sector Recommendations are made for fishery management in the polygons of the EEZ and also the importance of development of observer program in Costa Rica is shown, where there are recent incipient efforts to deploy observers in these fisheries and develop an official observer program.



## **Session 10. How much observer coverage and monitoring is enough? Methods for reducing and/or incorporating biased data collection.**

**Leader: Liz Scott-Denton**

There are many potential sources of bias in the collection and analysis of fisheries data. Examples from observer programs include vessel selection, catch sampling, changes in fishing behavior when an observer is, or is not, on board, and analytical techniques employed in the estimation of catch rates of target and bycatch species (including protected species). In this session, we explored the main sources of sampling or analytical bias common in observer and other monitoring programs and the methods that we can employ to minimize them.

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### **Oral Presentations - Extended Abstracts**

**Is it always safe to assume normality when deriving the confidence limits for bycatch estimates?**

**Yong-Woo Lee**

**Northwest Fisheries Science Center**

**National Marine Fisheries Service, NOAA, U.S.A.**

#### **Introduction**

Fisheries bycatch data collected by onboard scientific observers from commercial fishing fleets are a critical source of information for bycatch estimation in many fisheries across the globe. When such data are available, a ratio estimator approach is commonly used to estimate the bycatch ratios and, hence the total bycatch amounts of fish species. Bycatch data are often collected with a stratified design, or post-stratified for estimation purposes. A stratum is defined by a combination of temporal, spatial, and fishing-related factors (e.g., fishery sector, gear, latitude, depth, year, or season). The bycatch ratio of a species per given stratum is simply defined as the amount of bycatch of the species divided by the fishing effort. The estimated bycatch ratio is then expanded by the total fishing effort for the given stratum to estimate the total bycatch amount within the stratum. Retained amounts of target species or species groups from landing receipts are often used as a proxy of fishing effort in bycatch estimation, because they provide a verifiable measure with high accuracy.

The variance, as a measure of uncertainty, for the point estimate of a bycatch ratio is generally estimated based on a large-sample variance approximation. The estimated variance is then used to construct the conventional symmetric confidence limits around the ratio with an asymptotic normality assumption, and hence around total bycatch estimates. However, because observer sampling coverage is sometimes low (< 10%), an asymptotic

normality assumption for confidence limits should be evaluated over varying levels of observer coverage.

Another consideration regarding the normality assumption should be given in terms of the different encounter rates of the species when evaluating the normality assumption for the confidence limits. Encounter rates differ by species, due to such factors as current abundance, distributional patterns, gear avoidance, gear selection, etc. Some species are encountered much more rarely than other species. Despite the vast differences in the encounter rates by species, the same large-sample variance approximation formula is often applied across all species to estimate the variance, and hence confidence limits, with an assumption of normality.

Since 2011, the groundfish fishery on the U.S. West Coast has operated under a new management system, often referred to as Catch Shares. Under this system, fishing vessels in the federally regulated fishery must be accompanied by at least one at-sea observer onboard during all fishing trips (i.e., 100% observer coverage). Observers sample the amount of discarded bycatch by species, along with conducting other sampling duties. This type of 100% observed fishery data provides a unique opportunity to empirically evaluate the validity of confidence limits constructed with a normality assumption, because true population parameters are known to the investigators.

## **Materials and Methods**

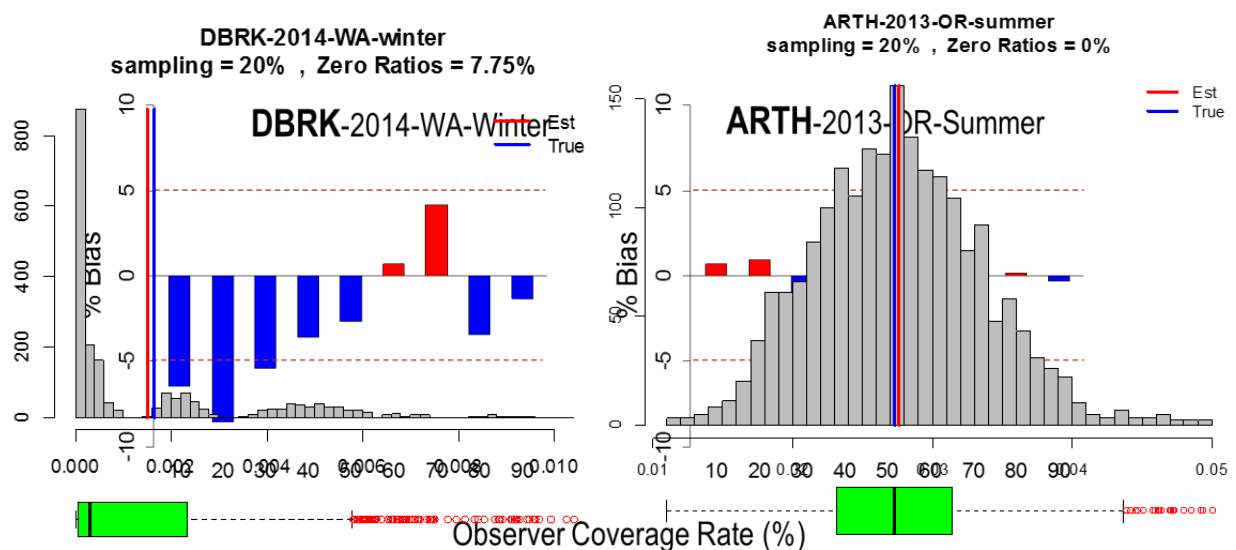
Four years of observer data (2011–2014) from the bottom trawl Catch Shares fishery on the U.S. West Coast were used for the study, which had 100% observer coverage (i.e., census data). The data were stratified by year, state, and season. A bootstrap resampling technique was used to simulate the bycatch observations for several groundfish species that were selected based on their bycatch levels (high vs. low). To simulate the varying levels of observer coverage within a given stratum, the data with 100% observation were randomly subsampled at a predetermined observer coverage rate. The coverage rates were set from 10% to 90%, with a 10% interval. The bycatch ratios of the selected species were estimated and stored for each coverage level per stratum. This procedure of data resampling and bycatch estimation was repeated 2,000 times, which resulted in 2,000 bycatch ratio estimates for each species per stratum at a given coverage rate. These estimated bycatch ratios from the resamples were then examined for accuracy and distributional features over the range of coverage rates.

## **Results and Discussion**

The results indicate that the relative bias in bycatch estimation became quickly negligible in most cases when the observer coverage level was more than 20%, although the level of relative bias could be concerning for rarely encountered species at lower coverage levels (Fig. 1).

Figure 1. Relative bias (%) of the bycatch ratio estimates over the range of different observer coverage levels for darkblotched rockfish (DBRK) in the stratum of Washington State during the winter season of 2014, and for arrowtooth flounder (ARTH) in the stratum of Oregon State during the summer season of 2013. DBRK is a rarely encountered species and ARTH is a commonly encountered species.

It was evident that the distributions of bycatch estimates were often highly skewed to the right at lower coverage rates (< 30%; Fig. 2). For the rarely encountered species, such as darkblotched rockfish, the skew was much more pronounced, and multimodal patterns were also present at lower coverage rates. Skewness did not improve until coverage rates became as high as 70% in some cases of rarely encountered species. The multimodal patterns in the distribution of the estimates for the rarely encountered species appeared to be caused by the large number of hauls with no encounters (i.e., zeros in the data set). It was also noted that rarely encountered species had high chances of having bycatch ratios estimated to be zero when observer coverage rates were low, even though the true ratio was positive. In other words, with low observer coverage rates, there is a greater chance to



produce false estimates of “zero bycatch” for rare species, even if the true bycatch is not zero.

Figure 2. Histograms of bycatch ratio estimates out of 2,000 resampled realizations at the sampling coverage rate of 20%. The vertical color lines indicate the average of the estimated ratios (red) and the true ratio (blue). To illustrate the contrast, two species with different levels of bycatch (low vs. high) were selected for graph presentation: darkblotched rockfish (DBRK) in the stratum of Washington State during the winter season of 2014, and arrowtooth flounder (ARTH) in the stratum of Oregon State during the summer season of

2013. It should be noted that the chance of falsely estimating the bycatch ratio to be zero was about 8% for DBRK, whereas it was 0% for ARTH at the coverage rate of 20%.

In addition, the bycatch ratios for rarely encountered species tend to be very small numbers (i.e., close to zero), with a relatively large variance because of sporadic encounters. If the confidence limits (CLs) are constructed based on an asymptotic normality for those rarely encountered species, the lower CLs are often estimated to be negative at low observer coverages, because of the symmetry of the assumed normality distribution around the point estimate. Negative values are not unrealistic for ratios and their confidence limits.

Given these findings, a bootstrap- or resampling-based estimation method would be recommended as a preferred method when constructing confidence limits for the bycatch estimates of rare-encounter species, rather than blindly relying on an asymptotic normality assumption. This is particularly true if the bycatch information needed is focused on a very few specific protected species for conservation or management matters, as those species tend to be more rarely encountered due to their low abundance.

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## **Evaluating the effects of observer sampling on estimates of fishing mortality in a U.S. Pacific groundfish fishery**

**Jason E. Jannot, M. Bellman, J. McVeigh, K. Somers, Y.-W. Lee**

**NWFSC, NMFS, NOAA, Seattle, WA**

### **Introduction**

A precise and complete accounting of fisheries mortality is necessary to: 1) prevent overfishing of target species; 2) prevent endangerment to threatened species and; 3) understand the impact of fishing on all ocean species. Total fishing mortality estimates includes two portions: (1) individuals discarded at sea (either target or non-target) and (2) individuals landed at the dock. Estimates of landed catch are often assumed to be relatively precise and accurate whereas, discard estimates tend to be more uncertain than landed catch estimates.

The percentage of fishing vessels monitored by observers (a.k.a., coverage), determines the amount of fishery dependent sampling and thus, the precision of discard estimates. The amount of observer coverage required to obtain precise discard mortality estimates will vary by fishery and species making it challenging to *a priori* estimate the coverage needed for a particular fishery. Estimates of the necessary observer coverage to meet precision goals are rare and, to our knowledge, none have had the advantage of studying the problem when a complete census of discards has been taken.

How much observer coverage is necessary to meet scientific data collection goals and precision standards? What is the relationship between observer coverage, estimates of discard mortality and precision surrounding discard estimates? How do these relationships vary by species or species-groups? To answer these questions we analyzed the relationship between observer coverage, discard mortality, and precision for a suite of species or species

groups in the US west coast IFQ groundfish fishery. We predicted that, at relatively low coverage rates discard estimates would converge near true discard amounts and that increasing coverage rates would decrease uncertainty around these estimates.

## Material and Methods

We exploited a recent shift in observer coverage from an average of 19% during the period 2002-10 to 100% mandatory observer coverage (2011-2013) in the multi-species US Pacific west coast bottom trawl groundfish fishery that operates between the US-Canadian and U.S-Mexican borders. In January 2011, an IFQ system was implemented in the fishery, requiring 100% observer coverage of all fishing trips. We examined the available observer data from the 100% coverage period (2011-2013) to help answer these questions.

We used non-parametric resampling to sample vessels, without replacement, 2000 times from the 100% observed IFQ fishery, at simulated target coverage rates from 0.05-0.95 at 0.05 intervals. For each draw, we estimated fleet-wide discard and precision (CV). All trips and hauls from each draw were included in estimates. We assumed 100% mortality for all discards. We show how estimated discard and CV vary across species split into four management categories: 1) IFQ species under a rebuilding plan; 2) IFQ species not under a rebuilding plan; 3) Protected species under management (eulachon, green sturgeon, Pacific halibut, salmon); and 4) Other species or species groups of interest that are not under IFQ or protection.

Finally, we present the results of a generalized linear model that explains how median CV changes as a function of coverage rate, while controlling for discard weight. The final model (discard weight, coverage, species-group, coverage-by-species interaction) was used to predict the median CV for each species or group at each coverage level.

## Results

Median estimates of precision (CV) were relatively high (> 30%) when actual discard amounts were low (< 1 mt) and then CVs exponentially declined as actual coast-wide discard amounts increased. CVs were more variable across coverage rates and across and within species than discard estimates. Half of the species or groups (20/40) had wide precision estimates at low coverage rates that exponentially declined as coverage rates increased. However, many other species (16/40) had precision estimates that declined in a more linear fashion and four species actually had an initial increase in CV with coverage before declining.

NOAA Fisheries recommends that CVs around bycatch estimates should be less than or equal to 30%. Within a realistic range of coverage (10-50%), median CVs varied widely depending on species or species group (Figure 1). The median resampled CV estimate for approximately one-third of the species in this study was never  $\leq$  the 30% NMFS recommended CV for any of the 3 years, at any coverage rate. Most IFQ rebuilding and a few IFQ species had median CVs that were not below the 30% recommendation (Figure 2). Most other IFQ species, protected species and other groups had median CVs below the 30% recommendation; however, all species, regardless of type, appear to have some probability of median CVs greater than 30% (Figure 2). For the 70% of species shown in Figure 1, a coverage rate of 35-40% would be necessary to achieve a 30% or less CV for all 3 years.

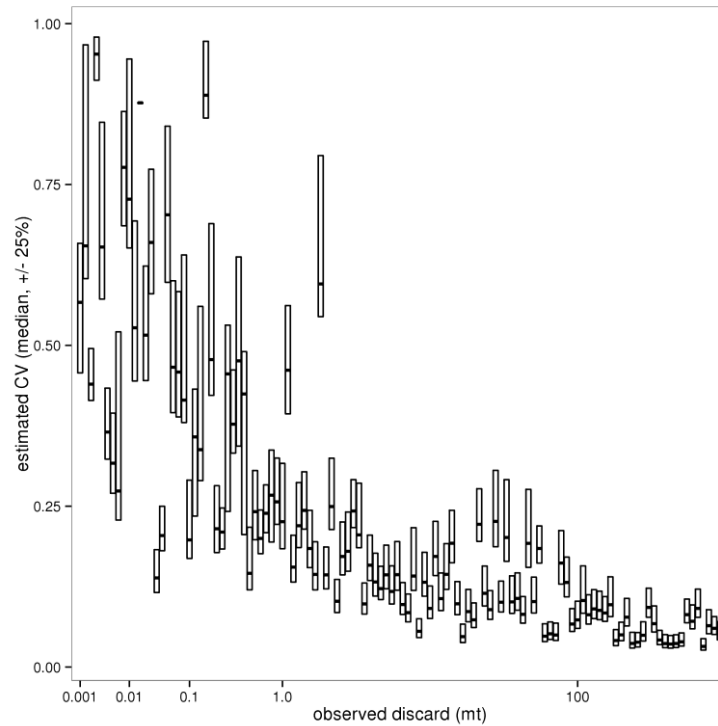
Discard weight accounted for almost 49% of the variance in CV whereas species or groups accounted for nearly 27% (Table 1). Despite the significant coverage-species interaction in the model, observer coverage and the coverage-species interaction accounted for less of the variation in median CV than discard weight and species (Table 1).

## **Discussion**

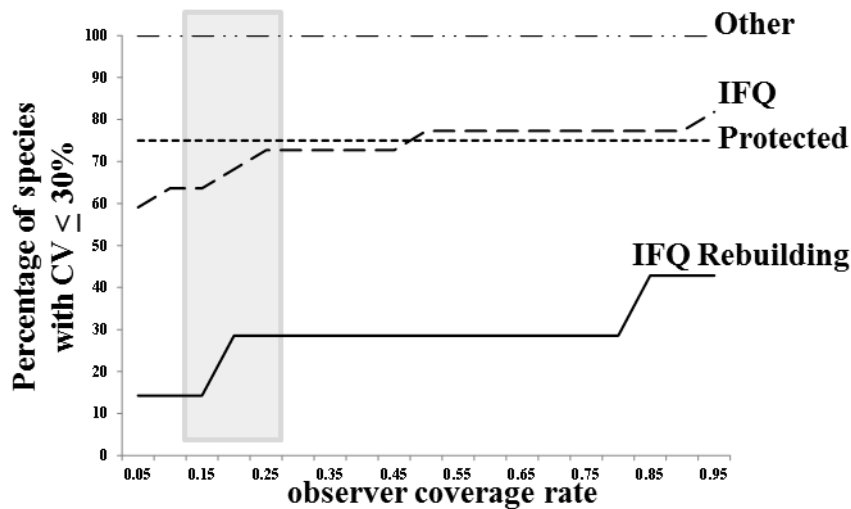
There are three main messages resulting from this work, all of which pertain to observer coverage less than 100%. First, uncertainty in discard mortality around species that are rarely or infrequently caught will be much greater than uncertainty around species commonly found in the catch. Managing threatened or endangered species, including rebuilding species, with low total population numbers that are rarely caught will require taking into account the greater uncertainty around discard estimates of these species. Second, the precision estimates are very sensitive to differences among species and the amount of discard. Surprisingly, even though observer coverage rate did significantly predict CV, its overall effect (i.e., explained variation) was low compared to discard weight and varied by species. The implication here is that altering coverage rate might have little overall effect on reducing scientific uncertainty and any effect realized by a change in coverage will be species specific. Third, this fishery appears to hit diminishing returns at a coverage rate of 0.4. At this level of coverage, only ~70% of the species actually had CVs less than the recommended 30%. The other 30% of species (mostly, IFQ rebuilding) in this study, uncertainty remained above the recommended level even when coverage rates were above 0.4. For these species, there is no reasonable coverage rate that will bring uncertainty below the 30% NMFS recommendation. Management will need to account for the increased risk of overfishing or endangerment of these species by adjusting harvest control rules to account for monitoring uncertainty if observer coverage goes below the current 100% mandate. Given the small effect of coverage on CVs, additional coverage (observer or EM) is not likely to dramatically increase precision of these estimates and thus increasing coverage might not be cost effective.

Given these caveats, we recommend that CV be used in combination with other factors to understand and estimate needed observer coverage. For example, observer programs should focus on ensuring selection is unbiased, that observer coverage is appropriately distributed in both space and time.





**Figure 1.** Estimated CV (median  $\pm$  25%) as a function of total observed discard. Each bar represents a species-year combination (2011-2013).



**Figure 2.** Percentage of species within each management category with a predicted median CV of  $\leq$  30% as a function of the proportion of observer coverage. Grey box represents historical observer coverage range for the fishery (2002-10). Predictions of median CV were obtained from the general linear model, holding the discard weight at the median observed (actual) weight for the 2011-13 period.

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**The EU landing obligation and its impact on discard data**

Lisa Borges

FishFix, Brussels, Belgium

Keywords: discard ban, management policy, European fisheries

## Introduction

The recent reform of the Common Fisheries Policy (CFP) of the European Union (EU) introduced a Landing Obligation (LO) for all EU fishing vessels for certain species and fisheries starting from 2015. Its introduction is one of the most significant reform elements in the new CFP, and represents a fundamental shift in the management approach to EU fisheries. Its primary objective is to reduce unwanted catch (European Union, 2013), while at the same time to promote sustainable fisheries by reducing fishing mortality of animals of low commercial value sizes and species.

The LO is only applicable to total allowable catch (TAC)-regulated species in the Atlantic and to species that have a minimum landing size (MLS) in the Mediterranean Sea, caught in European waters or by European fishing vessels. It is being implemented progressively by species and fisheries, starting with pelagic fisheries and fisheries in the Baltic Sea in 2015, to be completed by 2019 (European Union, 2013).

if the LO is fully implemented (i.e., is monitored at sea at significantly high levels) it will reduce unwanted catch in the first place since fishing operations will change to maximize the use of the space on board vessels and quota available for high value species and sizes. At the same time it will drive improvements in gear selectivity to reduce the catch of undesirable species and sizes. It will increase discard knowledge as monitoring of fishing operations will be increased from present low levels. And finally, it will safeguard stock recovery by protecting strong year classes of stocks under severe fishing pressure, by improving selectivity and/or closing the fishery when the quota has been reached (Borges, 2015).

## Results & Discussion

But one year on what has changed? In 2015 the EU landing obligation was only applicable to TAC regulated species caught by pelagic fisheries and fisheries in the Baltic Sea. Most importantly, enforcement of the LO was postponed to 2017 in order to give fishers time to adjust their operations (European Union, 2015). Three possible exemptions were also granted: species for which fishing is prohibited, species that have high survival rates after being discarded, and catches falling under the *de minimis* exemption (difficulties in increasing selectivity or disproportionate costs of handling unwanted catches).

It seems that fishing operations in the European Union have not changed significantly after one year of the LO. In some fisheries unwanted catch was simply reduced by setting the Minimum Conservation Reference Size (MCRS) below the previous MLS (Borges, 2016). But more importantly there was a refusal to let observers on board fishing vessels that lead to discard sampling only being resumed in the last quarter of the year. Furthermore, there is a clear discrepancy between discard rates reported by scientific agencies and national administrations, while there are indications that the catch profiles between observed and unobserved vessels are different. But more worryingly there seems to be decrease of selectivity, where more small fish are being caught (ICES, 2016).

So after one year of the LO discard sampling is likely biased, not only in time but also to the vessels that did allowed observer on board. Considering that discarding is changing trough

the LO exemptions granted, there is a clear decrease of knowledge on the discarding behavior by European fleets. This will undoubtedly compromise scientific advice on catch opportunities, that have now a strong component on discards. So while landings advice in Europe is based on long term systematic port sampling schemes, discard advice is based on limited sampling programmes that are currently likely to be biased. So how reliable is scientific advice now in Europe? These issues need to be urgently addressed by scientists to ensure the quality of future advice and, of course, of the management measures that depend on this advice (Borges, 2016).

In the future, since at-sea monitoring programmes have from now on in Europe an enforcement/surveillance role, scientist need to work very hard to make sure their data is meaningful. Control and enforcement agencies need to work in collaboration with scientist to establish goals, and carry out risk assessment, of existing and future monitoring programs, in close collaboration with data users.

### **Acknowledgements**

This work was funded through the DiscardLess Project, a European Union Horizon 2020 Research and Innovation Programme (Grant Agreement No. 633680).

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### **Open Discussion Session**

**John Carlson (NOAA Fisheries Southeast Science Center) to Jason Jannot and Yong-Woo Lee**

*Question/comment*

Is it time to abandon target observer coverage levels? In cases of clumped species, use a binomial estimator instead of a ratio estimator?

*Response*

*Jason Jannot:* 30% is a recommendation not a requirement, but should not be the sole determinant (e.g., correct for vessels, correct for distribution and actual observer coverage after vessel selection).

*Yong-Woo Lee:* Over time, try to make method better – 30% CV came up as an early useful guideline but cannot work for all species – it is a balancing act, depends on the fishery and if conservation or management viewpoint – bigger discussion needed (e.g., many species, tier system – common species use certain ratios).

*Comment: Isaac Foster (CCAMLR):* Have 100% coverage and require vessel bycatch reporting.

**Petri Suuronen (FAO, Italy) to Lisa Borges and Ruben Verkempynck**

*Question/comment*

Landing obligation? Everything went wrong – also introduced in Iceland and Norway and working well – 30+ years and they get the data – why so complicated/messy in EU?

*Response*

*Lisa Borges:* There are many differences – in EU only short time, cultural differences. Northerners follow the laws better – less species in northern waters 2–5 vs 200 species – in Norway started with one species but moved all 30 enforcement vessels to when change came about– Norway no observers at sea, all self-reported and landings – but better area to compare to would be Chile vs those northern countries – Chile and EU more similar.

*Ruben Verkempynck:* In Norway changes happened - it was beneficial to fishermen to change while in EU currently has higher number of fish.

**Bruce Turriss (Canadian Groundfish Research and Conservation Society) to Youg-Woo Lee and Lisa Borges**

*Question/comment*

Groundfish coverage percent depends on program objectives – compliance? Fairness? Different levels acceptable coverage – in comparing 100% coverage with observer data. What about “observer effect”? How to account for it?

*Response*

*Youg-Woo Lee:* This is a hot potato topic – proposals to investigate this (twice) were not selected. Maybe need better proposals? But definitely need more investigation – anytime

less than 100% coverage, always uncertainty other biases can exist too, but their model assumes no bias in actual data.

*Lisa Borges:* During my dissertation, answered that observer effect was negligible but now with landing obligation, TAC increased, but there are no controls.

*Bruce Turriss:* Fishermen will not report if against quota.

*Youg-Woo Lee:* Suggestion to use 30% above mean instead of mean to reflect true data but industry would be angry – would need more information from/about vessels.

**Steve Kennelly (IC Independent Consulting) to Youg-Woo Lee**

*Question/comment*

What about side about bias negative and positive values correct?

*Response*

*Youg-Woo Lee:* Yes, it is up and down, but all within an acceptable range.

**Andrew France (Ministry for Primary Industries) to Jason Jannot, Ruben Verkempynck and Lisa Borges**

*Question/comment*

How do you define 100% observer coverage? Large boat fishes 24/7 but the observer only works 12 hours? Have you considered 100%? How defined? Do they define it? And when observers on vessels, how do you account for priorities that take away from discards?

*Response*

*Jason Jannot:* They must hold discards until observer samples, even if dealing with incidental take first.

*Ruben Verkempynck:* Would define 100% as all discards sampled and all fishing behavior accounted for.

*Lisa Borges:* 100% should be on trips –would define 100% as all trips covered because statistically the variation occurs in between trips mostly, not hauls, etc.

**Ernesto Altamirano (Inter-American Tropical Tuna Commission) to Jason Jannot**

*Question/comment*

Purse seine has 100% coverage on large vessels – smaller vessels also pushing for 100% coverage, driven by certification, “MSC” dolphin-safe – is certification driven coverage legitimate? How does it fit into statistically- driven observer coverage?

*Response*

*Jason Jannot:* As long as observer has independent third-party certification.

**Joe Arceneaux (Pacific Islands) to Kirsten Håkansson and Jason Jannot**

### *Question/comment*

Is the panel aware of guidelines to help fledgling observer programs with coverage units – trips, sets, hauls?

### *Response*

*Kirsten Håkansson:* Yes, some from ISIS reports online on sampling.

*Jason Jannot:* Suggest looking at the very helpful NOAA document entitled Evaluating Bycatch.

*Comment: Steve Kennelly:* EU LO and northern countries - took 15 years to settle down.

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## **Poster Presentations – Extended Abstracts**

### **See What**

**Michelle Camara**

**TechSea International Inc**

Overall the Alaska observer program does a good job at the ecosystem approach for their data with few biases. Observers are required to collect data on many organisms; this includes data collected on fish, mammals, birds and invertebrates. Like all good things there is room for improvement. Over my almost ten years as an observer, which is a lifetime for most observers, I have seen a trend to identify more fish and less other organisms, like invertebrates, mammals and birds. The Alaska observer program and many observers are so concentrated on the fish aspect of the data that they down play the importance of other organisms. I want to discuss the way birds, mammals, invertebrates and plants are made less significant by both the program and the observers.

Birds seem to be seen as less important than the fish by many observers. I have heard many times that they did not look for short-tailed albatrosses because they did not want to write it up. I have also heard them say “Why should I care about the dead birds, they are too much work.”, “I hate birds” and my favorite “I’m a fish observer not a bird observer”. I realize that as observers we do a lot in each day and the forms are built for a single sighting yet many birds seem to follow a vessel for days within a trip. The form would be made better by putting haul to haul/day to day where the bird was sighted. No one would want to fill out the form for 10 days 3 hauls per day when it is the same bird or birds. I have worked with many observers in my ten years but most of them are not interested in the birds we see. I have told my partners hey there is a type of bird around the vessel; most ask me what it looks like. I will describe the bird and they will see it but do not seem interested. I had a partner tell me I see all the cool things. I told her it was because I look for them. I have spent on average 2 hours a day during my contracts watching seabirds how they act and move. Now I can separate a shearwater from a fulmar just by its flight and silhouette. But most

observers I have worked with can't separate them on the water. I tell my partners we are constantly doing highlights (a kids magazine to differentiate similar objects). When I started I was looking for different birds and realized that the differences are in shape and size (the obvious) and flight and movements (which are sometimes less obvious).

The observer program only wants data on a bird if it died as a result of the vessel, it is a short-tailed albatross, red legged kittiwake or any other species of concern, and if there was a bird storm. I have asked if they want data on land birds that land on the vessel at sea and have been told no we do not deal with land birds. I have taken pictures of seabirds that landed on the vessel and noted it in my logbook and asked debriefers do they want the pictures and are told "no that it was not an interaction since they landed on the vessel". I have also mentioned that in our guide "Beached bird guide" they should put a live picture and flight silhouette in it so that observers could identify the live birds better and have been told that observers are to identify the birds that come up in the gear. Some of the bird pictures in the beached bird guide have a dead bird which is a skeleton with some feathers. How is someone supposed to identify birds if the identification manual is only for dead birds? This biases observers to only worry about the dead birds and to ignore the live birds. The program cares if fish are out of range but would never know if a bird is out of range because no data is collected on sightings. We have an error in our data if a fish is out of range by 2 km but we would not know if a bird is out of range. How would an observer know if a rare sighting would be rare for a species?

Mammals are another area that observers tend to misrepresent mostly by not filling out marine mammal sighting forms or by asking not to be notified of a marine mammal. The marine mammal sighting form is built for a single sighting and requires observers have time to collect a lot of data on each mammal and fill out soon after. Yet most mammal sightings are quick and during times that observers are working and do not have the time to get the latitudes and longitudes, sit and draw the animal with distinguishing marks and colorations. This form is usually filled out at the end of the day after many hours of other work between sighting and form completion. For observers that do this their saving grace is their camera, yet some vessels do not like observers to have them. Tell me this If you saw a sea lion at 4 am the vessel hauled two strings on in a row you get to the wheel house to write this mammal up do I remember all the data. No you will probably remember overall appearance and the general time. Before you do this you still have to process and enter data you collected on 6-9 samples. Now you have to fill out a form for a mammal you saw for 10 seconds at the beginning of my shift when it was dark and you had to sample in 3 minutes. Another way observers bias data is to tell crew not to notify them of mammals. Captains have asked me do you want me to tell you if I see a whale or other mammal. I have to admit that after a long day at the end of my contracts that I do not want to see them either. I'm tired, my body is sore and I have collected bruises and aches, half of which I do not know where they have come from, so yes the last thing I want to do is sit up a little longer and write it up. But I also find that those same interactions lift my spirits.

The Alaska program does not do a presentation on mammal identification but will have us watch the same safety videos every training. In a way I believe this biases observers to think that they are less important than other things. I agree that safety is very important and should be taught and every observer should be reminded that our job is dangerous, but to show the same videos every year and not to have a mammal talk seems to me to be self

deprecating to the mammal part of observer data. We lose interest in the same videos. Let's change the training up a little show two less of the same videos and do a presentation on identification on lesser seen organisms. Make it a point to remind observers mammal sightings are a duty we should be trying to do. Many of the large CP's have 2 observers on the vessel and they have 12 hour shifts and between samples many observer admit to taking naps. This is a prime time to look out for mammals and seabirds and fill out the forms.

Invertebrates and plants do not get represented as well as they should be. I have seen a decline of the identification of small invertebrates. The observer manual has some pages about invertebrates but the program does not push for better identification of these organisms. The first manual I worked with had ten pages of invertebrates that could be identified and coral was all one group. Now there are seven pages but two pages are for identifying coral to smaller groups. The program had a manual between this that was 3 or 4 pages on invertebrates, but they went back to a slightly more inclusive invertebrate manual. During training they do not even have someone come in and show organisms or pictures. There are presentations on birds and fish but no such presentation on invertebrates. There are no checks for the invertebrates and no set guidelines for how they are recorded. Plants are also recorded as miscellaneous. So I can have in one sample 3 pieces of kelp, a piece of line and some netting and they are all recorded as miscellaneous. There is no code for plant unidentified, so it gets recorded as the same as garbage.

Observers are just as interested in the invertebrates as the program which is minutely. Some observers I talk to tell me they just put down invert unidentified because they are not that important, others put down miscellaneous unidentified. I find it odd that every observer is asked to do injury assessments on halibut but sand flea (amphipod) are not in the manual. These very destructive invertebrate that will eat an entire cod in a day is not in the manual but we are to assess halibut and one line of that assessment states for pots and longliners "Sand fleas have penetrated the body via the eyes, fins, or anus". We are to know the halibut is sand flead but there is no sand flea in the identification manual. There are other invertebrates that externally and internally parasitize cod and halibut that are not sand fleas.

I have been doing this close to ten years and I still find things I can't identify, new birds and new mammals. For me it is a challenge and I look forward to these moments that break the monotony of everyday sampling. I hope that birds, mammals, invertebrates and plants will become more important to both observers and the programs.

Finally I am proud of all those out there doing this thankless job, we collect data from a difficult place and still make it look easy. Most of those data points, which are used for this ecosystem, are from observers, fisherman that help us and companies carrying us.

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## **Abstracts of presentations that did not provide Extended Abstracts**



## **Using statistical methods to improve regional catch sampling**

**Kirsten Håkansson<sup>1</sup>, Marie Storr-Paulsen<sup>1</sup>, Liz Clarke<sup>2</sup>, Alastair Pout<sup>2</sup>, Chun Chen<sup>3</sup> and Edwin van Helmond<sup>3</sup>**

**<sup>1</sup>Technical University of Denmark, National Institute of Aquatic Resources, Denmark**

**<sup>2</sup>Marine Scotland Science, United Kingdom <sup>3</sup>Wageningen University, Institute for Marine Resources and Ecosystem Studies, Netherlands**

During the last couple of years the focus on commercial fisheries sampling programs in the European Union (EU) has been on statistically sound sampling designs as opposed to a more ad-hoc design commonly used in many European countries. To achieve a more cost effective sampling program focus has also been changing from the present national to a more regional approach. This study is part of a pilot project financed through an European grant (MARE/2014/19), where one of the goals were to suggest a future regional sampling designs for stocks caught in the North East Atlantic.

Four economically important pelagic stocks (herring, mackerel and sprat) caught in the North East Atlantic were used in a simulation study to compare various regional sampling designs. 11 counties in the EU provided data from logbook and sales note at trip level from 2013 and 2014. To optimize the sampling designs different stratification scenarios were tested e.g. countries, port size and vessel length. The present sampling effort was kept as a starting point however in some of the scenarios redistributed according to landed weight. Different sampling effort was applied to attain the level where uncertainty was not decreasing although the level of samples increased.

One of the suggested regional designs was based on self-sampling of catches at-sea. There are great benefits of self-sampling small pelagic at-sea compared to sampling by observers on-shore. If well designed it can be a very cost effective way to sample. Further the samples can be frozen directly after the catch and thus obtained on a haul by haul basis and not on a trip level which a harbour sample most likely will be. It may be noted that control samples will be needed in addition to ensure independent data to evaluate and control biases.

The main findings in this study were that with a relatively simple stratification and present regional sampling effort it would be possible to achieve a very effective regional sampling design. This highlights the benefits of using statistical method to evaluate sampling designs before implementation.

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## **Investigating Coverage Of On Board Sampled Trips And Bias In Fisheries Catch Data**

**Ana Cláudia Fernandes, Melinda Oroszlányová, Cristina Silva and Manuela Azevedo**

**IPMA, Portugal**

Major sources of bias on onboard sampling for fish catch data collection relate to vessel selection, catch sampling and changes in fishing behavior in the presence of observers. The Portuguese on board sampling programme, included in European Union Data Collection Framework (DCF), is based on a quasi-random sampling of cooperative commercial vessels

between 12 and 40 meters long and one of our concerns is related to the low number of cooperative vessels included in the sampling frame (between 5 and 10 in the period 2012-2015), that is justified by several types of refusals. We compared vessels characteristics and fishing activities using trips from the target fleet and trips from the sampling frame with and without observers on board. Several parameters were analyzed: landings (total landings and landings of selected species), fishing regime and fishing effort (trip duration, number of fishing operations and number of fishing hours), and fleet spatial distribution. The analysis was carried out for the period 2012-2015 using data derived from logbooks, market sales, fleet register and vessel monitoring system (VMS).

Multivariate analysis indicates two groups of fishing operations within the target fleet, persistent in the analyzed period, with distinct fishing regimes, total landings and main landed species. In 2012, no differences were found between the fishing activity of the vessels of the sampling frame and the vessels from target fleet as well as no observer's effect in sampled trips. From the analysis extended to the whole period, we investigate whether our sampling frame conforms to a reference fleet.

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## **Evaluating bias in an observer and self-sampling discard programme**

**Ruben Verkempynck, Chen Chun, Michiel Dammers and Edwin van Helmond**

**Wageningen IMARES, Noord-Holland, Netherlands**

Sampling bias in selecting discards samples is an issue in self-sampling. To gain insight in variations and possible bias in sorting of discards by fishermen, a co-sampling programme has been set up in the Dutch demersal fleet since 2011. During each observer trip on a vessel in the reference fleet two samples are sampled by the fishermen as they would during the self-sampling. This paper analyses the performance of both the observer and the self-sampling discard programme for bias.

From an unbiased estimator the variance of haul effect and fish residuals is estimated from the variance components. Results show that scientific observers overlook a number of fish species (mean=7.0,  $p < 0.01$ ). The most frequently detected species in both programmes is lemon sole and plaice. The mean lengths are compared for several target and bycatch species that are found in the samples. The length measurement of each individual fish is decomposed into grand mean, haul effect and residuals.

An unbiased estimator is used to estimate the grand mean, and variance of haul effect and fish residuals can be estimated from the variance components. Non-parametric bootstrapping method is used to estimate the mean difference of mean length and variance components. Results show that self-sampling exhibits an average of 1.2cm (95%CI 0.34-2.1cm) shorter plaice than observer samples, while for lemon sole no difference is detected (-0.1, 95%CI -0.7-0.5cm). This result suggests bias in sampling of plaice from the discards fraction. Self-sampling programme yields a smaller sampling variance of mean length than observer (0.07 vs. 0.20cm<sup>2</sup> for plaice, 0.10 vs. 0.12cm<sup>2</sup> for lemon sole). The estimated population variance of haul and fish are 3.10 and 11.29cm<sup>2</sup> (plaice), 2.04 and 8.7cm<sup>2</sup>

(lemon sole). The next step is to include non-co-sampled hauls and trips and conduct a variance component analysis.

Additionally, the differences in raised discard estimates based on both the observer and self-sampling discard programme will be presented in terms of their consequences for assessment and advice.

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## **Implementation, evaluation, and future of the automated observer deployment system used by the Northeast Fisheries Observer Program**

**Sarah Cierpich**

**NOAA/NMFS/NEFSC/FSB/Northeast Fisheries Observer Program, MA, United States**

The Pre-Trip Notification System (PTNS) is used by the Northeast Fisheries Observer Program (NEFOP) to randomly assign At-Sea Monitors (ASMs) and NEFOP observers to monitor activity on commercial fishing vessels in the Northeast groundfish fleet of the United States. It uses a self-adjusting, tiered, probability-based algorithm to select vessels in order to reach the target ASM and NEFOP coverage rates.

Now in its 7th year of implementation, the PTNS has had to adapt in order to address transitions in regulatory measures, vessel selection bias, and equity of coverage. Major adjustments to the system have been made to account for multivariate coverage type exemptions and for the recent conversion of the ASM program from agency- to industry-funded on March 1, 2016. Changes have also been made to reduce possible observer assignment and vessel trip cancellation bias. Non-random elements were introduced to create greater equity of coverage between vessels.

The future of the PTNS is uncertain. There are always opportunities for improvement. Depending on upcoming management decisions, the system may need minor adjustments, or it may need to be stripped down to the basic algorithm and re-built to accommodate new, more complicated methods of trip selection.

Either way, the core of the PTNS - its algorithm - remains true to scientifically-sound random selection. The challenge moving forward is reducing external influences that may create non-random effects in trip sampling while also ensuring fair and reasonable coverage on an individual vessel level and keeping up with unpredictable and quickly-changing rules and regulations.

## **Session 11. Can data from the fishing industry be used to monitor fisheries compliance, seafood traceability and/or fisheries certification?**

**Leader: Lisa Borges**

Because the fishing industry is increasingly required to prove their compliance to various fishing regulations, policies, traceability requirements and eco-labelling certification needs, this session explored examples where industry has taken the lead in monitoring their own activities for such purposes. This included how such programs are run and how the data are audited, validated and used.

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### **Oral Presentations - Extended Abstracts**

#### **Fisheries Information Management System**

**David Karis**

#### **National Fisheries Authority, Papua New Guinea**

The National Fisheries Authority Vessel Monitoring System was upgraded to a comprehensive web based platform known as the integrated Fisheries Information Management System(iFIMS) in 2010. iFIMS was developed "Fit for Purpose" as an integrated platform encompassing monitoring, eReporting, compliance and fisheries management tools. The database development has comprised of a series of projects since commencement, including:

- Vessel Register
- Asset Tracking System (ATS)
- VDS
- Crew Register
- MCS Live access and Photos
- Alerting Visual and Email/SMS
- e- Forms
- Electronic Vessel Register (Licensing)
- Other integration (such as with the FFA regional register)
- Port sampling
- Catch traceability
- Observer management and tracking
- FAD Tracking
- Industry Access
- Flag State Access.

These many interrelated components of the system are integrated and connected to each other. For example, the Observer Management module, includes the functional Observer booking system, but is also integrated to the Asset Tracking System (ATS), Alerting, eForms,

Catch Document Scheme (CDS), Licensing and Reporting systems. It is the power of this integration which makes iFIMS so efficient and effective for NFA PNG.

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## **Using Technology to Improve and Verify Fisher Self-Sampling**

### **Grant Course**

#### **SeaScope Fisheries Research Ltd.**

The use of self-declared data in fisheries science and management has often been treated with suspicion. These concerns have surrounded the accuracy of the recorded data, the way the data has been collected, and whether the fishermen have introduced bias, either intentionally or accidentally. The cost of using observers or fishery officers to collect biological data or check self-declared catch data in remote locations is often prohibitive, resulting in some stocks and fisheries being excluded from monitoring. However, without reliable and trusted verification, the self-declared data are potentially limited and may be rejected by scientific communities and fisheries managers.

In 2015, SeaScope Fisheries Research completed two European Fisheries Fund (EFF) funded pilot studies as part of the wider project “Evidence Gathering in Support of Sustainable Scottish Fisheries”. These were entitled, “Monitoring Fishery Catch to Assist Scientific Stock Assessments in Scottish Inshore Fisheries – a Pilot Study”; and “Identifying Catch Composition to Improve Scottish Inshore Fisheries Management using Technology to Enable Self-Reporting” – a Pilot Study. The duration of these projects was 9 months and they were combined and run simultaneously as one larger project.

The main objectives of these two projects were: -

- Install an appropriate Electronic Monitoring (EM) system aboard the selected participating vessels and use EM to verify self-reported catches.
- Train fishermen in self-sampling techniques and design and provide appropriate data recording sheets.
- Undertake sea trials to provide additional training in self-sampling, to collect control data, and to field test technical innovations. SeaScope investigated the use of radio frequency identification (RFID) tags, data storage tags, Bluetooth callipers and automated discard chutes.
- Collect data using EM technology and self-reporting to help address the issue of data deficient stocks.
- Undertake video review (10% of valid fishing trips) of collected data and carry out analysis on all sensor data.
- Provide catch estimates through video review and undertake comparisons between self-reported and video review catch estimates for verification purposes.

A total of 11 fishing vessels, distributed geographically between Leverburgh and the Isle of Whithorn, on the west coast of Scotland, participated in the trials; 9 creel vessels, 1 scallop dredger and a Nephrops trawler. All vessels were fitted with Archipelago Marine Research EM systems (a mixture of v4.5 and v5.0 units) complete with 3 digital video cameras per vessel. After some initial issues relating to radio frequency (RF) interference were addressed, the systems performed very well for the duration of the trials and data were collected from all vessels for at least 6 months each

The participating vessels undertook a total of 703 fishing trips as part of the project of which 568 provided self-reported catch data (Figure 1) of sufficient quality to evaluate the accuracy of self-sampling and data collection by EM technology.

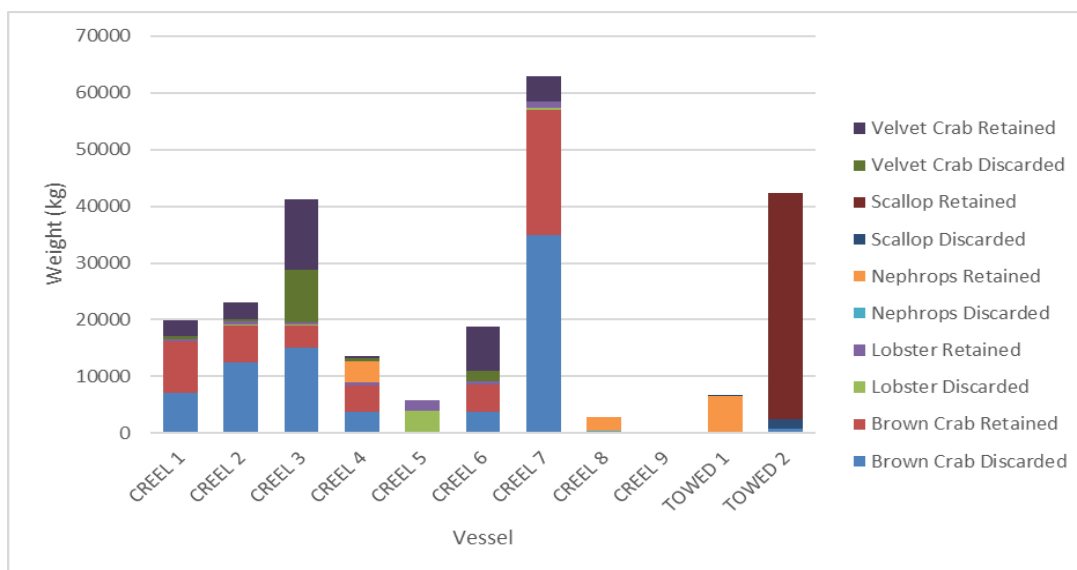


Figure 1. The self-reported catches from all valid sea trips.

In total, 85% of all fishing trips provided valid self-sampling data as usable paper records, whilst EM technology was able to collect valid usable data on 96% of all trips fished. Of these valid trips, full analysis and video review was carried out on 12% of the trips. The sensor data that was collected was reviewed at 100% of all trips undertaken, providing an excellent dataset on distribution of effort at string or haul level. Figure 2 shows a daily plot of fishing effort for one lobster creeling vessel with strings hauled marked in red.

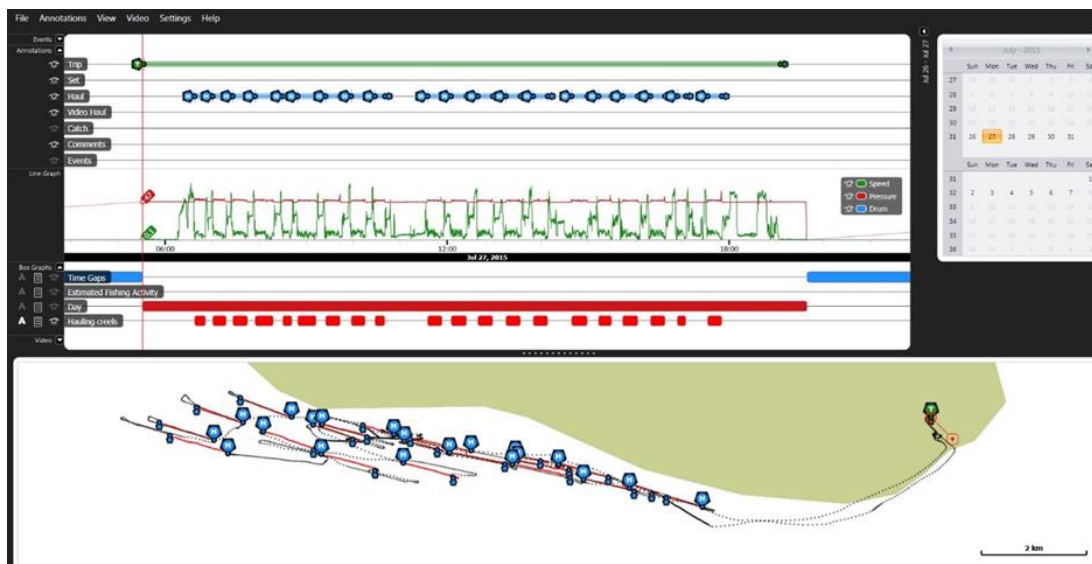


Figure 2. Screenshot from the AMR EMIPro software after the strings hauled by a creeling vessel have been identified using sensor and GPS data,

Fine-scale effort parameters (number of creels and creel soak time) can be difficult to ascertain from a 'standard' EM installation. Development of an integrated RFID system allowed these data to be collected automatically with little or no detriment to catch-handling procedures on-board. Integrating these data with catch data (determined through video analysis or self-reported data) provide CPUE data with fine scale spatial accuracy. A stand-alone data storage tag was also trialled which produced an accurate record of soak time at string level, with the added benefit of temperature at depth data.

Two separate sub-projects were trialled to address data deficiencies with fine scale biological data collection. Utilising Bluetooth callipers, fishers were able to collect length frequency data on retained target species (brown crab, lobster and velvet swimming crab) effectively and efficiently without any additional time burden as the sampling was conducted in approximately 10 minutes and whilst steaming back to port (Figure 3). To ensure that the catch was sampled randomly, one keep-pot with mixed sizes and sexes was selected for measuring. Approximately 60 individuals could be measured in 5 minutes. This mode of data collection could not only address some of the current data deficiencies but also offer significant cost savings to conventional methods of collecting shellfish length/sex data.



*Figure 3. A fisherman using the Bluetooth callipers linked to a tablet, to self-record length data.*

A second trial using a simulated discard chute fitted with 3 additional cameras provided footage that allowed for accurate collection of discard data. This included number by species, with accurate determination of sex for both brown crab and velvet swimming crab, and length estimations on a sub-sample of animals passing down the chute. Further refinement and development of this concept should improve its capabilities in length estimation across all species and sex determination of lobsters specifically.

Review of video data allowed 76% of the retained catch of brown crabs (by count) to be sexed, but only 32% of the discarded component of the catch. EM video review was less successful at sexing velvet crabs with only 25% sexed. Lobster proved difficult to sex from the video review due to issues with light contrasts and the need to clearly see the pleopods. Sex ratios estimated by video review were similar to those estimated by the skipper, but more rigorous on-board protocols need to be considered before these data could be used in assessments.

These trials have shown that most, if not all areas where data deficiencies exist, can potentially be supplemented with self-reported and/or data derived from EM technology. If self-reported data is to be used, then verification is necessary to remove any doubts associated with data quality. EM provides this facility. We would recommend establishing a working-group made up of fishers, researchers/scientists and managers to develop sampling schemes with realistic standardised self-sampling protocols and sampling scheme designs. We would further recommend an expanded trial over a number of years whereby a time series can be established. As these new protocols are introduced into the fishery we conclude that whilst EM can provide valuable data in itself, it is the most effective tool available at present to monitor and validate self-reported data. Further trials of innovative technology and those explored in this project, such as the Bluetooth callipers, the RFID tags and the automated discard chute, should continue to help provide additional stock assessment data.

Full project report available at [www.seacopefisheries.co.uk/publications](http://www.seacopefisheries.co.uk/publications)



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## **The Landing Obligation and MSC certified fisheries**

**Lisa Borges<sup>1</sup> and Rob Blyth-Skyrme<sup>2</sup>**

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Keywords: discard ban, certification, European fisheries

### **Introduction**

The recent reform of the Common Fisheries Policy (CFP) of the European Union (EU) introduced a Landing Obligation (LO) for all EU fishing vessels for certain species and fisheries starting from 2015. Its introduction is one of the most significant reform elements in the new CFP, and represents a fundamental shift in the management approach to EU fisheries. Its primary objective is to reduce unwanted catch (European Union, 2013), while at the same time to promote sustainable fisheries by reducing fishing mortality of animals of low commercial value sizes and species.

The LO is only applicable to total allowable catch (TAC)-regulated species in the Atlantic and to species that have a minimum landing size (MLS) in the Mediterranean Sea, caught in European waters or by European fishing vessels. It is being implemented progressively by species and fisheries, starting with pelagic fisheries and fisheries in the Baltic Sea in 2015, to be completed by 2019 (European Union, 2013).

No new technical measures are foreseen to specifically accompany the implementation of the LO. There are also no specific additional requirements for its monitoring and control, except for an obligation to document the catches, details of which are to be specified in multiannual plans. Failing to comply with the LO is categorized as a serious infringement under Regulation (EC) No. 1224/2009 (European Commission, 2009), but there will be a 2-year delay before sanctions take effect, i.e. from 1 January 2017 (European Union, 2015).

Many commercial stocks are moderately to highly discarded (ICES, 2015), so if the LO is fully implemented (i.e., is monitored at sea at significantly high levels) it will drive improvements in gear selectivity to reduce the catch of undesirable species and sizes, whilst it is likely that fishing operations will change to maximize the use of the space on board vessels and quota available for high value species and sizes. The LO could therefore represent the biggest push for more selective fishing in the European Union in the history of the CFP (Borges et al., 2016).

Furthermore, if the LO is fully implemented catch data quality will increase and so stock assessment uncertainty will decrease, the harvest strategy and HCR will be more robust, and evidence of compliance will be available. These factors should all lead to an increase in score (i.e., an increased chance of certification) for EU fisheries assessed against the MSC Standard. However, in undertaking this project, the authors have assumed that the LO will be implemented only weakly, with low levels of at-sea monitoring, since the LO has no

compulsory at-sea monitoring requirements, and EU Member States have yet to commit to a significant increase in monitoring, control and surveillance (MCS) programmes.

In recent years, significant efforts and various consumer-led approaches have also been attempting to drive greater sustainability and legality in European fisheries. The Marine Stewardship Council (MSC) certification scheme is one of these approaches and has achieved a high level of penetration. However, non-compliance with the LO would introduce illegality into the supply chain, which could lead to the loss of MSC certification and, with it, access to key markets. Evidence to date suggests weak LO implementation, continued discarding, and the likely degradation of catch data quality.

## **Methods**

This study assesses how strongly the LO interacts with the MSC Standard, based on a comparison of the LO specifications with the Scoring Issues (SIs) that are used to assess fisheries within the default Version 2.0 MSC assessment tree. A review of 25 MSC certified EU fisheries (covering demersal trawl, demersal static gear and pelagic fisheries from the Baltic Sea, North Sea, North Western waters and South Western waters) was also undertaken to determine if weak implementation of the LO could lead to their future suspension or reassessment failure.

It is important to emphasize that this project has attempted to forecast what may happen with MSC certified EU fisheries in 2019 when all TAC regulated fisheries and stocks will be covered by the LO, whilst assuming weak implementation of the LO. However, faster progress with implementing the LO, evidence of widespread fishery compliance with the LO specifications, changes to the MSC Standard, or other factors could render the results invalid.

## **Results & Conclusions**

There are strong interactions between the LO and MSC assessment tree, in particular with Performance Indicators (PIs) covering harvest strategy and compliance – PI 1.2.1 and PI 3.2.3, respectively.

Ongoing MSC certification of EU demersal trawl fisheries and EU fisheries with high discard rates is likely to be put at some risk if implementation of the LO is weak, though not meeting the MSC minimum acceptable Scoring Guidepost (SG)60 level of performance for Scoring Issues (SIs) covering harvest strategy monitoring and fishery compliance monitoring.

In the event of weak LO implementation, fisheries with already low (<10%) discard rates are considered to be at low risk of failing to meet the MSC requirements because of their intrinsic low risk of not meeting LO discarding specifications.

Although LO monitoring may have improved across the EU by 2019 when all relevant fisheries are scheduled to be subjected to the LO, the experience to date indicates that this is unlikely to be achieved at significant levels. Thus, the risk posed by the LO to almost half (6 out of 14) of the MSC-certified EU demersal trawl fisheries that were reviewed by this project is deemed high, and may lead to some of these fisheries being suspended and/or failing to achieve recertification.

Overall, the results of this project suggest that at-sea monitoring programmes will be important for the maintenance of MSC certification for many EU fisheries. These monitoring programmes provide a basis to judge if the LO, as a key component of CFP and the specific harvest strategy for individual fisheries, is being complied with.

### **Acknowledgements**

This work was funded through Funding Fish ([www.fundingfish.eu](http://www.fundingfish.eu)).

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### **Credible net to plate traceability and ecolabeling in the tuna sector is possible, but at a cost: Lessons from PNA's MSC Group Chain of Custody scheme**

**Maurice Brownjohn OBE,**

**PNA Office, Majuro, RMI**

What is in the claims of MSC, FAD free, free school, eco friendly, or even dolphin friendly tuna?

Consumers believe such claims are a sign of credible sustainability, they put their trust in the retailer for the validation of the claim and willingly pay premiums to help sustainability.

Whilst MSC, is considered a highly credible certifications, the level of monitoring is intense and expensive. Many competing eco claims offer similar economic returns but are clearly not based on any sustainability criteria or validation, rather “Green washing”, “statements of irrelevance”, or just non truths, but all play to the growing consumer consciousness and expectation, even backed by NGO pressure, the reality is the logos and claims are outgrowing the labels.

Whilst industry, brands and retailers hang their corporate image on these claims, I wonder how many boards, even know they may be party to the eco fraud of their clients.

It is only time before a class action goes from targeting can fill weights, price fixing and mis labeled of contents in the USA, to challenging the validity of the eco claims on the label.

I believe “Self certification” has a role in sectors where the consumer can readily validate the claims made, or otherwise the consequences of mis declaration are considered minor. - consider my self certified “beautiful baby” picture, You may see what I mean.!

Saying this, Self-declarations should be seen for what it is: Even if valid, without an associated and valid coc linked to absolute segregation, robust checks and balances to detect non-conformance and with independent 3<sup>rd</sup> party verification of set type from trail to the factory door, then such claims singularly, are in reality valueless. There is no such thing as “slightly Green”, “slightly sustainable”, probably or even “slightly eco friendly”. I might add the data from observers and EM alone are also not 100% either.

Reality is self certification schemes in the sector have facilitated laundering of non-sustainable and even IUU catches for premiums. Let us face it, who would declare their catch “unmarketable and valueless”? If this were not true, then can you tell me where to buy cheap tuna certified as “unsustainable and IUU”?

In the Pacific islands, where few other resources exist, true eco system based sustainability has driven our fishery management for thousands of years, this continues today.

PNA nations put their region’s governance of Skipjack and Yellowfin up for the MSC evaluation against the global “gold” standard of sustainable fisheries in 2010, and embraced the use the MSC COC , as it allows no discretion in “eligibility”. Even going as far as DNA testing in some fisheries to avoid mixing of stocks in the market.

However the PNA’s, MSC free school tuna fishery is much more complex, and without precedence. A single boat can catch eligible and non eligible MSC of the same species on the same boat, on the same day, with the same gear, and almost all MSC eligible catch is subject to transshipment before being consider for MSC certification upon landing.

The PNA COC scheme draws on various sources of data as a progressive filter from the net to the factory door where the factory’s MSC coc takes over and only then may the batch be considered MSC certified. Until that point, the catch of skipjack or Yellowfin free school is only MSC eligible [NOT MSC CERTIFIED. ]

## PNA MSC COC SCHEME

Eligible to do MSC trip – MOU, MSC trained, MSC observer, MSC trip code etc

Yes ↓ NO → **NOT A MSC TRIP**

Captain / log sheet claims a “Free school” set

Yes ↓ NO → **NOT MSC ELIGIBLE**

Observer records MSC eligibility and absolute segregation maintained

Yes ↓ NO → **NOT MSC ELIGIBLE**

Transshipment MSC eligible and absolute segregation maintained

Yes ↓ NO → **NOT MSC ELIGIBLE**

Discharged MSC eligible and absolute segregation maintained at factory

Yes ↓ NO → **NOT MSC ELIGIBLE**

NO FAD Species present. Weights per species and mass balances confirmed

Yes ↓ NO → **NOT MSC ELIGIBLE**



**BATCH MAY BE MSC CERTIFIED**



A few key points on the PNA COC scheme:

- Whilst PNA own the MSC certificate, they don't own the vessel or catch, so zero self certification, or self economic drive involved
- The company's data inputs eg captains log sheets are the first of many filters of eligibility in the PNA coc scheme.
- Company also provides carrier load plans and are required to follow PNA MSC COC segregation, loading and unloading requirements.
- Industry does withdraw loads where they have doubts.
- The independent 3<sup>rd</sup> party observer's data covers all points whilst at sea, transshipping, discharge and sorting on shore. At each stage it is monitored independently with reports on observations of compliance against requirements of the coc scheme and the maintenance of eligibility at each stage. Observers have no authority to downgrade.
- PNAO considers all the data from each source for progressive validation, looking especially at maintenance of absolute separation of MSC Eligible batches throughout, and especially the species and mass balance checks at the end.
- It is clear no declaration by the captain or an observer's reports can be 100% accurate, so they serve as progressive filters.
- The last check is any species that are totally FAD dependent like trigger fish, being present at any stage or even in the final out turn, this final check validates the coc and confirms no gaming of the catch during the coc.

- Only PNAO can make the final decisions to decide if MSC eligibility has been maintained, and whether the prestigious MSC certification is justified for a batch.
- The PNA COC scheme is also subject to rigorous independent audit spot and annual audits.
- Under the industry mou with PNA, the PNA Pacific marketing arm continues to collect data for traceability through the factory, including MSC batch codes, final can codes and deliveries to the retailer.

The industry typically returns 15% premium as an incentive for the more sustainable PNA MSC free school fishing, ironically other schemes show similar returns.

Further PNA MSC is only traded with the “Pacific” co branding, which besides being a geographic indicator, compliments the Brand, offers a unique traceability system based on the final product can code, where the consumer can trace the exact can, the factory the boat, even the captain and trip dates, whilst all the time linking the MSC product back to the peoples of the PNA nations.

Such schemes are unequal in the market, the role of observers is vital, and a comprehensive coc is critical. But such rigid schemes cost money, they are essential to ensure the credibility of the PNA MSC free school certification claims, and ultimately protect the retailer and brand to ensure the consumer genuinely gets what they pay for. Not the victim of more consumer fraud.

<http://www.pacific.com/traceability.html>

## **Can data from the fishing industry be used to monitor fisheries compliance, seafood traceability and/or fisheries certification? Regional Observer Program in Western Indian Ocean region**

**Mrs Jérôme Kompé FANJANIRINA**

**Indian Ocean Commission, Mauritius**

### **1. IOC PRSP mechanism**

The Indian Ocean Commission (IOC) is an intergovernmental organization that includes 5 African Indian Ocean nations: Comoros, Reunion (a department of France), Madagascar, Mauritius, and Seychelles. The combined Exclusive Economic Zone (EEZ) of IOC states is very large 5.5 million km<sup>2</sup>.

Tuna and other highly migratory species constitute the largest marine resource at the disposal of coastal countries, particularly when these are island states. The West Indian Ocean harbours important fisheries for tuna, that due to the highly migratory nature of the species, no country can monitor alone.

Therefore, in 2007, IOC member States decided to set up control mechanism namely PRSP (Regional Fisheries Surveillance Plan) funded by EU, to fight IUU fishing and to develop a coordinated strategy to improve sustainable fisheries management in the region.

Solutions found to improve fisheries catch and effort data in the IOC region include the implementation of Regional observer scheme and the sharing of Observer and MCS data. Other tools are monitor fisheries compliance, seafood traceability and fisheries certification.

## **2. Observer initiatives in the Western Indian Ocean region**

With tuna and tuna like species catches in the Western Indian Ocean coastal countries EEZs, constituting almost 40% of total landings of large pelagic fish in the region, there is a strong need from coastal countries to improve fisheries data on catches and fishing effort in this area.

Actually, there are 4 different types of Observer programmes active in the region, that have per objective to collect fisheries data (science and control) to meet national and regional requirements (IOTC resolution 11/04):

- National Observer Program (NOP) based on national legislation and IOTC resolution 11/04 on observer scheme
- IOC Regional Observer Programme based on the regional use of existing
- IOTC Observer Program to monitor transshipment at sea – based on the resolution 14/06
- Private Observer Program implemented by Industry. Agreement with Seychelles Fishing Authority (SFA) for the deployment and coordination of observers

## **3. National Observer Program (NOP)**

- Each IOC Member State has a National Observer Program.
- The NOPs have a national and regional legislation. The legislation mandate is provided by IOTC resolution 11/04 whereby in order to improve the collection of scientific data, at least 5% of the number of operations/sets for each gear type by the national fleet for vessel 24 meters overall length and over, and under 24 meters if they fish outside their EEZ.
- The NOP transmits observer data/reports to country fisheries management division who ensure with national prescription and compliance with RFMOs resolutions (IOTC Res.11/04) by forwarding observer data/report to the RFMO.
- It also address observation in the artisanal fisheries.

## **4. IOC Regional Observer Programme**

- Based on the regional use of existing National Observer Programme
- In 2007, IOC countries signed an arrangement, which authorizes individual national observers to observed and collected data in the EEZs of all IOC member States. An

agreement that allows for the sharing, optimization and cooperation of national observer missions at IOC level.

- IOC provided each national observer with a nominative accreditation and an official card which allows them to observe and collect data in the EEZs of all IOC member States
- Creation in 2014 of a Working group of NOP coordinators. They meet twice a year, their role is to:
  1. Identify actions to be conducted at national and regional level
  2. Coordinate observer deployments
  3. Standardization of observer data methods and tools
  4. Exchange experiences and know-how
  5. Harmonization of observer training and management
  6. Synchronization of data collection systems used at national level.
  7. Exchange of observer data grouped by EEZ (instead of by degree square) and sharing among IOC countries
- Extension to other countries: Kenya, Mozambique and Tanzania.

#### **5. IOTC Regional Observer programme to monitor at-sea transshipments**

- This programme established in 2012 for control purposes was superseded by Resolution 14/06.
- IOTC manages the implementation of the programme.
- IOTC outsources observer deployment to a private observer provider who appoints the observers and place them on board the carrier vessels authorized to receive transshipments of fish caught in the IOTC area of competence
- The request to place an observer on a transshipment vessel is made by the flag state of the donor vessel
- The observer should not be a national of the flag State or fishing entity, nor should they be a crew member or employed by the company of one of the vessel's involved in the transshipment.
- The observer also have a compliance mandate whereby reports of possible infraction of IOTC resolutions are reported to the IOTC who then transmit to flag states
- IOTC provided to the CPCs all the copies of raw data, summaries and reports

#### **6. Industry Observer programme**

There are multiple observer initiatives in the region implemented by the industry, such as:



- Orthongel (French) private observer programme OCUP
- Opagac and Anagac (Spain) private observer programme
- Dongwon Industries (Korea) private observer programme
- ANABAC and OPAGAG regroup all Spanish tropical tuna vessel owners. They signed a MoU with Seychelles Fishing Authority (SFA) for the 100% observer coverage of their fleet. Raw data is stocked by SFA and no data is presently shared with coastal countries or even with Spanish research institute.
- Dongwon industry is the owner of Korean flagged purse-seiners operating in the Indian Ocean. The agreement is to cover 100% of their fleet.

SFA supplies national observers to be deployed on board OPAGAC, ANABAC, Dongwon industries purse-seines, and is responsible for subsequent observer debriefing, data correction, processing and storing. SFA directly supplies IOTC with Observer Reports in the name of the Spanish and Korean fleets.

- Orthongel / OCUP (Common Unique and Permanent Observer Programme):

Orthongel regroups all French tropical tuna vessel owners. In 2013, Orthongel initiated its private fisheries observer programme, namely OCUP. This programme is implemented by the private company Océanic Développement (OD) which deploys observers from ACP countries on board French tropical tuna purse seiners operating in the Atlantic and the Indian Ocean.

OD signed a contract with SFA for the regional coordination (briefing, deployment and debriefing) of the programme in the Indian Ocean.

- Coastal countries supply national observers to be deployed in the context of OCUP. OD establishes an agreement with participating countries through the signature of a MoU or the emission of a deployment order by NOP.
- Océanic Développement is responsible for observer debriefing (by skype in the presence of SFA coordinator), data correction, processing and for reporting data to Orthongel, and forwards raw data to the French Research Institute (IRD).
- Coastal countries are supposed to have access to aggregated data collected in their EEZ through an internet tool but none of the IOC countries participating on this programme have yet access to this tool.
- The large majority of IOC countries participating to the programme haven't yet received observer reports or aggregated data concerning fishing activities conducted on their EEZ. They need the raw data collected by their observer to monitor fisheries compliance.

## **7. Tools used by FMC of IOC member States**

The IOC countries FMC use several tools, at national and regional level, to monitor local and foreign fishing vessels licensed to operate in IOC EEZ, including:

- The monitoring of fishing vessels activities through national and regional VMS
- The reception of an entry/exit EEZ report from each vessel. Report is received 24 hrs in advance, which allows to verify if the vessel doesn't have an history of IUU activities (infraction list in StaRFISH and IUU list of RFMOs). The vessel is subject to inspections at arrival and during landing of fish (countercheck with StaRFISH entry/exit reports)
- Licence and vessel registry (StaRFISH database)
- Procedure for unloading of vessels on arrival to Port (in line with the FAO model scheme on Port State Measures to combat IUU fishing)
- Logbooks dully filled are countercheck the VMS position (national and regional), S-AIS and radar imagery in SIGMA
- Inspection of catch on board (species, tonnage, date of landing, destination) and comparison with data provided on logbook, entre/exit report and observer data (if available).
- Inspection by the Competent Authority that the fish is fit for human consumption, issue of health certificate
- Inspection of fish quality, size and other restrictions
- Authorization of unloading

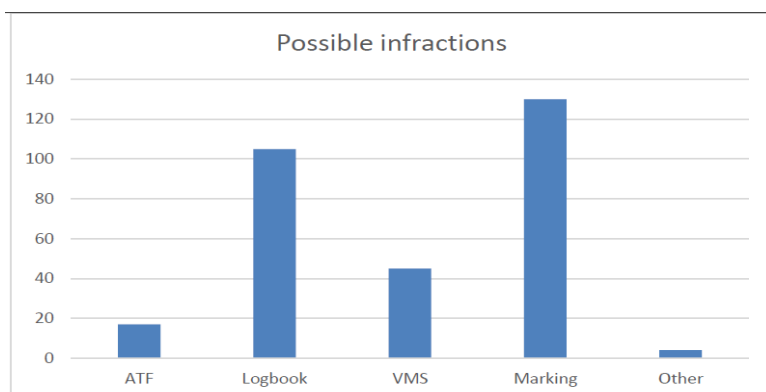
## **8. Monitor fisheries compliance**

Monitoring of compliance requires maximum information possible from different sources. IOC member states used different tools to monitor fisheries compliance.

Observer data can be used in the following:

- Verification of logbook for under reporting and/or miss reporting
- Verification with VMS data for VMS tempering
- Compliance with FADS management
- Compliance with Mitigation measures
- Compliance with regards to bycatch and discards
- In the case of IOTC observer scheme several type of infractions are detected or possible infractions are reported

This highlight not only the type of infraction but the type of fleets, countries and fishing companies that normally do not comply to national laws and IOTC resolutions



**Figure 1:** Possible infractions by category under the ROP in 2015.

## 9. Monitor traceability and certification

Normally validation for the purpose catch certification is done by verification of logbooks, transshipment documents and satellite tracking tool such VMS, AIS

Given the fact that observer data are more credible than logbooks, the use of observer data will strengthen the process.

## Open Discussion Session

**Eric Gilman (Hawaii Pacific University) to Jeromine Fanjanirina**

*Question/comment*

My question is related to purse seine fisheries with observers industry funded programs. Do you know of any issues with bias/collection of data?

*Response*

*Jeromine Fanjanirina:* problem with these programmes is that the contractor needs to keep the raw data, so that they can send the data directly to Seychelles Fishing Authority (SFA) who has a contract with them. So the data goes directly to SFA, which also uses national observer program data. The plan is to harmonize the contracts between industry and private companies, and ask for that data.

**Steve Kennelly (IC Independent Consulting) to Victor Ngcongo**

*Question/comment*

VIMS system allows to see observer in real time, do you use this for observer safety? To monitor safety?

*Response*

*Victor Ngcongo:* Yes, in two ways. Uses in reach button, which is registered with the Hawaiian coast guard. Observers can send a message to the office to inform if something is wrong with the vessel. Also, for collecting evidence, there is a camera and voice recording in the tablet, and these can be stored. Every day, the observer sends a daily report and the officer needs to validate that report, and that states the observer is ok. Also, daily journal and all other information are stored on the tablet. The tablet is backed up every day, so if anything happens to the tablet they will still have the daily reports. Regarding text messaging: every conversation between officer and observer is recorded.

**Ernesto Altamirano (Inter-American Tropical Tuna Commission) to Maurice Brownjohn**

*Question/comment*

Noticed that data needed to certification seems to be basically the same need as any observers programme. Imagines that certification provides customer with information on good ways to harvest product, and adds value to product. Does the observer get any extra money because they are a part of the certification process? And is the observer trained differently in Papua New Guinea? It seems like they are collecting the same data.

*Response*

*Maurice Brownjohn:* PNAS developed chain of custody system based on an existing system, built on captain's logbooks. Observers training and forms used are all the same, everything is based on existing paperwork. Observers on MSC trips require however additional training. The objective is to help them understand WHY they collect this and additional specific data. They are paid 10USD more to observe on these trips. Observers used in these programs are working in national observers programs.

**Josh With (Hawaii Regional Office) to Victor Ngcongo**

*Question/comment*

Impressed with PNG system, which is decades ahead of the Hawaiian regional office. Eforms come in and then there is debriefing process. Is this debriefing process in person? In real time? What is the process?

*Response*

*Victor Ngcongo:* Pre-debriefing happens when observers send in the daily observers report. After the trip, officer comes in and the observer is debriefed in person. Officer checks all the data with the observer. If the observer is in trouble the data can be sent in in real time. Costs 8000 USD/day. Gets to validate captain reports with observers reports.

**Bubba Cook (WWF)**

*Question/comment*

My question is related to Eric Gillman question regarding confidence in crew sampling. Dave COLpo mentioned that fishers are as smart as all of us, but they are smarter. They can cheat the system. What mechanisms do you have, to feel confident, that they will ensure the reliability of the data that comes into the system? How do you verify?

### *Response*

*Grant Course:* We were not dealing with MSC certification, we just wanted to gather data. Fishers wanted to improved science. Took Archipelago model and looked at 10% of the videos compared to what was declared by fishers. Got anomalies around certain types of information, but in general found high correlation between data. Data on discards were difficult to obtain, while retained catch and effort were easy to obtain. It was however hard to figure out the length of sets.

*Victor Ngcongo:* In our system observers data was the only way to verify crew logbooks. They needed to ensure that whatever data is collected is able to fulfill MSC requirements. Partly to verify captains logbooks.

*Maurice Brownjohn:* Experience tells us that no observer system is 100% full proof, so we use all systems (video, observers on board, etc.) to get higher compliance. Some fishers are dishonest, so you have to account for this. Brian Holman commented on dolphin compliance to NOAA: if we complied, our catch would have no value.

### **Dennis Hansford (NOAA Fisheries) for Victor Ngcongo**

#### *Question/comment*

Alluded to observers as quality assurance on data received. Slide indicated the government financed the programme until 2015. Who pays now the observers? Industry? With industry paying for observers do you feel confident that you still get quality data? Is there a perception of a conflict of interest?

#### *Response*

*Victor Ngcongo:* Yes, industry paid observers. The data that observers deliver is verified by a third party. WWF and other organizations verify the data for bias. MSC assessment team comes every two years to do an audit visit, and the team has to ensure there is no bias in the observer data collected. There is evidence that this programme is positive, as non-compliance is reported. Industry uses data for their own system for punishing those who do not comply. At first there was a perception of a conflict of interest. They have turned down some observer providers for this reason. Their aim was reprehensible. MoU states that they have to report on everything.

*Maurice Brownjohn:* In the pacific region, observers programs are under the national government of each country, boats do not pay observers directly.

### **Lisa Mitchell (APO) for David Karis**

#### *Question/comment*

Do the tablets have the capacity for an observer to send an SOS, and what is the protocol if you do receive an SOS message?

#### *Response*

All messages go directly to service provider. If an SOS message comes up, the Hawaiian Coast Guard rescue picks it up. They locate the position where the GPS signal comes from,

and if a GPS comes from their jurisdiction, or Australian's, they contact the right people. For other areas, there is an established protocol.

**Ernesto Altamirano (Inter-American Tropical Tuna Commission) to Maurice Brownjohn**

*Question/comment*

Sees all these different dolphin safe labels, tuna free tuna label, etc. and wonder if it would not be time to think about consolidation of certifications? MSC certifies fisheries to be sustainable when they do everything correctly, observers programme is perfect, but during the fishing, if the vessel fishes in a closed area, would you consider this fish to be sustainable? In other words, if fishing complied with MSC rules, but not local ones would it still be certified sustainable? If something happens today, next audit meeting happens in 2018, so how do you make certification happen in real time?

*Response*

*Maurice Brownjohn:* The RFMO, yes, wants to see all certifications part of this program. The remaining existent certifications are fraudulent, driven by money. But I would predict future shifts to better certification schemes. PNAS runs 100% VMS on these boats, so sets do get disqualified from MSC if they were fishing outside the right area. People do not like MSC recalls, as it is bad for everyone. So it should be impossible for a boat to get near an MSC certification, when they might get a recall. MSC has a rigorous process. RFMO looks at data years later, so it is difficult to use RFMO data at audit meeting, they get to deal with data in near real time.

*Victor Ngcongo:* In hake fisheries, the areas fished are assessed and the gear footprint is established, and fishing can only happen there thereafter. If they leave this area fishers can lose their fishing license. Observers programme for this project is not the only source of data, but is used to verify other data.

*Lisa Borges:* regarding harmonization of certification labels. The European Commission tried to establish common rules for certification of sustainability, but there was no political will. At the end, the EC only revised the current labels requirements, and added more information. In the EU, we need to wait another 10 years for another policy review.

*Maurice Brownjohn:* about labels again, second slide with shark label. In the bottom of the slide there was a can from Europe, canned in the Indian Ocean and claimed FAO area from the south of New Zealand.

**Unidentified (Pacific Community)**

*Question/comment*

In Hawaii only experienced observers are trained in MSC certification, observers who have at least 6 trips experience. It takes around 3-4 days to do MSC training course.

*Response*

*Ernesto Altamirano:* all management measures that apply here, apply everywhere. Whole Ocean is covered.

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## **Abstracts of presentations that did not provide Extended Abstracts**

### **Marine Stewardship Certification of the South African Hake Trawl fishery – the development of a client-based Observer programme and data collection protocol**

**Victor Ngcongo**

**Capricorn Marine Environmental, Western Cape SA, South Africa**

In 2004, the Hake Trawl fishery became the first fishery in South Africa to be certified by the Marine Stewardship Council (MSC). The certification has been renewed twice and currently remains the only certified trawl fishery in Africa. The MSC assessment relies heavily on information collected by sea-based observers that was initially provided by the state-funded observer programme, known as the Offshore Resources Observer Programme (OROP). Obtaining MSC certification requires rigorous stock assessment, ecosystem sensitivity and collaborative management. Certification resulted in the setting of conditions and the intensive collection of sea-based information. The client (South African Deep-Sea Trawling Industry Association, SADSTIA) addressed each condition through an "action plan" as required by the certification process. With the demise of OROP on recertification in 2010, SADSTIA implemented an independent observer programme in order to sustain the sea-based data collection necessary for closing out the MSC conditions. CapMarine is responsible for the observer programme and works closely with SADSTIA and the management authority (Department of Agriculture, Forestry and Fisheries, DAFF) to collect the data needed. These data include catch estimations of the target species (*Merluccius paradoxus* and *M. capensis*) to facilitate the stock assessment using a depth-base algorithm. Further, observers are trained to identify bird species, bycatch, discard species and also Endangered Threatened and Protected (ETP) species. Observer data have supported the closing out of several MSC conditions including seabird and trawl warp interactions, habitat impacts and the separation of primary and secondary bycatch species. Data collection of a high quality is vital and the programme with SADSTIA is ongoing. It is now an integral part of the MSC certification of the hake trawl sector. The development of the SADSTIA programme has also had a positive spin-off on other fishery sectors, encouraging the hake longline sector to introduce a collaborative Fishery Improvement Project (FIP) with the World Wildlife Fund (WWF). The long-term objectives of developing observer programmes in the region has had a positive influence on other African fisheries by setting a high standard in observer data collection and increasing the potential for more fisheries in the region to work towards sustainability and possibly MSC certification in the future.

## Session 12. How can fisheries monitoring programs support an ecosystem based approach to fisheries management?

**Leader: Eric Gilman**

As agencies throughout the world implement elements of Ecosystem Based Fisheries Management (EBFM), the data requirements from fisheries monitoring programs have been substantially broadened. This session focused on the uses of observer and other monitoring data to underpin the implementation of EBFM. Topics included: accounting for total sources of catch and bycatch; analyzing species diversity, richness, productivity and susceptibility; meeting data requirements for multispecies stock assessments and defining alternative ecosystem-level reference points; monitoring ecosystem pressure, status and response indicators; monitoring broad community- and ecosystem-level effects of fishing; demonstrating adherence to the precautionary approach; and using observer data to design, refine and improve monitoring programs

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### **Oral Presentations - Extended Abstracts**

#### **Designing fisheries monitoring programs to support ecological data requirements for ecosystem-based fisheries management**

**Eric Gilman**

##### **Pelagic Ecosystems Research Group**

The data requirements from fisheries monitoring programs have been substantially broadened as fisheries management authorities throughout the world transition to implementing elements of Ecosystem Based Fisheries Management (EBFM). This presentation opens the conference session, *Fisheries Monitoring to Support EBFM*, which delves into issues on uses of observer and other monitoring data to underpin the implementation of EBFM.

The presentation begins by explaining how elements of EBFM extend, rather than replacing, components of conventional fisheries management systems. We then provide five examples to demonstrate how data from fisheries observer programs underpin the implementation of elements of EBFM. Observer data enable monitoring catch, morbidity and mortality rates and levels of endangered, threatened and protected species and assessing the performance of fisheries bycatch management measures. Observer data provide a subset of the inputs needed to conduct ecological risk assessments, including semi-quantitative productivity-susceptibility analyses and quantitative model-based analyses, including multispecies and ecosystem modeling. Observer data can support estimates of some sources of unaccounted collateral fishing mortality. We conclude with recommendations for meeting EBFM data requirements. See <http://tinyurl.com/data-for-EBFM> for the full presentation.



## 1. EBFM Extends (and Doesn't Replace) Conventional Management

EBFM aims to sustain both the integrity of ecosystems and their services, balance often competing societal objectives and equitably distribute benefits, and extend (and not replace) conventional single-stock, single-fishery approaches of fisheries management systems (Table 1). Even rudimentary fisheries governance systems with limited data and resources can transition to EBFM. Some simple steps towards EBFM are inexpensive and feasible now.

For example, expanding on the first entry presented in Table 1, the EBFM extension to conventional single stock management is a multi-species harvest strategy. An ecosystem-based fisheries harvest strategy includes various elements, including ecosystem-level target and limit reference points (thresholds); harvest control rules (HCRs), which are pre-agreed actions that aim to stay near ecosystem-based targets and to not exceed ecosystem-level limits; and monitoring ecosystem pressures (including stressors from fishing), state and management response indicators, in part to inform evaluations of the performance of the HCR.

Table 1. Examples of elements of an ecosystem approach to fisheries that broaden (and do not replace) conventional fisheries management system approaches.

Conventional	EAF Extension
<b>Single-stock harvest strategy</b> through stock-specific reference points, harvest control rule, monitoring and evaluation	<b>Multispecies harvest strategy</b> through ecosystem reference points; harvest control rules; ecosystem pressure, state and response indicators. Manages effects of fishing on target and associated and dependent species, habitat, and broader effects (e.g., altered tropho-dynamics, size structure, diversity)
<b>Narrow scale</b> , single stocks of principal market species & single fisheries	<b>Nested scales</b> , all manifestations of biodiversity (populations, habitats, communities) within a defined ecosystem, and local to regional fisheries
<b>Stock assessments</b> for principal market species	<b>Multispecies and ecosystem models</b> to assess broad effects of management options (as well as define a system's reference state, patterns and trends in change)

## 2. Observer Program Data Collection to Support EBFM Extensions

### 2.1. Monitor catch, injury and mortality of ETP species and assess performance of bycatch management measures

One component of EBFM is to manage fishery effects on associated and dependent species, including endangered, threatened and protected (ETP) species. Main categories of fields collected by observers in part to monitor & manage bycatch are:

- Vessel characteristics and equipment

- Environmental parameters (e.g., sea surface temperature, Beaufort scale)
- Gear characteristics (e.g., longline hook and bait types)
- Fishing methods (e.g., purse seine set type, vessel position, date/time of operation)
- Catch (e.g., species, length, sex, longline hook number, at-vessel condition, fate, final condition)

These data fields and collection protocols enable monitoring bycatch levels, standardizing bycatch rates, determining what factors significantly explain bycatch and survival rates; and enable assessing the performance of bycatch management measures. Examples of these applications provided in the presentation include: raising observer ETP catch rates to estimate fleetwide annual catch levels; fitting observer catch data to standardized catch and survival rate models to identify factors that significantly explain catch and mortality risk; and comparing nominal and standardized ETP catch rates before and after bycatch mitigation regulations came into effect.

While findings from controlled and comparative experiments are critical to assess the capacity for efficacy and commercial viability, because crew implementation of bycatch mitigation methods that rely on crew behavior during commercial operations can differ from those during research experiments, properly designed analyses of observer data that explicitly account for potentially significant explanatory factors and covariates represent one of the only reliable methods to assess their in-practice performance.

## ***2.2. Conduct semi-quantitative Ecological Risk Assessments***

The most common approach for semi-quantitative ecological risk assessments (ERAs) is to use Productivity Susceptibility Analyses (PSAs). Attributes used to characterize relative susceptibility can be supplied by observer data. For example, the location of fishing grounds; depth of the fishing gear; and seasonal distribution of effort from observer data can be used to determine the degree of overlap between a species and the fishery. Information on gear designs from observer data, such as mesh size or hook size can be used to determine selectivity by species and age class. And, for example, observer data on at-vessel mortality rates (proportion of the catch that is alive vs. dead at haulback before being handled by crew) and fate of catch (retained, released alive or discarded dead) can be used to assess susceptibility.

## ***2.3. Conduct quantitative model-based Ecological Risk Assessments***

Multispecies and ecosystem models include those that define a system's reference state, determine patterns and trends in changes in ecosystem changes in response to pressures, including from fishing, and determine socio-ecological effects from management options. A subset of the information critical for building robust ecosystem models are supplied by observer datasets, including, for example, components of total fishing mortality, the size structure of the catch, the selectivity of fishery removals (relative catchability of functional groups), and temporal trends in mean trophic level of the catch.

## ***2.4. Estimate collateral sources of fishing mortality***

Explained in the previous section, reliable ecosystem models – as well as conventional single stock assessment models - require high certainty estimates of *total* fishing mortality, including from collateral, not readily detectable, sources. Collateral sources of fishing mortality include pre-catch, post-release, ghost fishing, and from cumulative and interacting indirect effects of fishing, such as when repeated sub-lethal interactions result in mortality, when released catch is displaced from habitat used for shelter, or from habitat degradation such as anoxia from discards and habitat loss caused by fishing gear. Tunas and other subsurface predators drive baitfish to the sea surface, making them available to foraging seabirds. Reduced abundance of tunas and other large pelagics due to fishing can therefore affect prey availability to seabirds.

There are sparse examples of fisheries where components of collateral mortality are routinely monitored. For example, observers in the New England trawl herring fishery estimate slipped pre-catch. Many observer programs record the disposition of organisms when returned to the sea – including degree of injury and amount of terminal tackle remaining attached, which can assist in estimating probability of post-release mortality. And in some fisheries observers record abandoned, lost and discarded fishing gear. Pre-catch losses of seabirds caught in longline and trawl fisheries have been estimated by comparing counts of bird captures during setting to the number retrieved during gear haulback.

### ***2.5. Monitor ecosystem pressure and state indicators & assess performance of ecosystem-level HCRs***

Observer data can be used to monitor ecosystem state indicators. For example, observer catch and length data collected by the Hawaii longline observer program enabled an assessment of changes in the relative abundance of species in different trophic levels and in the size structure of the pelagic ecosystem. So, this demonstrates the use of observer data to monitor an ecosystem trophodynamic state indicator that's sensitive to fishing pressure. And, for example, Hawaii longline seabird catch data provide an indication of ocean productivity, where higher standardized catch rates occurred during El Nino-like low ocean productivity conditions— demonstrating how observer data can be used to monitor a pelagic ecosystem state indicator.

## **3. Recommendations to Support Transitioning to Meet EBFM Data Requirements**

Some steps towards EBFM are inexpensive and feasible now, including small changes to observer data fields and collection protocols to:

- Monitor bycatch and assess the performance of bycatch mgmt. measures (e.g., data on hook and bait type, and trends in ETP species standardized catch rates)
- Support ERAs (e.g., multispecies catch data on at-vessel survival rates)
- Increase certainty of ecosystem models (e.g., species and length catch data to estimate trends in mean trophic level of catch)
- Estimate collateral mortalities (e.g., amount of ALD fishing gear)

- Monitor ecosystem pressure and state indicators (e.g., multispecies standardized catch rates and length frequencies to estimate ecosystem size structure)

Furthermore, harmonizing observer data collection protocols would enable sharing resources for training and monitoring, and enable pooling datasets necessary to support large spatial scale analyses.

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## **What level of monitoring is required? An ecosystem risk-based approach for identifying required levels of monitoring programs for Canadian Pacific Coast fisheries**

**By Katie Beach<sup>15</sup>, Howard Stiff<sup>16</sup>, Carole Eros<sup>17</sup>, Dave Barrett<sup>18</sup>**

### **Introduction**

Canada's Department of Fisheries and Ocean (DFO) manages marine fisheries to ensure harvests are sustainable. Management decisions have historically focused on stock productivity, but since the early 2000s, DFO has increasingly considered broader ecological impacts. The need to increase understanding of these impacts was spawned by a myriad of ecosystem and economic challenges to existing management regimes. These challenges include: climate change, declining and/or more variable fish stock abundance, reduced economic viability in some fisheries, an evolving global marketplace, heightened competition for aquatic resources, and more consumer interest in ensuring the sustainability of products they consume. Moreover, international and domestic commitments compel DFO to adopt a broader ecosystem-based approach to resource management.

In its 2012 *Strategic Framework for Fishery Monitoring and Catch Reporting in the Pacific Fisheries* (The Framework), DFO Pacific Region has moved toward ecosystem-based management by basing catch monitoring standards on ecological risk. Since not all fisheries operate the same or have the same impacts, the purpose of the Framework is to provide a common understanding and approach to establishing fisheries monitoring and catch reporting standards, and to provide guidance to resource managers and harvesters on how to develop appropriate monitoring programs with specific ecological risks associated with each fishery.

This paper describes a structured risk-based analysis of the impacts of fisheries on species, stocks and habitat. Aside from basic catch data and biological sampling from the target stock, information requirements of this risk assessment include: ecological impacts on habitat and on target and non-target species (including releases of fish, seabirds, marine mammals, etc.) and encounters with species that are not captured but still impacted. The risk assessment runs through a scoring process based on the Framework to determine the

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required level of monitoring and guides the development and implementation of catch monitoring programs that respond to diverse information needs and risks as required.

### **Process of development of risk assessment tool**

The Framework is meant to ensure that monitoring programs were developed with the following principles of resource management:

1. Conservation and Sustainable Use of the resource.
2. Consistency and Transparency of the decision making process.
3. Tailored requirements.
4. Shared Accountability and Access.
5. Cost Effectiveness.

To help with implementation of the Framework, DFO enlisted the advice of the Pacific Fisheries Monitoring and Compliance Panel (M&C Panel). This M&C Panel was formed as a collaborative and inclusive forum where various interests could work towards sustainable fisheries and where cross-sectoral conversations could safely and respectfully occur with respect to developing innovative solutions to on-going challenges. Participants range from community leaders from the First Nations, commercial, recreational, environmental non-government organizations (ENGOs), Fisheries and Oceans Canada (DFO) and the Province of BC as well as representatives of wider public concerns.

The M&C Panel contracted consultants Katie Beach and Howard Stiff to develop a risk assessment model to help standardize the application of DFO's 2012 Strategic Framework. Until now, a number of tools had been developed ad hoc to assess the ecological risks of fisheries and to guide the development of Catch Reporting and Fishery Monitoring (CR&FM) programs, but these exercises did not always compare the same variables nor did they do so equally. Furthermore, there was an obvious need for greater collaboration with industry and experts outside of the Department. As a result, DFO asked the M&C Panel to take on the development of the Risk Assessment Tool.

The Framework described the risk factors to be used (which extended beyond target species and included non-target interactions and impacts on habitat), the scale to be used to value risk (1-9) and a risk equation (consequence x likelihood).

### **The Risk Assessment Tool**

There are six sections to the tool.

- Part A defines the fishery (e.g. gear used, timing of analysis, size and catch capability);
- Part B undertakes the ecological risk assessment;
- Part C provides an opportunity to consider resource management factors that influence decisions;

- Part D shows the calculated ecological risk scores;
- Part E shows the final risk scores, and resulting fishery monitoring target level;
- Part F provides room for notes.

To design the risk assessment tool, we used ecosystem and management factors that were identified in the *Framework*. We grouped the factors into three categories that dealt with ecosystem risks, and one that dealt with resource management variables. These categories were:

	Ecological Risks			Resource Management
	Impacts on the Main Species/Stock	Impacts on Retained and Released By-catch	Impacts on the Ecological Community and Habitat	Resource Management Considerations
Factors	<ol style="list-style-type: none"> <li>1. Status of Main Species/Stock</li> <li>2. Vulnerability</li> <li>3. Behavioural Changes</li> </ol>	<ol style="list-style-type: none"> <li>1. Status of Retained By-Catch</li> <li>2. Vulnerability of Retained By-catch</li> <li>3. Status of Released By-catch</li> <li>4. Vulnerability of Released By-catch</li> </ol>	<ol style="list-style-type: none"> <li>1. Impacts on key predators or prey species</li> <li>2. Direct Habitat Impacts</li> <li>3. Indirect Habitat Impacts</li> </ol>	<ol style="list-style-type: none"> <li>1. Type of Fishery</li> <li>2. Potential to Overharvest</li> <li>3. Compliance and Enforcement History</li> <li>4. International and Treaty Criteria</li> <li>5. Info to manage other fisheries</li> <li>6. Public relations</li> </ol>

The final risk score drives the monitoring program towards a Low, Generic, or Enhanced monitoring level. DFO then works with the user groups to design an appropriate monitoring program that addresses the areas of risk and is cost effective.

### The benefits of the Risk Assessment Tool

The risk assessment tool presented here has important benefits related to transparency when implementing the 2012 Strategic Framework. These benefits include:

- Ensuring that decisions are made using consistent risk factors across all Pacific fishery assessments.
- Asking respondents to enter both a value and a rationale for the value. This provides transparency of decisions that can help fishery interests to understand why decisions are made and what risk factors are driving those decisions.
- Directing conversations between DFO and fishery interests on the ecosystem and management risks of a fishery. Through these conversations, better understanding about why decisions are made about required levels of monitoring can be established.
- The structure of the assessment allows users to see the areas of risk and particular factors that drive decisions. This can lead to tailored solutions. For instance, if a fishery has no issues with by-catch or ecological community and habitat impacts, then a FR&CM program can use a cost effective dockside monitoring program that focuses on landed catch, instead of more costly at-sea monitoring. At-sea monitoring may still occur under this example, but it can be done at a lower level and resources can instead focus on dock-side monitoring.
- Re-evaluation of a fishery is possible. This allows managers and interest groups to track how successful management measures are.

### **The challenges**

The authors noted some challenges in designing a risk assessment model that would cover all Canadian Pacific Fisheries. The challenges include:

- Applicability across all species and fishing methods. The descriptions and examples used to explain each risk factor was especially challenging since there are numerous terms used in fisheries management throughout different fisheries in B.C.
- Applicability to complex fisheries or species. For instance, many salmon species have weak year classes when the risk may be high but an enhanced monitoring program may not be needed or cost effective for other year classes.
- Qualitative nature of assessments. Although we tried to set bounds on answer options, it is still possible that one user group may rate their fishery differently than another group.
- Display platform. The authors decided to use an Excel-based tool because almost everyone can access Excel and it is relatively easy to use. However, users must add comments for each risk rating and that does not make it easy to see or use. In the future another assessment tool may be appropriate.

For more information, see

Fisheries and Oceans Canada (DFO). 2012. Strategic Framework for Fishery Monitoring and Catch Reporting in the Pacific Fisheries.

## **Azores Fisheries Observer Program and COSTA Project: an example of cooperation to achieve sea turtle conservation objectives**

**Carla Damaso<sup>4</sup>, Miguel Machete<sup>1,2</sup>, Marco Santos<sup>3</sup>, Hugo Parra<sup>1,2</sup>, Maria Joana Cruz<sup>4</sup>, Christopher Pham<sup>1,2</sup>, Frederic Vandeperre<sup>1,2</sup>**

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Accidental capture of juvenile loggerhead sea turtles (*Caretta caretta*) during the oceanic stage is a well recognised issue for their conservation. While great effort has been invested in protecting nesting populations on the Atlantic coast of the USA, few measures are currently in place to protect juveniles from interactions with surface longline gear.

The Azores is a Portuguese Archipelago situated in the centre of the North Atlantic with an EEZ covering almost 1 million km<sup>2</sup> (extended continental shelf of Portugal could cover 3.9 million km<sup>2</sup>). The area is considered important for juvenile loggerheads that originate mainly from rookeries in the south eastern USA (90%) (Bolten et al. 1998, Bolker et al. 2003, Okuyama and Bolker 2005). Although available data suggest high by-catch rates (0.27/1000 hooks; Ferreira et al. 2001) in areas with high fishing effort (Mejuto et al. 2008), there is currently no abundance estimate for the region. Based on demographic, tagging and telemetry data, the residency times in the area are estimated to last several years (Bolten 2003). During this time, sea turtles show a strong association with the seamounts that are abundant in the area, probably for feeding and navigation (Santos et al. 2007).

Conservation of North Atlantic loggerhead sea turtles will necessarily need to be the object of a coordinated international effort. Yet, it is clear that the Azores will fulfil a key role in this process, because of its importance for the species, high longline fishing effort, central location and extended jurisdictional area.

Sea turtle research and conservation in the Azores started to develop strongly during the early 1980s, fruit of the collaboration of scientists from DOP/IMAR with Archie Carr, and later the Archie Carr Centre for Sea Turtle Research (ACCSTR) of the University of Florida. This collaboration, which was initially mainly restricted to the sea turtle tagging program, turned out to be instrumental in establishing and validating the “lost year” theory for North Atlantic loggerheads (Bolten et al. 1998). The collaboration later extended to other projects such as the satellite tagging of sea turtles to investigate their migratory patterns (Bolten 2003) and a five year project (2000-2004) to investigate the effect of gear modifications on the by-catch of loggerheads in the longline fishery (Bolten and Bjorndal, 2005). All this research projects resulted in an exceptional local awareness for conservation issues relating to loggerhead sea turtles and a unique involvement of the island communities. Yet, during the last decade research programs on sea turtles in the Azores gradually decreased and



awareness on issues regarding sea turtles decreased accordingly, in particular with regard to the younger generations.

The ongoing COSTA project (start in August 2015) was conceived to invert this negative tendency. Firstly, the project aimed to complement by-catch data from the longline fishery within Azorean waters. Secondly, the project aimed to restructure and consolidate long-term scientific programs, in particular the conventional tagging and sampling program. Both of these actions will support the ongoing development of a regional maritime strategy (Marine Strategy Framework Directive - MSFD, 2008/56/EC; Maritime Spatial Planning Directive – MSPD, 2014/89/EU) and are also utilized to promote awareness on sea turtle conservation issues, be it through the dissemination of best handling practises to fishermen or through the involvement of the local community and tourists in the scientific programs.

The COSTA project allowed us to successfully establish an observer program for the Portuguese surface longline fishery that is coordinated by the Azores fisheries observer program POPA (Programa de Observação das Pescas dos Açores) and is relying on a network of fishing associations, vessel owners and captains. The observers themselves are instrumental in building this network, as it strongly relies on the relationship of trust that they cultivate during their activities. Within the first year (Sep 15, 2015 – July 31, 2016) the two observers performed 375 sea days and observed 207 fishing operations (203975 hooks) onboard eight different vessels.

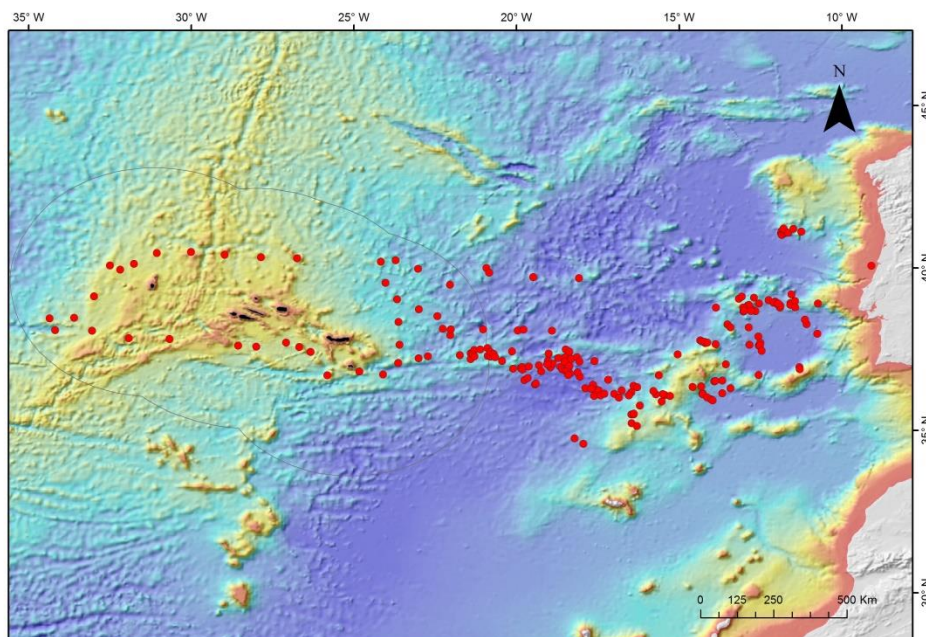


Figure 1 – Set locations of the longline fishing operations covered by COSTA observers between September 2015 and August 2016.

The spatial coverage of the observer program reflects the seasonal activity of the Portuguese fleet, and therefore covers both the area between the Iberian Peninsula and the Azores (mainly autumn-winter, 156628 hooks deployed) as well as the Azorean EEZ (mainly spring-summer, 47347 hooks deployed). Provisional by-catch rates of loggerheads within the Azores EEZ (0.04 turtles/1000 hooks) are significantly lower than previous estimates for

the area (0.27/1000 hooks; Ferreira et al. 2001). Yet, we are still striving to obtain more adequate observer coverage before drawing conclusions, because the fishing operations were largely performed during different seasons. Outside the EEZ, observed by-catch rates averaged to 0.15 turtles/1000 hooks. In addition, the observers also recorded an average by-catch rate of 0.06/1000 hooks for leatherback sea turtles. The observers further collect relevant data for conservation and resource management: 1/ catch information on target species, namely blue shark, mako shark and swordfish, which display high levels of juvenile by-catch, and 2/ catch information on species of conservation interest such as pelagic sharks (e.g. thresher sharks).

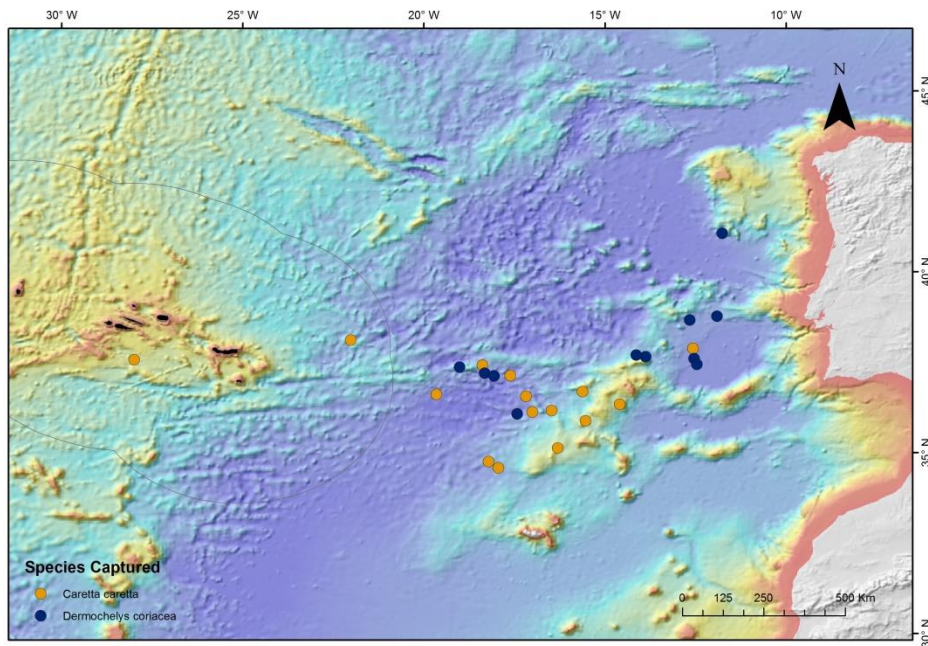


Figure 2 – Capture locations of loggerhead and leatherback sea turtles in the Portuguese longline fishery recorded by COSTA observers (period September 2015 to August 2016).

Finally, the COSTA project allowed us to develop new initiatives related to the issue of marine litter. Interaction with marine litter is, besides accidental capture in fisheries, an important threat for sea turtles, and in particular during their oceanic stage (Schuyler et al. 2014). Our observers therefore started gathering data on the distribution of floating marine litter by performing standardised transects during transit. Accurate information on this distribution will allow us to assess if the interaction in oceanic areas is related to areas of high litter accumulation, as current assessments fail to make this link (Schuyler et al. 2014).

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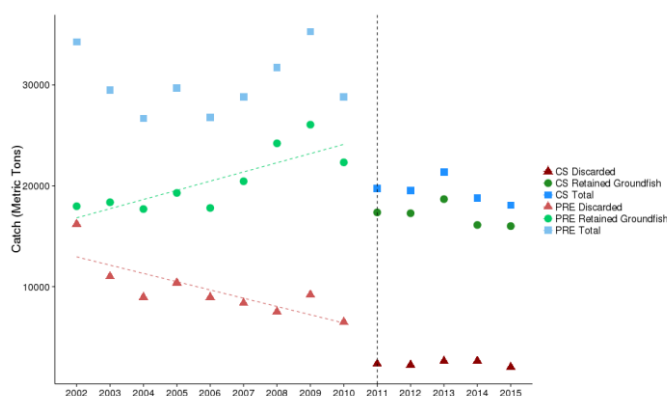
## Discard Trends in a Rationalized Fishery

Kayleigh A. Somers, Jason E. Jannot, Jon T. McVeigh

### NOAA Fisheries

In 2011, Individual Fishing Quotas (IFQs; a catch shares [CS] program) were introduced to the U.S. west coast groundfish bottom trawl fishery. IFQs create individual accountability for landings and discards, improving economic stability for fishermen and long-term sustainability for fish stocks. CS programs should incentivize ecologically sustainable fishing practices, such as reducing discard of overfished stocks. The few studies examining the ecological sustainability of CS programs focus mainly on target and overfished stocks and ignore species outside of the formal IFQ framework, which are rarely accounted for in

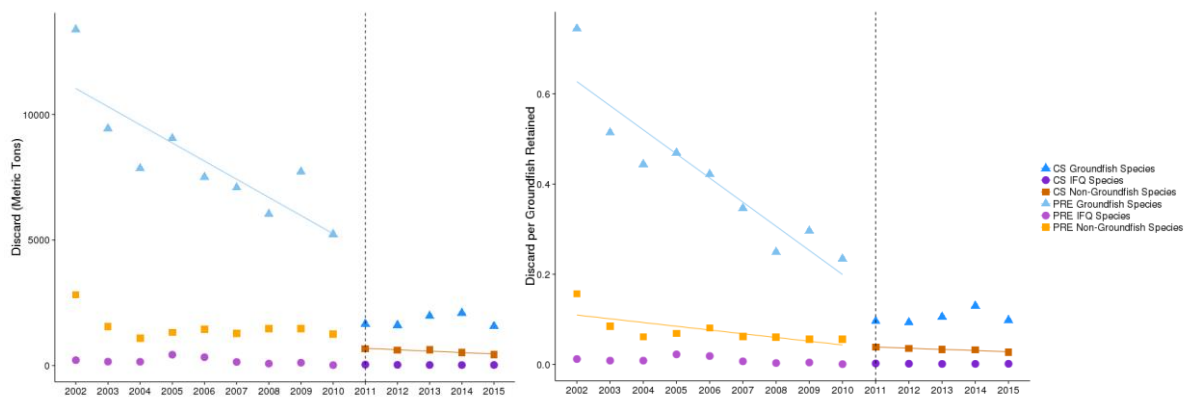
landings or compliance program data.



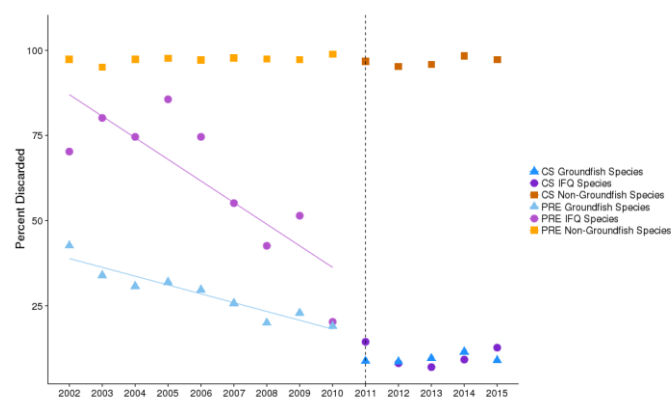
In these cases, observer data is often the only data source available to assess the impacts of a fishery at the ecosystem level. We used data from

the West Coast Groundfish Observer Program (WCGOP) to take a more holistic, ecosystem-based approach and explore how trends differ between species explicitly managed by IFQs, species managed by the Fishery Management Plan (FMP), and ecosystem component species caught but not managed within the FMP. Specifically, we asked how trends (based on linear models) and amounts (based on unpaired t-tests) for these groupings differed in terms of discard and retained amounts, rates, and proportions before and during CS management.

From 2002 to 2015, the total amount of discard and catch have shown significant, decreasing trends. Prior to CS implementation, from 2002 to 2010, retained groundfish showed an increasing trend, but no significant trend was evident during CS management or across the entire time period of 2002 to 2015. After CS implementation, the amount of discard, groundfish retained, and total catch have stabilized and do not show significant trends. Discards and total catch are at historic lows, while groundfish retained during CS management is similar to the lower range prior to CS implementation.



Total discard amounts and rates of IFQ and FMP- and non-FMP-managed species all showed significant decreasing trends from 2002 to 2015 and were significantly lower after CS implementation. FMP-managed species showed the greatest decreases, followed by non-FMP-managed species. Although statistically significant, the reduction in discard amount and rates of IFQ species was minute, likely because both variables were very low throughout 2002 to 2015.



The percent of catch discarded was significantly lower and maintained historic lows after CS implementation for both IFQ and FMP-managed species, both of which showed negative, decreasing trends from both 2002 to 2015 and 2002 to 2010. Non-FMP-managed species, however, showed no trend and 97% were both before and after CS implementation.

Species outside of the formal IFQ management framework, although not targeted, are an important part of a healthy ocean ecosystem and a high-yielding fishery. Using observer data, we are able to see the ways in which management impacts all species in the ecosystem, not just those that were targeted by regulation. These results highlight how management actions focused on a subset of species impact the discard behavior of all species encountered in a fishery, and these behavioral changes should be more explicitly incorporated into assessments of the CS program and management plans in general. With scientific data from observer programs, management can measure success beyond regulatory compliance, consider ways to better protect the ecosystem as a whole, and react quickly when a species not directly managed yesterday becomes of interest today. While CS management has reduced the percentage of IFQ species catch that are discarded, observer data shows that nearly all non-FMP species encountered continue to be discarded and highlights a potential area on which to focus future regulations. These results highlight the need to incorporate observer data in the design of additional management techniques for CS program to function within a truly ecosystem-based framework.

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## **Using Bite Times To Adjust Longline Soak Times And Increase Efficiency While Reducing Protected Species Interactions**

**Matthew DUFFY**

### **NOAA Fisheries**

In order to more effectively manage the world's fish stocks, managers must begin looking at the entire ecosystem as opposed to the older method of single species management. This Ecosystem Based Fisheries Management (EBFM) provides many benefits by creating a wider perspective, including creating a more stable foundation, allowing stock that have been and are being overexploited to rebound faster, and reducing the incidental take of protected species and bycatch. The Galveston Observer Program (GOP) spearheaded a study<sup>1</sup> that was used to determine the optimum soak times in bottom longline targeting primarily red grouper (*Epinephelus morio*) while reducing the amount of take of protected species, such as sharks and sea turtles.

The sea turtle mortality associated with fisheries in the Gulf of Mexico (GOM) has been a contentious issue for years. Many attempts have been made to decrease the number of sea turtle interactions with the predominant fisheries, including shrimping and bottom longlining, in the GOM without interfering with the fishers' ability to make a living harvesting from the ocean. In the case of bottom longlining, measures such as seasonal closures, hook limits, decreasing fleet size and fishing depth restrictions have been implemented. While these have decreased significantly the number of interactions, there are still numerous turtles caught with longline gear. According to studies<sup>2</sup>, sea turtle mortality increased substantially when tow times in shrimp gear exceeded 50 minutes. This, when compared to longline mean soak times of 116 minutes (NMFS, unpublished data), could be key to further decreasing sea turtle mortality in the longline fishery.



A study was performed in two separate phases to determine the average time hooks were bitten after deployment. The first phase ran from September to December of 2010 and the second phase ran from January to May of 2013. Observers were placed on vessels, and they recorded times when the timers went in the water by section, time when the timer was retrieved, as well as elapsed time on the timer. Time Depth Recorders were placed along the line to measure the time it took to sink. Capture times were calculated using recorded times using  $\text{Capture Time} = \text{Time Boarded} - \text{Elapsed Time on timer} - \text{Sink Time} - \text{Section deployment time}$ . These studies discovered a lot of valuable information regarding how selectively a longline fishes based on soak time in the first phase and soak time as well as bait type during the second phase. The research found that relatively shorter soak times were optimal for catching stationary scavengers, like grouper and snapper, while longer soak times wound up catching a higher number of migratory foragers, like sharks, and, for the purpose of this study due to their similar foraging style, turtles. In fact, after a soak of 46 minutes, over 90% of the targeted grouper were caught, and the line was almost exclusively catching only migratory foragers (sharks and turtles) after that. Fish catch rates tapered off exponentially, while shark catch rates were considerably more linear, further proving this (figure 1).

The second phase of this study also examined effects of bait type on catch rates as well as whether the fish were of legal size or not. 4 types of bait were used: herring, ladyfish head, skate and squid. The findings indicated that ladyfish head had the lowest catch rates of undersized grouper while still catching legal sized grouper, whereas skate had low CPUE on all grouper size classes, and squid caught more of both size classes (figures 2 and 3). One side effect of note is that the addition of the hook timer increased catch rates significantly when compared to a gangion without a timer (figure 4).

The data collected can easily be used by managers to implement new measures to decrease incidental take, while simultaneously increase the fishers efficiency. Shorter soak times would result in less turtles and sharks being caught, those that were caught would be released relatively quickly (optimally the longest soak time would be 46 minutes), and the fishers could set more lines, more hooks and subsequently catch more fish.

1. Foster, Daniel, Pulver, Jeffrey, Scott-Denton, Elizabeth, Bergmann, Charles, in preparation. Factors Affecting Capture Time for Species Taken in the Commercial Bottom Longline Fishery in the Eastern Gulf of Mexico.
2. Sasso, C.R. and Epperly, S.P. 2006. Seasonal sea turtle mortality risk from forced submergence in bottom trawls. *Fish. Res.* 81: 86–88.

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## **Open Discussion Session**

Following the seven presentations the participants and panelists discussed several issues related to how fisheries monitoring programs can meet ecological data requirements for ecosystem-based fisheries management.

The following is a summary of the main topics of discussion.

### **How should data fields be prioritized for collection by onboard human fisheries observers given the increasing data requirements of EBFM?**

Panelist Matt Duffy provided examples from his presentation demonstrating how observer data on bait type and gear soak times can be easily collected by observers, and provide information to mitigate problematic bycatch. Panelist and session chair Eric Gilman drew on examples from his presentation, demonstrating that even relatively data-deficient fisheries with rudimentary management systems can adopt some steps towards EBFM that are inexpensive and feasible now. This includes small changes to observer data fields and collection protocols to support the various elements of EBFM, including, for example, the changes recently made by the Western and Central Pacific Fisheries Commission, a tuna regional fisheries management organization, to the pelagic longline regional observer program data collection protocols to improve monitoring bycatch.

### **How can outreach to fishermen support higher compliance?**

The participants discussed how fishers are reluctant to change longstanding practices, despite empirical evidence from research. Outreach efforts can augment fishing community support for changes in fishing methods and gear that reduce, for example, bycatch and discards. Panelist Rodrigo Vega drew on the example he provided in his presentation on how gradually building the trust of the fishermen led to their support to increase logbook submissions and in allowing observers on their vessels. The observer program for the Chilean purse seine fishery for small pelagics has been effective in part due to the incorporation of land-based interactions between the observers and fishers – gradually building trust between them. Observers play a critical role in providing outreach to fishers – explaining how to comply with regulations. Some participants who are fishery observers shared that they are underpaid and feel underappreciated, and desire to be viewed as biologists who relay information to fishers on the science behind the data being collected.

### **When changes to observer data collection fields and protocols are proposed, there is a need to account for the burden on institutions and observers.**

Drawing on examples from the first presentation in the session by Eric Gilman, there are numerous examples of small changes and additions to observer program data collection fields and protocols that are a nominal burden on observers and can contribute substantially to understanding ecological effects of fisheries. However, modifying the observer data collection methods has an institutional burden that can be high, including changing observer training methods. In some cases there may be observer data collection protocols that are not useful, and should be dropped from the observer requirements. An example of how gradual changes to the Hawaii longline observer program methods for conducting seabird scan counts was referenced as an example of how observer protocols were amended over time to balance the demand on observers' time and data quality, where scan counts during setting were reduced to once at the beginning and once at the end of sets, but every hour during the haul, where during setting the observer needs time to sleep and eat.

## **Poster Presentations – Extended Abstracts**

### **Modeling Community Structure and Species Co-occurrence Using Fishery Observer Data**

**Jeffrey R. Pulver**

**NOAA Fisheries, Reef Fish and Shrimp Observer Program. Galveston, TX, US.**

#### **Introduction**

The incidental captures of undersized or non-target species (bycatch) are of great concern to fishery managers due to the overexploitation of stocks not only in the Gulf of Mexico (Gulf) but worldwide. Selective fishing and its consequential bycatch have a range of unintended effects such as modifying food webs and ecosystem structure, altering energy flow and species interactions, and reducing system resilience and fisheries production. The commercial Gulf reef fishery targets primarily groupers (*Epinephelus* sp. and *Mycteroperca* sp.) and snappers (*Lutjanus* sp.) using two primary gear types, bottom longline and vertical line. This fishery also has incidental bycatch for a number of species.

Analyzing fishery observer data from the Gulf deepwater reef fish fishery for community structure can provide an opportunity to examine the current quota management system that has undergone many changes in the past decade. The most recent change is a shift from a "derby" style fleet-wide quota system to an individual fishing quota (IFQ) allocation for each permit holder based on historical landings for a number of species. Managers often create quota allocations based on historical landings using logbook data<sup>19</sup>. By using fishery observer data that includes site-specific abundance information, more accurate representation of community structure can be derived.

Fishery managers can make better-informed decisions when determining multi-species IFQ allocation categories if patterns in species co-occurrence and stratifications in the fishery could be readily identified using fishery dependent data. The objective of this research was to compare the utility of analytical tools necessary for quantifying species relationships and revealing stratifications, if existing, for multi-species fisheries<sup>20</sup>.

#### **Methods**

The mandatory reef fish program incorporates a randomized selection process to select federally permitted commercial reef fish vessels for observer coverage stratified by season, gear, and region<sup>21</sup>. To limit the scale of the study, only fishery observer data collected on

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<sup>19</sup> Shertzer, K.W., and Williams, E.H. 2008. Fish assemblages and indicator species: reef fishes off the southeastern United States. *Fishery Bulletin*, 106: 257–269.

<sup>20</sup> Pulver, J.R., H.Liu, and E. Scott-Denton. 2016. Modelling community structure and species co-occurrence using fishery observer data. *ICES Journal of Marine Science*. doi:10.1093/icesjms/fsw033.

<sup>21</sup> Scott-Denton, E., and et al. 2011. Descriptions of the U.S. Gulf of Mexico reef fish bottom longline and vertical line fisheries based on observer data. *Marine Fisheries Review*, 73: 1–26.



vessels from 2006 through 2013 using bottom longline and vertical line gear from depths  $\geq 100$  m were included in the analyses. The deepwater grouper IFQ allocation is not for a single species but instead comprises four different grouper species: snowy grouper (*Epinephelus niveatus*), speckled hind (*Epinephelus drummondhayi*), warsaw grouper (*Epinephelus nigritus*), and yellowedge grouper (*Epinephelus flavolimbatus*). The tilefish IFQ allocation consists of three species: blueline tilefish (*Caulolatilus microps*), goldface tilefish (*Caulolatilus chrysops*), and golden tilefish (*Lopholatilus chamaeleonticeps*).

The hierarchical cluster analyses (HCA) were conducted on data sets with both gear types combined, each gear type, the most common species with  $\geq 1,000$  captures, and the IFQ-managed species to investigate consistent patterns in the species assemblages. Additionally, the IFQ-managed species were separated into two groups of retained and discarded, e.g., retained and discarded blueline tilefish, to analyze patterns in retention rates for each fishing set. Count data were converted to log-transformed abundance prior to HCA to reduce the influence of outliers and normalize the data. For this study, the correlation and Bray-Curtis dissimilarity measures were compared for each grouping of the analysis (Figure 1). The HCA was done using the package 'pvclust' in R with 1,000 multiscale bootstraps to create probabilities to evaluate the statistical significance in each cluster or stratification<sup>22,23</sup>.

In addition to the HCA with multiscale bootstrapping, simulated random data were included with the actual catch data to verify species stratifications and compare methods of dissimilarity and linkage. The simulated random data used for comparisons in this study were five species with a 0.5 probability of occurrence during the fishing sets with abundance equal to the mean positive abundance for that dataset. We compared stratifications in the dendrograms using significant clusters for species stratifications with a bootstrapped probability  $\geq 0.95$ . The significant stratifications were used to reveal patterns in covariance between the IFQ-managed species managed with multi-species deepwater quotas. By comparing these patterns in covariance with the retention rates observed, insights can be derived into fisher behavior during fishing sets.

## Results/Conclusions

From 2006 through 2013, in depths  $\geq 100$  meters, observers recorded a total of 117,702 reef fish captures. Of these captures, 99,510 fish were recorded from vessels using bottom longline gear, and 18,192 from vertical line gear. A total of 3,194 fishing sets with captures recorded were observed for both gear types, of which 1,978 were bottom longline sets, and 1,216 were vertical line sets. A small number of species groupings dominated the catch with the 10 most abundant species accounting for  $> 78\%$  of the number of captures, and the 3 most abundant comprising  $> 50\%$ . Yellowedge grouper, golden tilefish, and blueline tilefish were the three most abundant species observed and were primarily captured using bottom longline gear.

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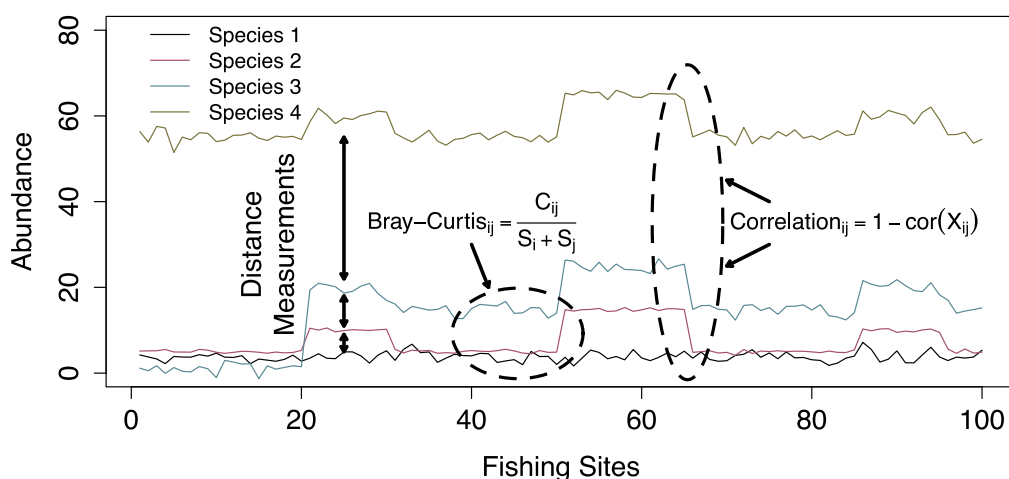
<sup>22</sup> R Core Team. 2015. R: a Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0.

<sup>23</sup> Suzuki, R., and Shimodaira, H. 2011. pvclust: Hierarchical clustering with p-values via multiscale bootstrap resampling. R package version 1.2-2.

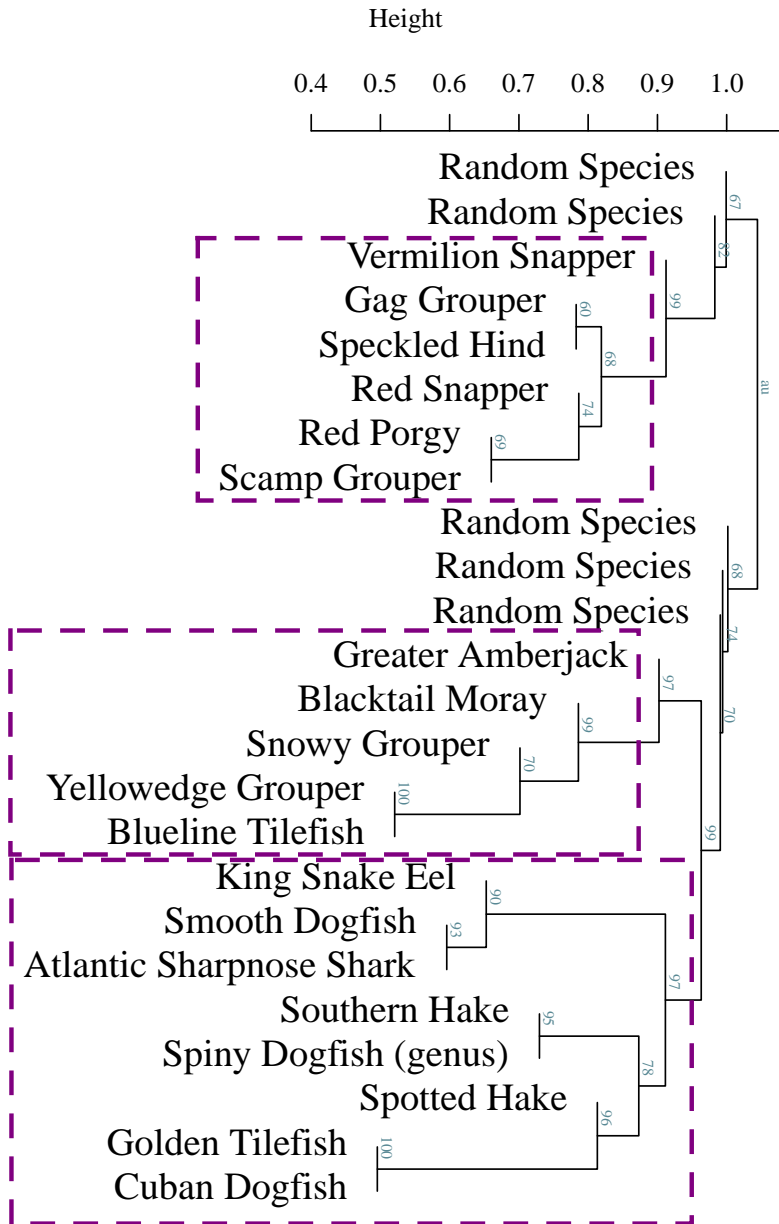
For examining community structure with HCA, the most consistent method for filtering out the simulated random species across all subsets of the data was the correlation measure of dissimilarity with average agglomerative linkage (Figure 2). When the IFQ-managed species disposition was added for cluster analysis, previous stratifications were evident such as retained and discarded golden tilefish clustering significantly together, but not with any other IFQ-managed species (Figure 3). Blueline tilefish being kept and discarded clustered significantly with yellowedge grouper, snowy grouper, and speckled hind that were retained. Discarded yellowedge, snowy, and speckled hind grouper significantly clustered together indicating that they are not being retained during the same fishing sets.

This research is of primary interest to fisheries scientists and managers interested in deriving insights from stratifications or species co-occurrence using fishery observer data. The techniques presented are useful for determining if multi-species quota allocations could be divided into more or less distinct management units based on their stratification and co-occurrence. Using the multi-species IFQ-managed tilefish as an example, a refinement of the current allocation category into more distinct units (i.e., golden tilefish separately) may be warranted since evidence exists that this species has minimal co-occurrence with other IFQ-managed tilefish and grouper species only occurring with yellowedge grouper on some fishing sets. Figure 3 suggests the intention of fishers to selectively target golden tilefish separately from the other IFQ-managed species on fishing sets.

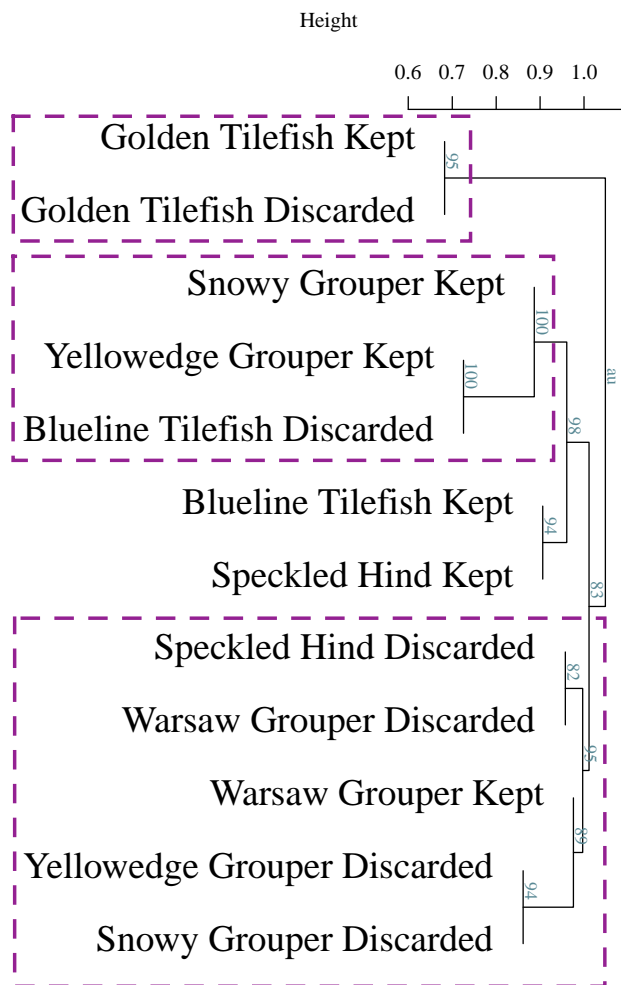
As an initial quantitative study on Gulf of Mexico bycatch issues, this research is an important step in advancing ecosystem-based fisheries management through our increased understanding of the complex marine environment. The statistical techniques presented in this study can be applied for analyzing fishery observer or independent data to reveal underlying stratifications and co-occurrence in other regions. These approaches provide fishery managers useful tools for visualizing community structure when proposing actions that can affect multiple species and will be highly valuable in assessing the potential impacts of regulatory mandates.



**Figure 1.** A hypothetical illustration of different species abundance over multiple fishing sites to compare measurement choice. Species 1-3 would be most similar using Bray-Curtis due to smaller count differences. Species 2-4 would be the most similar using correlation because of corresponding linear changes in association.



**Figure 2.** Dendrogram of simulated random species and species with >1,000 captures observed using the correlation measure of dissimilarity with significant stratifications.



**Figure 3.** Dendrogram of deepwater IFQ-managed reef fish species with retention information and significant stratifications.

## How can fisheries monitoring programs support an ecosystem based approach to fisheries management

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It is unquestionable that commercial fishing operations have an impact on the ecosystem. The degree of said impacts depend on numerous factors such as fishing pressure, species targeted, bycatch, seasonal variances in species abundance and diversity, effects regarding interactions with wildlife, and impacts on the habitats themselves.

The ecological impact of the fishery would be heavily influenced by which trophic level the target and by-catch species occupy. Fisheries that target top level predators, such as tuna, billfish, sharks, etc. would have significantly different impacts from fisheries targeting forage species such as smelt, mullet, shrimps, etc. It would come as no surprise that both high and

low trophic level target fisheries would have impacts on each other. Observers monitoring low trophic targeted fisheries could identify and estimate predator numbers interacting with the fishing gear, such as fishes, sharks, birds and mammals; since species that prey upon the targeted catch would likely be in the area of fishing operations. Observers monitoring high trophic targeted fisheries could collect stomach contents of retained fishes for analysis of prey species that are being fed upon. This data could be used to determine if low trophic targeted fisheries could be affecting the prey availability to upper tier predators. While proper, accurate analysis of these stomach contents may require techniques and tools not readily available to observers in the field, the observers could at least collect stomachs or stomach contents and preserve them to be sent to labs for analysis. Observer programs could also aid in ecosystem assessment by comparing catch data from previous years to determine any shifts in populations of both targeted and bycatch species over the years.

The interactions regarding feedings on discards by predatory species would be important in several regards. A significant impact of fishing operations would be the modification of predatory behavior. It is very common for predatory species such as sharks, birds, fishes, and mammals to follow commercial fishing vessels to feed on the discards. One aspect is that the species being fed upon might not be a significant part of the predators' normal, natural diet. An example of this would be the feeding of discarded grouper and snapper entrails by birds in the Gulf of Mexico. It is unlikely that these entrails would normally be a regular staple of the diet of sea birds, and many of these birds will follow a vessel to feed upon these discards for the duration of the fishing trip. It is possible that there would be physiological effects on the animals due to this shift in diet. Or for instance, species that are discarded that would not normally be preyed upon could be targeted by predators after becoming accustomed to feeding upon them as bycatch discards. Another potential impact with predator interactions is the shift of the role of the predator that would normally target the sick and weak of natural prey species, to one of a scavenger feeding upon discards of commercial fishing operations. These scavenging behaviors can be passed on to offspring in birds and mammals, who often learn foraging techniques from their parents in their early stages of life. This type of behavioral shift could also impact the populations of prey species, allowing them to proliferate since some of their natural predators would have shifted their focus to scavenging of discards. The scavenging behavior could also put the wellbeing of these animals at risk by their coming into close proximity to fishing operations and increasing the risk of entanglement in gear. It would be pertinent to investigate whether the shift of predators foraging on fishing vessel discards and catches is a result of utilizing an easier source of food or a result of their normal, natural forage being depleted, with commercial fishing vessels playing the role of a competitor for available prey. Indirect feeding behaviors, such as utilizing lights of the fishing vessels to hunt prey not caught in fishing operations could also have an impact on animal behaviors. One example of such behavior is that of spotted dolphins utilizing the bright fluorescent lights on shrimp boats to hunt flying fish that fall under the lights. Observers could also note non-feeding interactions that occur. Sea birds often utilize fishing vessels as a floating resting place, although this can also be attributed to the feeding on discards. Interactive play behavior with fishing vessels, namely from marine mammals, such as bow riding and playing with fishing gear (floats, ropes, etc) that could potentially result in harm, would also be worth recording.

Observers could also focus on identifying invasive species, such as the lionfish (*Pterois* species) and Asian tiger shrimp (*Penaeus monodon*) in the Gulf of Mexico and southeast

Atlantic, to determine the spread, seasonal movements, and population dynamics of invasive species and their potential impact on fisheries and the environment. Observers could retain specimens of these invasive species for genetic studies and age/growth determination. An analysis of stomach contents and feeding habits of these invasive species could determine whether these species are actively preying upon commercially targeted species or acting as a competitor for resources with targeted species. Stomach content analysis of targeted species could also reveal potential predation opportunities of these invasive species for commercially important species.

A significant ecological impact of commercial fisheries is on the environment itself. Lost gear, snagging on structure such as corals, sponges, and oyster beds, and disturbance of the bottom substrate are among the major impacts of commercial fishing. Bottom trawlers perhaps may have the largest ecological impact on the environment. These types of fisheries can have devastating impact on benthic communities. Not only do they indiscriminately capture marine organisms, but they damage the environment by damaging or destroying the benthic substrate. Grass beds and corals are of special concern as they often serve as nursery areas for the juveniles of many species. However, there are also potential benefits of bottom trawling to the environment. Coastal areas are often subject to pollutants from runoff that can contaminate benthic communities. Benthic trawling can stir up these harmful contaminants from the bottom substrate and allow tides and currents to flush them out and dilute the pollutants. Studies could be conducted to compare and assess the health of coastal benthic communities where bottom trawling is prevalent and where it is prohibited. Analysis of the substrate could determine if these trawling activities provide a sort of cleansing benefit to the environment. A further environmental consideration is that of decomposing discards, namely from trawler fisheries. While many discards end up being consumed by scavengers, there is the potential for excess discards to remain in the environment to decompose. This would be of particular concern for inshore, enclosed waters such as sounds, bays, and estuaries where the effects would be more concentrated. It is plausible that excessive decomposing discards in these waters could contribute to detrimental effects on the ecosystem, such as toxic algae blooms and bacterial contamination. It would be pertinent to look into regulations that would reduce this potential impact on the ecosystem. Observer programs already collect data in regards to bycatch and discards. This data could be used to assess the amount of discards and predator/scavenger observations could help determine how many of these discards are left in the environment to decompose.

Observer programs could aid in better ecosystem based fisheries management by increasing coverage on vessels that fish in areas more likely to encounter endangered or threatened species. Many of these species have seasonal abundances, such as nesting sea turtles, whale and bird migrations, etc. Some of these species also have a limited distribution range and it would be crucial to monitor these areas closely for potential interactions. The data collected could help implement regulations that could help ensure the protection of these species. These kinds of coverage strategies have been implemented by the Galveston observer program such as placing observers on skimmer trawlers to address concerns of turtle interactions and the possibility of implementing TED (turtle excluder devices) requirements in the skimmer trawl fishery.

A final and ecologically significant impact of commercial fishing operations that requires monitoring is that of pollution and discarded or lost fishing gear. Many observer programs are now increasingly required to report violations regarding pollution. Plastics are especially harmful because they remain in the environment for long periods of time may harm wildlife. Even more potentially harmful is discarded or lost fishing gear. These “ghost gears” continue to kill fish and other wildlife indiscriminately, including endangered and protected species. Observer data recording these occurrences can be compiled and used to determine the amount of debris and gear entering the environment and could reveal its potential impact. Observers could also record instances of entanglement of discarded gear from other vessels.

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## **Using observer data to support an ecosystem based approach in CCAMLR fisheries**

**Isaac Forster**

**CCAMLR, Australia.**

### Introduction

The Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR) was founded under the 1982 Convention of the same name. The CCAMLR area is extensive covering approximately 11% of the world’s ocean, is remotely located in the southern ocean, and contains sensitive ecosystems that have been subjected to minimal anthropogenic disturbance. Due to the remoteness, challenging environmental conditions, and the expense of accessing the convention area, relatively few independent scientific expeditions have been undertaken and the vast majority of the marine environment remains unsurveyed.

The principles of an ecosystem based approach to fisheries are enshrined in the CCAMLR Convention text<sup>24</sup>. The text comprises 33 articles, drawn up as a multilateral response to concerns that unregulated increases in krill catches in the Southern Ocean could be detrimental for Antarctic marine ecosystems, particularly for seabirds, seals, whales and fish that depend on krill for food. In particular article II binds the Commission to ensure the “prevention of decrease in the size of any harvested population to levels below those which ensure its stable recruitment” and the “maintenance of the ecological relationships between harvested, dependent and related populations of Antarctic marine living resources”. Article IX also requires the Commission to “facilitate research into and comprehensive studies of Antarctic marine living resources and of the Antarctic marine ecosystem” and “compile data on the status of and changes in population of Antarctic marine living resources and on factors affecting the distribution, abundance and productivity of harvested species and dependent or related species or populations”.

The mechanisms to achieve the objectives and principles outlined in the articles require the Commission to “formulate, adopt and revise conservation measures on the basis of the best

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<sup>24</sup> <https://www.ccamlr.org/en/organisation/camlr-convention-text>

scientific evidence available". CCAMLR Conservation Measures<sup>25</sup> implement a comprehensive set of regulations in the categories of compliance, general fishery matters, fishery regulations and protected areas. The details of several of these conservation measures require the deployment of Scientific Observers to gather data on both the target species, and the wider marine ecosystem, and to ensure compliance with fishery regulations.

### Scheme of International Scientific Observation

The CCAMLR Scheme of International Scientific Observation (SISO) was established in 1992 and comprises a series of data collection protocols for both target species and benthic bycatch, as well as the monitoring of seabird interactions with vessels and assessing vessels' mitigation measures to reduce seabird and marine mammal bycatch<sup>26</sup>. The data collection requirements for observers are dependent on the developmental stage of the fishery as well as the target species. For recently established fisheries that are still in the exploratory stage of development there is a requirement for two observers on board each vessel, one of whom must be appointed under the terms of SISO. For established fisheries a single international SISO observer is sufficient in finfish, crab and squid fisheries, whilst in krill fisheries there is a requirement for 50% observer coverage fleet wide. However many members also deploy domestic observers on their krill fishing vessels who voluntarily collect and submit under SISO protocols. Therefore in the past five years 92% observer coverage has been achieved in the krill fleet.

### Data Collection Protocols

Currently there are three commercial fisheries operating in the CCAMLR area. These are:

- Patagonian and Antarctic Toothfish (*Dissostichus eleginoides* & *Dissostichus mawsoni*).
- Mackerel Icefish (*Champsocephalus gunnari*)
- Antarctic Krill (*Euphausia superba*)

In the toothfish fishery observers oversee a mark, recapture tagging programme to enable more accurate stock assessment, as well as periodic tagging studies on skate bycatch.

For all target species, detailed recording of length, weight, and maturity stages provides data for determining input parameters for fish stock assessment models. Sampling also takes place of representative bycatch species, and observers assist in the identification of bycatch taxa, as vessels are required to report all bycatch in their commercial catch forms. Bycatch data are used to refine specific conservation measures, which limit the amount of bycatch that can be taken on a line by line basis and total amounts of bycatch in some fisheries, and both temporary and permanent no fishing activity areas are declared due to the presence of high numbers of bycatch taxa.

Observers are also required to observe seabird and marine mammal interactions with fishing vessels, and measure and assess mitigation devices that vessels are required to

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<sup>25</sup> <https://www.ccamlr.org/en/conservation-and-management/conservation-measures>

<sup>26</sup> <https://www.ccamlr.org/en/science/ccamlr-scheme-international-scientific-observation-siso>



deploy during fishing activities. Both vessels are observers are encourage to design and test mitigation devices that further reduce detrimental interactions.

### Observer Contribution to Ecosystem Management Decision Making in CCAMLR

The CCAMLR Scientific Committee<sup>27</sup> provides the best available scientific information on ecosystem management to the Commission, which is obligated by the Convention to take full account of the recommendations and advice of the Scientific Committee. The SISO programme is a key data contributor to several of the Scientific Committee's expert working groups, along with commercial fisheries data and wider ecosystem monitoring programmes undertaken by members. The data collection protocols for SISO are reviewed annually as the data collected by observers are essential for CCAMLR's assessment of fish stocks, evaluation of fishery impacts on marine resources, and assessment on the performance of conservation measures.

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### **Abstracts of presentations that did not provide Extended Abstracts**

#### **Interactions between Marine Mammals and Peruvian Purse Seine Fishery: Importance of the on board observers**

**Sofia Rivadeneyra Villafuerte<sup>1</sup>, Gersson Roman Amancio<sup>2</sup> and Elisa Goya Sueyoshi<sup>2</sup>**

**<sup>1</sup>Instituto del Mar del Peru, Lima, Peru <sup>2</sup>Instituto del Mar del Peru, Peru**

According to the International Union for the Conservation of Nature (IUCN), 26 of the 39 species of marine mammals registered in Peru are classified as Data Deficient (DD), which means that given the lack of information, their population status is still unknown. Since 2009 the Instituto del Mar del Peru (IMARPE) on board Programme "Programa Bitacorras de Pesca (PBP)" carries out the record of marine mammals interaction with the anchovy commercial vessels, getting valuable information about resident and migrating species, behavior of the groups involved in the interaction and age and sex of the individuals. This data contributes to the knowledge of the seasonal variability (related to reproductive seasons, environmental changes, etc.), distribution and relative abundance of marine mammals in the Peruvian coast.

By the time, the PBP counts with 40 observers who are mainly distributed along the central - northern coast, because of the size of the fleet. The information registered by the observers indicates that the most seen species is the South American Sea Lion, which occur mostly while the net is enclosing the fish and causes damage to nets and catches. By the other hand, the PBP has reported the presence of humpback whales and common dolphins foraging around the net and feeding on catches into the net. This findings helps to better

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<sup>27</sup> <https://www.ccamlr.org/en/science/scientific-committee>

understand the feeding behavior of cetaceans and its patterns of distribution along the Peruvian Coast.

The on board observers provides of comparable annual data and allows to stablish levels of interaction between marine mammals and the purse seine fleet, seasonal tendencies as well as foraging patterns and its temporal and spacial changes, bringing trustworthy real time information.

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### **Discard and bycatch research program in the Chilean pelagic purse seine fleets: A work-based approach with fishermen**

**Rodrigo Vega<sup>1</sup> and Oscar Guzman<sup>2</sup>**

**<sup>1</sup>Instituto de Fomento Pesquero, Valparaiso, Chile <sup>2</sup>Instituto de Fomento Pesquero, Other, Chile**

The Discard and Bycatch Research Program in Purse Seine Fisheries of Small Pelagic Fishes is a scientific observer program implemented in Chile since 2014 which aims to collect technical background to be used in the preparation of a national plan to reduce discards of target species and bycatch including seabirds, mammals and marine turtles. In this way, it is intended to advance in the implementation of an ecosystem management-based approach. The methodology considered gathering information through two sources: the data obtained directly from fishermen through a self-report log of each fishing trip and the data obtained on board through fisheries observers in vessels that operate from different ports in the study area.

Unlike traditional monitoring programs that holds the Government of Chile on a number of artisanal and industrial fisheries, the methodological structure was modified, including extensive diffusion work in land, carried out mainly by the same scientific observers. The shift to a human dimension focused on users of the fishery was necessary due to the nature of the study variables and the large-scale fleet that includes more than 500 vessels (semi-industrial) with coastal operation from multiple points of landing between 33° and 40° LS. This fleet has a complex organization system, medium to low educational level of the fishermen, and high distrust in research and fisheries management.

The approach of this program allowed to increase the level of participation with compliance in the delivery of logs which changed from 1.320 (24%) in 2014 to 4.296 (69%) in 2015. A significant difference was also observed in the number of trips made by observers, increasing annually from 1.3% to 2.1% of all fishing trips. This coverage increase is mainly explained by the interaction process that led to build trust and linkages that changed the willingness and availability for receiving observers onboard. The analysis of the results are showing new paths that contribute to propose to the Fisheries Authority, alternative regulatory, operational, cultural, or other changes whose implementation promotes the reduction of discards and bycatch in these fisheries.

## Observer Professionalism Workshop

### Leaders: Reuben Beazley and Amy Martins,

Most people won't argue that being an observer is a very challenging position. We strive to make the job better, safer, and more secure. An Observer Professionalism Working Group, Safety Working Group, and Training Group were established in 2006. Best practices and solutions to the most challenging issues related to observing were described in products from the various IFOMC working groups (<http://www.st.nmfs.noaa.gov/ifomc2009/workGrps.html>). Over time there have been focuses on social equity, support and opportunities, employment standards, and wages and benefits. These continue to be important aspects to being an observer.

Because of tragic loss of lives and disappearances of observers while on the job, we felt that it was necessary to review and discuss specific issues surrounding observer safety and personal health in this current workshop.

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### Participants

Kit VanMeter, Dispute Resolution Coordinator, NE U.S.

Ken Keene, Atlantic Pelagic Longline, NOAA SERO, Miami FL

Pat Carrol, Observer, NOAA SEFSC, Galveston, TX

Bubba Cook, World Wildlife Fund

Elizabeth (Liz) Mitchell, Association for Professional Observers (APO)

Simione Cagilaba, Former Fiji Fisheries Observer

Patrick Nugent, MRAG UK

Jaclyn Smith, NOAA OLE, AK

Robert (Bob) Hogan, NOAA General Council OLE, Silver Spring MD

Ches Rose, Seawatch Newfoundland

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### Part 1: Conflict Resolution Training and Medical

#### Kit VanMeter

Why include "dispute resolution" as part of observer training platform?

- Foster a safety culture with observers, fishermen, and other involved

stakeholders

- Initial training:
  - Identify dispute situations with questionnaire for observers
  - Recognize personal styles and those of others
  - The current problems now are drug use and observers are hesitant to report it for fear of losing their job
  - Know escalation factors

### Ken Keene

Infectious Disease – Awareness, Recognition, Prevention, and Response

- Staff infections/ MRSA (super bug)
  - Most are antibiotic resistant
- Two types
  - Community Associated MRSA (CA-MRSA)
    - Genetically different from HC-MRSA
    - Commonly manifested as skin infections
  - Health Care Associated MRSA (HC-MRSA)
    - Occurs in a medical setting
    - Typically more resistant to conventional antibiotics
- 20-30% of people are shown to carry some form of Staff in their nose
- < 2% have MRSA
- Pervasiveness ultimately a result of historic overuse of antibiotics
- Causes
  - Crowding
  - Contact
  - Compromised skin
  - Contaminated items
  - Cleanliness
- Symptoms
  - Skin infections (Pimples, boils, 'Fish Poison')
  - Can manifest further into organs => fever and chronic illness
  - Described symptoms – yellow in center of wound, joint pain, fever, headache, sweating
- Precautions
  - Hygiene
  - Keep wounds clean
  - Do NOT share personal items
  - Wear Personal Protective Equipment (PPE) – cover wound
  - Advise and care for potentially infected crew

### Pat Carrol

- Community Acquired Diseases
  - MRSA, Hepatitis, Meningitis, Bed Bugs, etc.
  - Mattresses are subsequent “hot-spots” (sterilize mattress in sunlight)

- Cover mattress with some sort of barrier
- Tuberculosis
  - More common internationally (outside the U.S.)
  - Good idea to perform regular checks
- Hepatitis
  - More common with high drug-use individuals (type C)
  - Has a long “shelf-life” on surfaces
  - Must be aware of potential infection sites
- Meningitis & Influenza => community acquired
  - Potential for epidemic/ mass infections

Noteworthy that most providers do not provide health insurance while observers are the most likely employees to be exposed to a disease at ground zero. Programs should develop a list of illnesses

### **Discussion: Conflict Resolution Training and Medical**

Reuben Beazley – Do we observers, know what is available for medical supplies/ equipment onboard the commercial vessels of deployment?

Tom Menino (EWTS, NE observer) – Experience in AK reflects excellent equipment and facilities for the treatment of medical situations. However, these vessels are large and deploy for extended periods of time. In the Northeast, equipment and facilities for addressing medical situations onboard commercial vessels is woefully inadequate, if existent at all. These are comparatively smaller vessels, deploying on shorter trips, and sometimes in extremely depressed fisheries (NE groundfish).

Phil Brown (Techsea) – Ultimately observers are responsible for their own health care and disease prevention and must be proactive/diligent to the nature of disease risk. “I carry MRSA medication and personal first-aid materials.”

Christa Colway – NOAA requires all R/V personnel to have regular TB tests for deployment qualification.

Unidentified, Hawaiian Observer – Observer carries medication for MRSA and other health precautionary items when going on long trips as he believes he needs to take safety into his own hands. He stated he previously was an ambulance driver with first aid experience. Also stated crews will use an observers’ personal items more than expected, ie toothbrush, nail clippers, and razors. First contact for proper medical care could be Coast Guard vessels. He emphasized observers supply their own first aid to supplement on-board resources (meds, staples, syringes, etc lots of anecdotes) stating you can’t rely on the vessel’s safety kit because they may not have one or it could be expired

Reuben Beazley’s response – Wants to see improvement of first aid equipment on vessel(s)

Christa (Westcoast Groundfish) – Annual requirement of TB testing

Amy Martins – The NE Observer Program is expanding the training for physical and mental responses to medical issues. Further, there is an effort to expand the available support for

observers. There is not currently an EMT component of observer training, but it is certainly worth exploring.

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## **Part 2: Regional Fisheries Management Organizations – Observer Safety**

### Bubba Cook

- Professionalism and provision of adequate safety resources for observers are directly related
  - o Joseph Banks, Charles Darwin, Robert Clark were the at-sea scientists that are the progenitors of modern fisheries observation. They laid the foundation for much of what we know about the ocean today. This is a proud and noble tradition!
- Observers must know that there is a system that supports them. It's one thing to have policies and procedures in place, but observers must *feel* as though they are valued.
  - o Are adequate resources available?
    - Management response is critical. *How* you respond is as important as the response itself. Observers should never be made to feel that they were at fault for a threat, harassment, or worse against them.
    - Observers must have confidence that the system will support them.
    - Management must keep observers informed => follow up with incident response on a periodic basis. An observer cannot feel as though their report goes into a "black box" with no response.
- Management authorities cannot foster retention and trust if observers do not feel that they are cared for
- Management authorities must also address recourse for offenses. There must be clear and consistent consequences for offenses against observers.

### Elizabeth Mitchell

#### Transparent Reporting – Observer Harassment, Injury, and Death and Other Observer Reports in Regional Fisheries Management Organizations (RFMOs)

There is a particular need for improving the transparency of observer reports and complaints in RFMO observer programs because at least 5 observers have died or disappeared under suspicious circumstances over the last 6 years in RFMO fisheries, none of which have been reported publicly by the managing agencies,

Publicly reporting observer harassment and interference and especially death is important because:

- It is a public interest issue and would allow for the ease of finding information regarding what observers are experiencing;
- Facilitates monitoring the effectiveness of observer safety measures;

- Facilitates monitoring the effectiveness of RFMO observer programs in general; and,
- Increases public confidence in the monitoring programs.

#### Suggestions for increased transparency in RFMO observer programs:

- Establish an educational web-based portal for all RFMO observer programs where all resources are in one location and/or otherwise easily accessible to the public;
- Include observer sampling protocols, manuals, and training materials;
- Include existing observer program reports and data;
- Include a description of observer programs under RFMO management;
- Identify the chain of custody of observer data and information in various RFMO observer programs;
- Establish independent resources for observers such as counseling and mental health resources and develop a reporting hotline for observer harassment;
- Recommendations for management protocols, including publicly tracking observer complaints.

#### Simione Cagliaba

#### Legal Issues Regarding the Protection Measures for Observers

##### Complexity of Prosecuting Observer Reports

- There are limits to the extent of law, especially at sea and these should be clearly outlined and understood by all;
- Follow-up on observer reports are not taken seriously due to a number of factors:
  - o Responsible officers are not adequately trained or experienced
  - o Inadequate procedural delays in the investigative process, damaging the integrity of the whole chain of evidence;
  - o Lack of transparent security and isolation of evidence to prevent tampering and contamination;
- Response to any observer report is very slow since normal procedures dictate mandate a full debriefing.
- Observers needing immediate assistance (those who experience harassment, interference and who are reporting violations) must be fast tracked into the debriefing process. This is especially important to maintain the credibility of the observer because the element of surprise and confirmation of alibis is usually lost when there are delays in debriefing.
- There is a need for clear roles and accountability of observer program managers and enforcement regarding their culpability of attending to the needs of an observer experiencing harassment. The observer has to know who they can expect to protect them.

#### **Discussion Part 2: Regional Fisheries Management Organizations – Observer Safety**

Brian Avery (Savatech Nova Scotia) - Believes he was intentionally locked in bathroom to hide him from seeing “something” and he felt intimidated when trying to find out what

happened. Understands one (observer) vs. many (crew), and difficulty with lack of evidence and consequent lack of confidence in reporting and when trying to prosecute later.

Reuben Beazley – There is an increasing need for a faster feedback loop. The delay in the reporting process is an ongoing issue in observer programs that impacts prosecution of violations. There needs to be protocol instituted which will facilitate timely return of information and protection of evidence

Bubba Cook – Federal enforcement protocols are not easily changed. Continued communication with observer (follow up) is critical and to let them know their report is valid and being looked into.

Isaac Forster (CCLMAR) - Please elaborate on the availability of information of report with respect to a portal for observer harassment.

Elizabeth Mitchell – There needs to be a publicly accessible place where information about RFMOs and their fisheries monitoring programs are easily accessible, including observer complaints of fishing violations and complaints of observer injury, assault, bribery attempts, harassment and interference. Deaths need to be reported publicly.

Bubba Cook – Acknowledged a need for a clearinghouse of information relating to RFMOs. However, there is difficulty navigating legalities, both domestically and internationally with respect to flag state, landing state, company origin, etc. The problem is that there is currently no real place to see a history of incidents with details. There are difficulties with confidentiality. Details couldn't be made transparent and available.

Elizabeth Mitchell – Acknowledged difficulties but that it is necessary and possible to report without revealing confidential information. The difficulties highlight the ongoing need to continue further efforts between conferences to explore and resolve the complexities involved in RFMO monitoring program transparency, jurisdiction and accountability.

Rich Kupfer (NOAA Pacific) - We have to make a commitment to observers, FIRST. All observer expectations are available publicly. Resolutions take time, but follow up is and does occur. All data of enforcement issues tracked.

Victor (CapFish, S. Africa) - Agrees with Bubba that accountability is critical. Why bother reporting if there is no recourse. In S. Africa, fishermen cannot continue fishing until resolution has been achieved.

Bubba Cook – Unfortunately, increased consequences to fishermen often correlate to increased consequences for observers. Achieving recourse is a tenuous process that needs to be handled on a situational basis. Increased responsibility to follow up with observer to make sure they feel protected and able to come forward.

Unidentified - Case resolution information should always be provided to observers once available. Manuals and field resources are online and available (NOAA Pacific) to facilitate public awareness of observer roles and responsibilities. "If you don't feel your organization is behind you, you won't be motivated to report incidents"



### **Part 3: RFMO – Observer Safety (continued); Legal Action and Enforcement of Observer Protections**

#### **Patrick Nugent**

##### Safety Standards in the IOTC Observer Program

- Policy => Common Policy across programs
  - o Linked to sister programs
  - o Program-specific risk assessment
    - Used to develop policies
    - Scoring component; risk rating matrix
- Observer Standards of Conduct
  - o Addresses conflict of Interest and Confidentiality
- Memorandum of Understanding
  - o Outlines responsibilities for all
  - o Sets minimum safety standards
  - o Provides basis for pre-sea safety inspection

#### **Jaclyn Smith**

- Identify top priority incidents
  - o Harassment, assault, etc.
- 3 hr. & additional 1.5 hr. training for all new observers
- The enforcement training includes role playing scenarios for common issues
- Community outreach – warnings issued through public forums, informal communication
- Retain the option to charge the company, or an individual

#### **Bob Hogan**

- Prosecutes civil, not criminal cases
- Requires due-process to accused
  - o Takes time
  - o Chain of evidence is difficult to establish
- Better course for remedy => resolution through OLE
- Results are published on website (<http://www.gc.noaa.gov/enforce-office6.html>)
- Environmental Protection Agency (EPA) judges hear cases (only 3 judges serving all observer programs in the United States)
  - o Slow wheels of justice

#### **Ches Rose**

- Mostly small vessels
  - o Over 5,000 vessels under 35ft.

- Crab, shrimp, groundfish
- Comprehensive safety legislation
- There has been a downward trend in fatalities. This could be attributed to:
  - Increased safety culture
  - Mandatory safety requirements for vessels;
  - Safety checklist employed by the observer prior to boarding (contains 'no-go' section for safety features and equipment that, if absent, trigger automatic refusal of boarding by the observer)
- N.F. vessels have the highest rate of safety compliance in Canada
- Non-compliance results in prohibition of departure from port until the safety issue is resolved.
- Challenges:
  - Jurisdiction
  - Legislation
  - Substance abuse
  - Safety standards of foreign vessels

### **Discussion Part 3: Safety, Legal Action and Enforcement**

Reuben Beazley - Very important to address job related stress and mental illness

Michelle Tocom - Some AK fish companies are acknowledging the importance of regular TB tests.

Tom Knudson, Center of Investigative Reporting - What is the status of Keith Davis' investigation?

Hogan – NOAA is not involved with the investigation. The incident is being handled by Panamanian authority and FBI. NOAA has no investigatory authority. There are many jurisdictional issues.

Rich Kupfer - FBI says it is still an open and active investigation. NOAA reacted fast and is conducting a national safety audit concluding in spring/summer of 2017. The safety audit is focusing into 7 areas.

Elizabeth Mitchell - Is NOAA asking observers to be involved in the safety audit investigatory process?

Kupfer – NOAA does not stipulate the safety audit contractor to specifically target observers in their inquiry. It is up to the contractor to decide if they wish to include observers or not.

Christa Colway - Smoking is an issue. How can we protect observers from second-hand smoke as it is a working environment?

Reuben – Newfoundland had passed the Non-Smokers Health Act 7-8 years ago mandating that the activity must cease. It was implemented within a year with surprisingly little resistance. Anticipated it would be problematic, but legislation helped establish recourse for violations.

Keene – While the U.S. is collecting data on the relative occurrence, but the U.S. has little jurisdiction off-shore.

Pat Carrol – There is a cultural shift of less smoking in common closed spaces.

Joe Arceneaux - Without a formal collection of incident reporting, informal discussion and compilation of common incidents can be used for preparation for a hasty resolution. What is a reasonable recourse for observers that ignore “no-go” items on the safety check list and instead go on a boat with the overriding motive to make money or go when they aren’t supposed to?

Nugent – In the UK, observers are automatically placed at the top of the list for the next available trip if there is a safety deficiency.

Reuben – It would be good to have the observer retrained in safety standards and policies so all adhere in the same way. This is especially the importance for considering the other/next observer to deploy on that vessel. Ultimately, there should be consequences!

Amy – In the NE U.S., observers who opt to sail when known ‘No-Go’ violations are onboard, this is cause for decertification. We are understanding if there has been an unintentional mistake/error and have several levels of recourse: pre-probation, probation, and finally decertification. For observers who have neglected expired safety equipment and have still taken a trip, this will result in decertification. Safety cannot be overlooked.

Pat Carrol – It is in the best interest of both observers and fishermen to heed safety protocols. There is a monetary penalty for violation.

Phillip Brown - I have concerns with emission exposure from engine exhaust. Has anyone addressed these concerns?

Universal response – no

Isaac Forster - Is it required for observers in the U.S. to have completed a first aid course?

Amy – Yes, first aid and CPR

Bobbi Wessel (A.S. Observer North Pacific) - Acknowledges strong community support in AK. There is a strong emphasis (drill, drill, drill) on incident reporting. Always felt comfortable with support system. The more detailed the safety, the more credible.

Hogan – Contemporaneous record (notes) are critical in forming a strong case for recourse in incident reporting. Notes are very important for a lawyer if written the day of the incident. Records are key as is the timeframe.

Susanne Brian - Feels comfortable with both the formal and informal support in the NE U.S. with regard to maintaining sanity and mental health. Massachusetts has readily available Narcan kits, which are typically covered by insurance.

Amy – The NE program has not officially endorsed Narcan kits. There are concerns regarding potential health risks (physical and mental) after the application of the drug. Narcan is a brand name for the drug Naloxone, which is a prescription medication used to reverse the effects of opioids especially in an overdose. EMT’s may carry Narcan as first responders.

There are concerns with allowing observers to carry Narcan since it may be beyond their training and scope, and often immediate medical attention is also needed which may not be available at sea. There can be side effects and reactions to the drug that would be difficult to manage at sea.

Roy Morris (North Pacific Observer) - Good connection with OLE but poor connection and support from Coast Guard. Is there any interest in having USCG participate in the discussion as they are the most likely on-site first responders to an incident with U.S. waters?

Amy – The USCG is invited to the initial observer training and NMFS also has a memorandum of understanding with the Coast Guard. USCG was invited to the conference but were unable to attend. Unfortunately, there is a high turnover in personnel within the Coast Guard boarding officers, which makes building a long-term relationship difficult, but much progress and a good working relations has been made. We have instituted the use of boarding reports, completed by observers in the event of a boarding. Unfortunately, it is often the case the observers may be treated the same as crew during a boarding, so follow up is needed.

Rich Kupfer (NOAA Pacific Islands) - It is worth pointing out the unaddressed element of tracking stewardship. That is to say, tracking the positive impacts of observers on incidents; not negative elements only.

Matt Kemp (North Pacific Observer Program) - To expand on Mr. Kupfer's comment, how likely is an incident to be reported without the prior informing of the vessel master.

Hogan – Judges are not likely to impute liability to owner or captain if communication of an incident is not established. Individuals may be prosecuted, but there is little liability beyond that. It is ultimately at the judge's discretion.

Alethia (Fiji Observer Program) - Fiji has adopted an Off Shore Management Creed. It began with a 3-year grace period, but now have fixed penalty notices. These can sometimes prevent a vessel from sailing. Fiji fisheries management is lucky that their national law system takes fisheries incidents very seriously.

Bubba – The FFA recently held workshops with judges and magistrates to educate and inform them about how to deal with fish and observer issues.

Casandra Donovan (NOAA Observer) - Wanted to point out her availability as a professional resource (recommendations) for career development.

Bruce Turriss (Vancouver) - How do you address accusations of "bad observers" to ensure or propagate industry confidence in the management? How to provide feedback to industry?

Nugent – Sometimes have an advisory observer on board or incorporate extra-long debriefings. If an observer is not doing his/her job, it would likely reflect itself across other aspects of professionalism. Sometimes audits of statistics and data are used as metrics. However, it is usually self-resolving. That is to say, if an observer is confronted about questionable work practices, he/she fixes the issue so as to avoid further repercussion.

Amy- OLE will prosecute observers for data falsification. The structured nature of incident reporting apparently makes observers worried to report other observers not doing their job.

NMFS is working to develop a less structured system to allow for confidential reporting of poor observer conduct. There is a saying used by the State Police Department that promotes the police to work together to ensure that they have measures in place to help them be accountable, "who watches the watchers?" – we could say, "who observes the observers?" [From wikipedia **Quis custodiet ipsos custodes?** is a [Latin phrase](#) found in the work of the Roman poet [Juvenal](#) from his Satires (Satire VI, lines 347–8). It is literally translated as "**Who will guard the guards themselves?**", though is also known by variant translations. Now this phrase is commonly used more generally to refer to the problem of controlling the actions of persons in positions of power, an issue discussed by Plato in the [Republic](#). Socrates quotes that the best person "has a divine ruler within himself," and that "it is better for everyone to be ruled by divine reason, preferably within himself and his own, otherwise imposed from without." "Who monitors the Monitor?"]

I see that we all should take part to stand together to ensure that we are all doing the right thing.

Keene – Vessel masters are given a vessel/observer evaluation at the conclusion of every trip. Electronic monitoring also works as a check on observer behavior.

Sarah Cierpich (NEFSC FSB, Integrated Statistics) - Loves the USCG, they have been very helpful to her when she was an observer. Does the U.S. have a Good Samaritan law that applies to observers who aid in incidents?

Hogan – There is no law that ensures lack of liability. However, there is often situational leniency. Canada does have a Good Samaritan Law.

Keene – As in the case of the Atlantic Pelagic Longline Fleet, observers are covered for liability up to their respective level of training.

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### **Keynote Speakers Statements which emphasize the importance of Fisheries Observers.**

#### **Samuel D. Rauch, III, Deputy Assistant Administrator for Regulatory Programs, NOAA Fisheries**

- Observers need professional training and to act professionally. Observers are ambassadors and need to foster collaborative working relationships (which takes time).
- In many cases the observer is the most scientifically and safety trained person onboard.
- One of few things criminal in US Law that are intended to protect observers from harassment is found in the Magnuson-Stevens Act.
- Work is intense, hazardous. Observers need a safe onboard environment & sea worthy vessels.
- The fact that observers can refuse to board an unsafe vessel has promoted the safety of vessels.

#### **William A. Karp, NEFSC's Science and Research Director**

- Acknowledged public ownership of natural resources, citing the Doctrine of Public Trust and the need for accountability;
- Logbooks are a primary source of information but there are concerns of bias (giving rise to the need for unbiased data through observer programs);
- Management authority should set standards;
- Observer programs will continue to rely heavily on observers;
- “While they are not our employees, observers deserve our support.” Emphasized the need for observer training, support and safety;
- Acknowledged an increased need for observers with concurrent increased investment into developing and supporting the observer workforce;
- Perhaps most valuable in reducing errors is the attitude of the person in charge of data collection.
- We learn the most and get best data when work effectively with industry and partner with fishermen.
- A collaborative partnership framework is needed for implementing monitoring programs, including work with NGOs, fishermen, foundations and observers;
- Need more, better, timely, high quality, objective, verifiable, accountable data as importance of data increases for scientist to do their job.
- Observer can: be flexible to changing conditions; outreach in the community; be a bridge between agencies, fisheries, & port samples.
- Moral obligation to understand what is happening “out there” on the high seas.

## Electronic Monitoring Workshop

### Leaders: Howard McElderry and Dennis Hansford

There is a high level of interest to deploy Electronic Monitoring technologies where its efficacy, operational feasibility and cost effectiveness can be demonstrated. The technical sessions in this conference have described a variety of cases where EM technology is being successfully put to work. The institutional arrangements for the delivery these programs have only been mentioned in passing, without specific discussion of the details. The purpose of this workshop is to discuss the business environment for program delivery in greater detail.

To help explain this topic it is useful to recognize that successful deployment of EM involves both products and services which are usually provided by EM technology vendors, hired by fisheries agencies, or industry groups, or potentially others. The offerings of EM vendors are the result of their innovations and investments, as they seek to develop product and service solutions to satisfy an emerging market demand. The business decisions for EM vendors simplify to an assessment of the opportunity, risks and rewards. EM vendors are willing to invest capital for the development of EM products and services if there is reasonable likelihood of creating opportunities that provide a return on their investments. The end user, or purchaser of these solutions, directly influences this supplier response in the way their needs are defined, the size of markets created, and the purchasing policies employed. It is helpful to think of these concepts collectively as ‘market forces’.

Does the use of EM technologies make data collection more accurate, timelier, and more cost efficient? These are some of the aspects that end-users envision being addressed through the implementation of EM. They’ve identified a number of policy and data-related challenges presented by adoption of EM. These include the handling of the enormous amount of data involved and effects on time series of data used in stock assessments. But the most talked about challenges are the relative costs of various approaches and who pays. Thoughtful solutions to these cross-cutting issues and fishery-specific challenges requires vendor and end-user collaboration and planning. This was the dialogue of this workshop.

The business of EM is very new and there are few other business examples from which to learn. In fact, it is only the very recent availability of EM technology that has opened the door of possibilities to monitoring fisheries with automated technologies. Ultimately, we are seeking innovation to satisfy the ‘better, cheaper, faster’ market expectations and it is timely to consider what the market forces look like and evaluate if they are working effectively. We examined this topic with two separate panels. The first group represented EM vendors who provided their market perspective of the strengths, weaknesses, opportunities and threats. This was followed by a panel of end users to respond and provide their own perspective.

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### Part 1 – Electronic Monitoring Vendors Panel

Howard McElderry – Archipelago Marine Research Ltd.

Based in Victoria BC and founded in 1978, the service focussed company has three main business areas including marine environmental assessments, at sea observer programs and electronic monitoring. The company's 30-year history with at sea observer programs, where over 3,000 seadays are delivered annually, was the basis for pioneering electronic monitoring technology, now 17 years underway, with over 600 systems deployed, 7 fully operational fishery programs, totalling about 30,000 seadays per annum. An iceberg is a useful metaphor for EM programs, where the visible portion is the technology and the less visible parts include the service framework, and all parts make up an effective monitoring system. Technology based monitoring can be very cost effective and this is demonstrated by several existing fishery programs. Program design is key, where the monitoring objectives, operational requirements, fishery characteristics and other factors are considered to ensure cost optimization. Provision of EM is really two businesses: the product business and the service business. The two have very different market requirements, competencies and level of risk. Key messages to end users include the following:

- Prototypes are not the same as products – High performance expectations demand that EM products be properly tested at scale before they are deployed in commercial applications.
- Agency EM policies should encourage innovation – A healthy, dynamic EM product environment is one where EM vendors are incentivized to make investments to develop EM technology; policies such as open source discourage investment of private funds.
- Include EM Vendors in program design stage - EM vendors understand program cost drivers best and should be included in the discussion of program design, rather than after when the detailed statement of work and requests for proposals is released.
- Technology development vision – Because the life span of deployed EM systems is typically 5 years or longer, and the rate of technology change is rapid, more thought should be given to technology integration, to ensure adoption without creating disruptive or costly transition.
- Data standards – There are no data standards for EM products or programs which is problematic for end users who share data or work with multiple vendor systems.

### **Mike Kelly – CLS Americas**

CLS Americas is a global provider of satellite communications and the largest provider of electronic reporting systems, including VMS. CLS has operations in 16 countries and annual revenues of \$125m. EM product development occurs within the intersection of three independent drivers: what is technologically possible, where there is a business need for the technology solution, and where there is a willingness to pay for the solution. This intersection, or sweet spot, defines the setting where product development makes sense. The next facet for a company to consider product development is through an analysis of the market. There are several aspects to this such as market size and scope, rate of change, characteristics of other competitors, competitive advantage, and others. CLS has mostly concentrated on the development of sensors and has been slow to consider the EM market. A distinction is drawn between the government and the commercial market, where the former is often important in early stages and the latter is ultimately where the market will



develop over time. Hence, in considering long term sustainable products, it is important to consider the commercial market, including willingness to pay, purpose of the technology (e.g., compliance), value add opportunities (e.g., vessel maintenance, fuel efficiency, building public acceptability, etc.). This conference, and discussions with participants has been really beneficial to learn more about product needs to help guide and inform business decisions.

### **Faustino Maganto – Satlink**

Electronic monitoring is often seen to be in conflict with at sea observers, when it should really be seen as a tool to support observers. EM is a tool to support observer programs and help increase coverage, particularly on vessels where there is not enough space for an observer. Observers can be involved in the design and installation of EM systems on vessels, and can carry out the analysis of EM data sets. Hence, observers can participate in fisheries monitoring without having to go to sea, where they may be away from home for weeks at a time. [The balance of the presentation was a video describing Satlink's products and services]

### **Gabriel Gomez – Marine Instruments**

Marine Instruments is located near the major fishing port of Vigo, Spain and builds ruggedized marine electronics, such as tracking buoys and EM products. The company was founded in 2003, has 110 employees and is part of a larger organization called the Arbulu Group. The Iceberg metaphor for EM is very appropriate, not only to describe the program but to highlight the importance of the technology aspect. Products and prototypes are not the same thing. Manufacturing is a skill that delivers products of consistent quality, available in the required volumes. EM is deployed in a hostile marine environment and performance expectations are high. Thus, many components of an EM system are purpose built and not off the shelf. EM systems also need to be tamperproof and easy to install in less than a few hours. Many fisheries operate across broad geographies where logistics are poor and technical skill sets low. Furthermore, the system should not be over specified, with more data collected than necessary. For example, Marine Instruments believes in the use of high resolution still photography, instead of video, in order to meet data needs at a much lower overall data storage requirement. EM product development is challenging because of the rapidly changing technology, end user expectations of declining cost, and multiple product versions over short time span. Market leadership in this environment requires investment and long term thinking. Standards are needed to define EM data sets, data transfer and interoperability. Open standards would help accelerate development and reduce costs. Integration between EM, ER and VMS functions should be improved. Current approach where a new box is required for each function drives up end user cost and reduces efficiencies.

### **Amanda Barney – Ecotrust Canada**

Ecotrust is a charitable organization, built on a triple bottom line (economic, social and sustainability) philosophy to help address needs in coastal communities. Ecotrust has over 20 years experience conducting fisheries projects with small vessel operators in a changing environment. Ecotrust has a strong data technology/IT group working with the broad suite of fisheries data, facilitating their ability to incorporate EM into their programs. They use an open source platform for data capture, enabling the integration of other data sources such as electronic logs and VMS. They have developed their data analysis software as a proprietary resource, with methods and structures specifically tailored to individual application needs. Their experience working on a range of fisheries issues has led to a broader perspective of fisheries data, incorporating both resource data and market data, informing the whole story. Fisheries are different and therefore program and cost effectiveness comes with program design. There isn't a 'one size fits all' monitoring solution and one shouldn't expect simple easy solutions from technology. There is a lack of standards. What are the regulatory standards that define how a fishery should be monitored? As well, standards are needed to define data structures and data delivery methods. Open design standards can create interoperability between systems while proprietary systems have their place where there may be very customer specific methods of analysis.

### **Jared Fuller – Saltwater**

Saltwater has been a provider of observer services for over 25 years. Our involvement in EM is motivated by the belief that EM could be a cost effective tool for collecting the data needed to manage sustainable fisheries. In that sense the EM workshop structure should be reversed so we, as vendors, could better understand the data needs from end users which include the fishery managers, the industry, and other stakeholders. It is difficult for all of us to see clearly down the road because of the rapid changes in technology. Moore's law predicts that technology will be twice as fast and half as cheap every two years, but translating this concept to practical fisheries applications is not easy. It is important not to be fixated on one particular piece of EM (the shiny bauble), but instead look at the whole management system, what technological advances will be achieved over two years, and what our goal posts should be. EM is standing on the shoulders of giants because of all the previous work by fisheries managers, observers, and others to sustain our fisheries. Full integration of EM will include the cost of analysis, a clear assessment of what can be accomplished, and open-ended thinking about what else may be possible. This could come from multiple directions. As an example, the Nature Conservancy is sponsoring work with machine learning for EM. In collaboration with SeaState and Chordata and with funding from the National Fish and Wildlife Foundation, Saltwater has developed an open source platform for EM data review. We chose to use an open source platform with the hope that it will drive down the costs of EM data review and inspire innovation by multiple developers, both from within and outside the world of fisheries. The software has been designed to be adaptable for different fisheries with the hope that different managers and regions will find it useful for the data issues in their particular fisheries.

### **Discussion**

*Question* – Emma Fowler (NE Observer) – How do you manage apparent conflict between the privacy needs of crew on small vessels with the full deck video recording requirements of EM? What can be done to combat misuse of using blind spots for illegal purposes (e.g., discarding fish)?

*Response* – Several panelists responded by indicating that privacy requirements are often managed in several ways including only video recording in certain locations or times (only during catch retrieval), intentional blind spots (curtained area or foredeck where no video recording takes place), vessel monitoring plans.

*Question (to Howard McElderry)* – Mark Hager (GMRI) - How many of the listed implemented EM programs are from US. Any lessons learned from the many pilot programs that would be helpful to speed up implementation of existing fisheries.

*Response* – Howard McElderry - The list of seven were mostly from British Columbia, but included one from Australia and one from west coast US. The latter is the shore-based whiting fishery that operated with EM from 2004 to 2010, then again since 2014. Regarding lessons learned to help speed up implementation, perhaps the biggest challenge is with when fishery groups are very bracketed into their thinking and simply try to use EM technology as a surrogate replacement for an observer without considering the broader elements of program design. The examples shown in the presentation with very significant cost reductions are examples where this broader design is used.

*Question* – Gil Sylvia (Oregon State University) – Question to all panelists about the importance of incentives, particularly those offered by agencies, in driving success in an EM program.

*Response* – Mike Kelly responded that Exempted Fishing Permits incentives and provide regulatory flexibility. Industry cooperation can be very high with these programs.

*Question* – Melissa Mahoney (EDF) – Concerning fisheries that would like to adopt EM but the number of vessels is low, what can be done to address scale and make EM affordable.

*Response* – Amanda Barney responded that one way of building local capacity is through building partnerships with people on the ground in ports where EM services are needed. It may not always work with small numbers of vessels because of fishery specific design and set up costs but there may be economies realized by replicating from other similar programs. Scale is a big reason for making EM programs cost effective.

*Question* - Melissa Hooper (NMFS West Coast) – What do you think the government's role should be in assisting with the development of EM standards? If the role is to assist, what are the incentives for EM providers to participate?

*Response* – Mike Kelly responded that the government has done an excellent job with standards for VMS, laying out very specific requirements for vendors. This approach for environmental monitoring is much more difficult and would likely require a type approval process for companies for specific fisheries.

*Question* - Melissa Hooper (NMFS West Coast) – Concerning the high risk side of product development, do you think it is helpful for the government to assist with grants to help offset the risk, or does ‘fear of failure create the right incentives to ‘get it right the first time’?

*Response* – Gabriel Gomez responded that government assistance can be both good and bad. In some ways it can be used improperly by creating artificial competition. For example, the case where government has used grants to fund development a competing product to one that Archipelago has developed and paid for with its own funds. Jared Fuller provided another point of view, indicating that NFWF (US National Fish and Wildlife Fund) grant program has been very successful providing funds to help in small fisheries with limited resources.

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## **Part 2 – Electronic Monitoring End-User Panel**

### **Melissa Hooper – NMFS West Coast Region**

NMFS relies on fisheries monitoring programs to inform management decisions. They want to encourage approaches that meet their information needs and provide cost effective, timely and accurate data. The regulatory approaches used to ensure this vary across regions and fisheries, varying in the level of specificity and flexibility. Highly specified programs are implemented through regulations (e.g., type approval) which can be problematic because of the time required to develop and implement regulations, and the difficulty in making changes when needed. A more flexible approach allows for adaptability to respond to new technologies, but lacks the specificity that defines program requirements so that vendors can most efficiently tailor their product development efforts. In terms of data, the government could have a role in the creation of open data standards for outputs from an EM system. Such standards could improve integration of EM data with other types of fisheries data. This approach is challenged by the tendency for different region and state programs to have their own preferences for data standards. A more open data standard could increase EM markets by making it easier for smaller fisheries to overcome entry barriers. Standards could be problematic for existing programs with non-conforming EM equipment. The fishing industry has a role in driving monitoring program cost efficiencies, by examining their operations and considering changes that could drive operational efficiencies for EM providers.

### **Nichole Rossi – NMFS NE Region**

The NE Fisheries Science Center has been working with EM since 2010 and is currently working on two fisheries, the groundfish multispecies and the Atlantic herring mackerel fishery. There are two key themes for consideration – technology innovation and operational implementation. In terms of the first theme, there is a wide range of technology that can be considered and it is important to consider carefully what level of innovation is enough to satisfy the needs. There appear to be benefits to the integration EM and electronic reporting but these should be weighed against the costs and practicalities. Also, some newer low cost video systems (e.g., Flywire) offer advantages, including the potential for integration of underwater imagery. Finally, still image systems (e.g., Marine Instruments) may provide the needed resolution but with much lower data storage costs. The second theme, implementation, involves the uptake of EM. Coverage level is a key issue as EM is most suited for 100% levels and partial coverage levels generally have lower cost efficiencies. Implementation also requires support from many levels including council, industry and others. Support can come from acceptance that the EM can successfully address the fishery data needs.

### **Jon McVeigh – NMFS NW Region**

The NW Fisheries Science Center runs the observer program and has had a role in helping get the west coast EM program off the ground. They participated in the collaboration with industry, council, agency, providers and others, that led to the creation of the program. Observers also played an important role in validating EM, providing complimentary data sets that could be used for comparison. While the EM program is mostly for compliance purposes (presence or absence of discarding events), collaboration between the EM and observer programs has led to discussion about how EM could be used for science purposes. The development of EM technology also provides benefits for observer programs with tools such as small, portable, deck-friendly tablets to help observers move to paperless data recording methods. Simpler, portable data collection systems (e.g., Flywire) may also provide data to augment observer data. EM technology applications for shore-based monitoring may also be beneficial, improving integration between at-sea and shore operations. Finally, whereas EM is often introduced to reduce monitoring costs, it is important to be mindful of impacts on observers. EM programs are often seen as a threat to observers by reducing job opportunity, particularly when there may be little transparency on potential observer impacts. Most programs depend upon a strong observer program and should make use of observers in the best way possible.

### **Jacqueline Smith – NMFS North Pacific**

EM has been used in Alaskan fisheries and is proving to be a good tool for enforcement. EM data can be used to corroborate observer statements. Enforcement officials can also use EM data to perform targeted audits of vessel catch reports, or monitoring deck operations to monitor discarding or high grading. EM could have potential value for geo-fencing purposes, providing real time reporting of vessel positions and potentially enable dialog between enforcement and the vessel for boundary infractions. If EM systems report on

performance status of EM system, there is also the potential for dialog between vessel and enforcement when equipment failures occur.

### **Dave Colpo – PSMFC**

PSMFC is the workforce behind the west coast EM program whereas NMFS is sets the program framework (elephant versus elephant rider analogy). An EM program has the following necessary components:

- Willing Participants – vessels operators must want EM.
- Camera Systems – technology to capture data aboard the vessels.
- Field Services – the provider of Camera Systems needs to provide technicians to install, service and repair systems aboard the vessels.
- Software to Expedite the Review – a software tool is needed to efficiently process imagery and record fisheries observations. Ideally, this technology integrates sensor information to enable more efficient identification of fishing operations and other events that require viewing.
- Database – a database is needed to house interpreted data, integrate with other fishery data, and store raw image and sensor data.

PSMFC has a staff of about four full time individuals who look after both west coast and Alaska program. About 70% of the effort is directed at the west coast, where about one-third of the groundfish fleet carries EM systems for 100% monitoring. The approximate data storage cost for a year of EM data is \$75k (all data for 4 years).

The following comments were offered in relation to the EM Vendor remarks:

- EM needs is here and now – While technology innovation offers many opportunities in the future, these are not proven or can be operationally implemented now. Providing EM for the present needs to utilize technology that is proven and operationally ready today. Computer vision is an example of a technology of tremendous potential, yet it has little operational value at present.
- Open Source – While this may have a lot of potential in large markets (e.g., cell phones), it has no practical value for EM because the markets are too small. For example, there are 50,000 cell phones in the world for every fishing boat with a deck. Most of the fishing boats in the world do not have any form of monitoring. NMFS' open source policy for EM software is inconsistent with their practice of wide use of proprietary software in a range of applications (email, word processing, etc.).
- Incentivizing EM – It makes little difference to PSMFC whether the vessel chooses EM or an observer. On the west coast 100% monitoring is compulsory and vessels can choose between using an observer or EM. Ultimately, the choice should be based on what makes the most business sense for the vessel.
- It's Not Technology, Its People – EM is new and a lot of the people involved with operational implementation of EM don't really understand EM and what is needed to put it in use. Too many people are preoccupied with the shiny bauble of technology and not getting on with operational implementation.

## **Alfred 'Bubba' Cook – WWF**

As mentioned by previous speakers the goal is about people and getting the information. Technology is not the end but potentially the means – 'potentially', because the role of technology needs to make sense, starting with clear definition of the problem, issue and challenge. WWF has limited resources and needs to be very judicious in its funding decisions. There has been some discussion on drivers, common internal drivers relate to faster access of high quality information. External drivers include programs such as MSC certification which specify improvements to data quality. As well, there is a trend toward greater transparency in order to minimize brand risk. Industries will move toward greater transparency because markets don't want to be associated with practices such as human trafficking, unsustainable fishing, and IUU fisheries. WWF is not a regulator but seeks to identify willing partners and act as a catalyst for change. WWF hosted the Emerging Technologies Workshop in Auckland, NZ earlier this year in order to bring vendors into the same room to learn about available technologies and promote discussion on possible integration opportunities. WWF has funded projects such as one in Papua New Guinea to integrate monitoring data in real time, as well as a project in Indonesia to test small, low cost EM units (Flywire) on an artisanal fleet. WWF feels its projects need to include willing partners and the project needs to make sense for end users. The project also needs to make economic sense, and the return on investment needs to ensure sustainability.

## **Wes Erikson – Fishermen BC, Canada [Extended Abstract provided by author]**

2006 marked the implementation of 100% monitoring on all vessels in the British Columbia groundfish fishery, 10 years ago.

The British Columbia groundfish fishery has evolved over the last 30 years. This is the story of what it was like, what happened, and what it's like now, I grew up commercial fishing, and became the captain of my first fishing vessel at the age of 16. In 1987, at the age of 20, I had saved enough money to put a down payment on my own vessel, licensed for salmon and halibut. It was a two year plan. There was that much uncertainty.

Why does pain seem to be the catalyst for change and growth? In the 1980's, the BC halibut fishery was in pain and needed to change:

- Six days of fishing;
- 435 vessels;
- Poor quality;
- Limited fresh supply;
- Low price;
- Fish discarded; and
- Gear loss.

And lives were lost. We knew something had to change. The idea of Individual Transferable Quotas (ITQ) came from a fisherman who belonged to an industry organization. The organization presented the idea to the Department of Fisheries and Oceans (DFO). We

agreed on an individual allocation formula and industry worked with DFO to develop a set of rules to manage the fishery.

Fear almost always relates to future events, such as worsening of a situation, or continuation of a situation that is unacceptable. Fear that we may lose something we already possessed or fail to get something we demand. We designed the fishery to address our fears. The halibut fishery moved to a catch share fishery in 1991 and with it the beginning of third party monitoring (Hail requirements, Port Validation).

Years passed happily fishing halibut, encountering non-target species like rockfish, and in many cases throwing them away. I thought, 'Wow, don't imagine we will be able to do this forever.' Some of my fellow fishermen said, 'there is absolutely nothing wrong with discarding fish'. "There is lots of this bycatch stuff." "We wouldn't keep catching it, if there wasn't lots." We could cap out on all our allowable catch by discarding our overages. At-sea observers began to be deployed on vessels 5-10% of the time. Fishermen found innovative ways and persuasive arguments to avoid taking observers; "This is a privacy issue and you are violating my human rights", and there was Observer Bias.

In almost all fisheries, many species are encountered, and closed areas and discarded catch are difficult to monitor and this fact did not go unnoticed. As a result of pressure from the environmental community, we needed to prove ourselves sustainable. We needed to integrate the various fisheries. For the first time, fishermen began to understand that we needed more than just a commercial license to fish, we needed a social license. The next step in our evolution was to integrate and become accountable. This was no easy task. It began with admitting there was a problem (unreported catch) then beginning a process to address the problem. Seven fishing sectors participated in the process known as the Commercial Industry Caucus (CIC):

- Sablefish;
- Lingcod;
- Halibut;
- Dogfish;
- Trawl;
- Rockfish (inside); and
- Rockfish (outside).

We met for two to three days every month for a year and accomplished nothing. We could not even agree on who would chair the process. We were unwilling and not ready to change. Some would say our industry was not mature enough. We then reported our progress to the Department of Fisheries and Oceans. They issued an ultimatum:

1. All rockfish catch must be accounted for;
2. Rockfish catches will be managed according to established rockfish management areas;
3. Fishermen will be individually accountable for their catch;
4. New monitoring standards will be established and implemented to meet the above three objectives; and
5. Species of concern will be closely examined and actions such as reduction of total



allowable catch (TAC's) and other catch limits will be considered and implemented to be consistent with the precautionary approach for management.

Basically DFO said that we will account for all fish and prove it furthermore, if we couldn't figure it out, they would. We knew that would effectively end the fishery so, we had the incentive to find a solution, and we were motivated to accomplish it within the three year timeline. We selected an independent professional facilitator who helped us create a mission statement and developed a set of guiding principles. Then we began negotiating and eventually determined how to share fish and make our fishery defensible. This had to work and be affordable for the smallest boat (5m) in the fleet as well as the largest (50m). Knowing we would bear much of the cost, we realized that EM would be the only option for our smaller vessels. We envisioned the technology we would need to meet our objectives then worked with the monitoring company to develop the equipment and procedures. We began to realize that a fully monitored fleet would eliminate the question of "trust" from the equation. This would allow the industry to communicate with science and managers like never before.

In April 2006, we launched the Pilot Integrated Groundfish Fishery; seven fisheries, all with various catches, combined, and became fully accountable with over 70 species to manage in up to five management areas per species:

- One management plan;
- Catch shares for all species and vessels;
- Each vessel accountable for all catch – whether retained or released;
- Trading of quotas among vessels, gear types, and fisheries;
- 100% dockside and at sea monitoring; and
- One logbook for all vessels.

Logbooks are audited against video footage and then compared to the offload. The same logbooks are being use in science and management (we can trust the data now). At-sea data provides information on total catch mortality (retained and released)

How did we facilitate change?

- Define the objectives (providing rational for them),
- Identify participants,
- Begin a consultative process,
- Every fishery will have a different design to address specific problems and concerns, and
- With enough "incentive" any problem can be solved.

What were the principles of the process?

1. Involve the stakeholders (Involvement is the key to commitment. Without involvement, there is no commitment),
2. Impose a deadline (the work expands to fill the time allocated for its completion),

3. Allow the process to determine the roadmap to the objectives,
4. Continually re-visit the objectives, and
5. Trust the process. The process is as important as the outcome (the right answer too soon is the wrong answer)

Sometimes only a fishermen can talk to a fishermen.

B.C. fishermen now lead by example in conservation. We now have the ability to retain all species caught and account for all species discarded. Individual accountability and monitoring can eliminate illegal fishing activities, and our efforts were not conditional on something or someone else changing.

The five most important components of this fishery are:

1. Elimination of the race for fish,
2. Individual Accountability,
3. Transferability,
4. An innovative dynamic advisory body, and
5. Monitoring

I know that without these elements in my fishery, there was a guarantee for failure. Many of us now will survive and thrive because the system gives us the flexibility to be innovative.

This has allowed for much better working relationships with everyone involved in the industry and we will continue to evolve and mature over time because the system allows it.

Monitoring in fisheries benefits everyone - without exception.

Full accountability and monitoring are now accepted as the new reality. We think of it as paying for insurance. With it, our fishery is defensible.

Today, I am grateful that we made the decision to live in the solution rather than exist in the problem.

### **Dean Baigent – New Zealand Ministry of Primary Industries**

New Zealand commercial fisheries have become very politicized recently because of recent work by a university professor, showing catch reconstruction over the past 65 years and much higher than reported discarding levels – 3 fish discarded out of every 4 fish caught. The foreign charter program and the QMS create a ‘race for fish’ environment where discarding could occur, but the agency believes that discarding levels are not as high as suggested in the study. This has prompted the ministry to implement new policies concerning electronic monitoring and reporting. There are about 1,100 fishing entities that collectively fish 99,000 days per year; 153 fish less than 20 days and 193 catch valued at less than \$20,000. There is good observer coverage in the deepwater fleet (28%), yet the inshore fleet has very low coverage (4%) and is probably the greatest risk in terms of where discarding is occurring. The inshore fleet is difficult to monitor because of vessel size. NZ

has 4<sup>th</sup> largest EEZ in world and no boundaries with neighboring states. We don't believe there is an illegal or unregulated problem in these fisheries, but there is a problem with unreported catch. The focus is less about compliance and more about getting accurate, verifiable fisheries data to inform fisheries managers. The integrated electronic monitoring and reporting framework is intended to address this need. The integration of these elements provides more value than isolated systems. There is a set pathway toward implementation involving legislation, policy development, database management, and definition of reporting requirements. The QMS system in NZ provides a unique advantage because over 90% of the quota is owned by five companies who in turn provide catch entitlement to individual fishers. These companies have embraced the need to reform catch reporting and can provide significant leverage on the fishers. Implementation of this will probably result in fleet rationalization. The new reporting system will improve data quality and likely cause uncertainty with TAC settings. As well, the penalty regime was based on low contact – high consequence approach, and the new reporting system will be based on high contact. The ministry intends to focus on benefits over penalties, and take an incremental approach, 'eating the elephant one bite at a time.'

## Discussion

*Comment* – Jared Fuller (Saltwater) – Offered a comment on open source discussion, emphasizing that it has been used in order to build collaboration.

*Question* – Bret Alger (NMFS NE Region) – Everyone has a different level of tolerance around how much they are willing to break the rules. In the design of EM, the proportion of imagery reviewed may vary. In programs where less than 100% imagery is reviewed, fishermen have the potential to break the rules and not get caught. In the BC fishery, where just 10% of the imagery is viewed, how much of a disincentive is this?

*Answer* – Wes Erikson – The BC system is much like a radar trap system where the fisher does not know what imagery will be reviewed and risk of the penalty is high. The disincentive is high.

*Answer* – Amanda Barney – While the image review may be less than 100% often analysis is performed on sensor data to screen for certain events such as closed area fishing. As well, detailed investigation may occur with anomalies in the data set such as time gaps.

*Question* – Gil Sylvia (Oregon State) – Question for Dean Baigent about who pays for the EM/ER system in New Zealand, and whether the ministry is delivering performance standards or a complete operational program.

*Answer* – Dean Baigent – New Zealand has a levy system that collects funds from quota holders and is used to pay for programs such as this. The program cost should be viewed as installation costs and ongoing operational costs. NZ is a major seafood exporter and understands the importance of showing transparency.

Question – Philip Lens (FFA) – it is a pleasure to be here and be able to learn about EM.  
Question to the panel about whether EM data is admissible in court.

Answer – Dean Baigent – For New Zealand, EM is regarded as evidence and not an offence.  
Still need to go through an investigative process to gather and review evidence.

Comment – Howard McElderry (Archipelago) – Thanks to all the EM End Users for being flexible to incorporate EM Vendor comments in their presentations. EM offers the potential to be a significant game changer in creating transparency in fisheries. Fulfilling this is challenging and we are decades away from significant adoption. Often, when groups consider implementation in their fisheries, program design elements that have adverse cost implication, become hard coded in the design, making it harder to achieve this vision of wide scale adoption of transparency principles in fisheries.

Response – Dennis Hansford – While I somewhat agree, one needs to be mindful of the authorities and responsibilities that guide how various jurisdictions approach adoption of EM. In the US the process is slow but we are making progress.

Response to Dennis – Howard McElderry (Archipelago) - The larger vision of trying to achieve wide scale transparency across many fisheries means we can't let the current systems bracket our thinking. To make EM affordable, we need to find ways to open the market very broadly.

Comment - Mike Kelly (CLS) – Thanks to everyone for their involvement in this. It has been great to learn and gain new perspectives. It is great to learn about the ways the science community can use VMS and other data. Existing monitoring programs already provide a wealth of information and it is important to fully understand the capabilities of these programs before considering new technology. For example, an issue like zonal alerts to notify when a fishing vessel crosses a boundary already exist with current technology.

Comment to Mike Kelly – Alfred 'Bubba' Cook - There are so many new data streams and most fisheries agencies don't have the server banks to accommodate the data volume. The costs for this infrastructure is high and this will be a problem for agencies until the economies of scale make this affordable.

Comment - David Barrett – In response to McElderry's question 'What if monitoring costs were reduced to 25% of current price' in terms of the value monitoring provides. Monitoring protects places, times, markets and people. Monitoring in fisheries doesn't happen overnight and doesn't need to be viewed negatively. It is important to consider the pay off's that monitoring can provide.

Comment – Bruce Turriss (CGRS, BC Canada) – Thanks to the panelists for their contributions. Suggests that future panels like this could include other end users such as ENGO's, buyers, marketers, independent scientists, to bring in a broader diversity of views. It is important to keep an open mind in how we view EM and its potential uses. For example, EM could be

used to monitor crew who carry out scientific sampling activities, or vessels which could be engaged to participate in scientific survey activities during normal commercial trips. Moving forward with advancement of EM technology depends on movement toward more open architecture systems where the work elements could be separate but integrated. Industry wants to avoid being locked into a setting where there is no competition. The government has an important role but development of technology isn't one of their roles. They should be setting the standards, defining the needs and identifying the uses. As well, the government should be ensuring the process is equitable to all users. While a commercial fishery is often tasked with paying the costs of monitoring, it is important to keep in mind that there are many who benefit from a well managed resource, including other stakeholders, the public, and the government itself.

Comment – Amos Barkai (Olrac, South Africa) – Some of the worst predictions of all time relate to the future potential of very common technology like computers and the internet. The fishing industry is one of the most data hungry industries of the world, yet it relies on 50 year old technology. Wide scale adoption of technology in fisheries will happen but is going to take a change in vision to get there. Failure to change seems to be a delaying tactic, where people stay with their comfort zone, rather than responding to the needs. Moving this forward requires proper funding and development of standards.

Comment/Question – Melissa Hooper – In my role of writing regulations, what specific barriers are there to innovation? What specific things should be considered? EM Vendors identified subsidies, scale, partitioning as elements.

Comment – [Unidentified from NZ] – Feels like this is being approached from an adversarial position when this is more about recognizing the value of data. There are many large players investing in Big Data systems and the potential for EM and ER data is immense.

## Best Poster Awards

As with all our previous conferences, and in keeping with our desire to highlight the all-important poster presentations, we only give awards for what are adjudged to be the best posters presented.

At this conference the number and quality of posters was truly remarkable and resulted in excellent and interactive Poster sessions throughout the week as well as during the dedicated evening poster reception. The Conference Organising Committee together with a host of other judges scored all the posters presented and decided on the following winners:

**First Prize: Deirdre Brogan** - *How Do We Observe & Monitor Artisanal Tuna Fisheries In The Western And Central Pacific?*

**Second Prize: Adriana Myers** - *Conducting Effective Training Drills During Observer Safety Training: Building Muscle Memory And A Strong Safety Culture*

**Third Prize: Lara Erikson** - *Fishery Dependent Electronic Log And Remote Data Entry*

Congratulations to all our winners and to all the poster presenters for their fantastic displays.

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## Wrap-up Session and Where to From Here?

The final session of the conference was devoted to summaries about the conference and to hear from all delegates about suggestions for future conferences. Firstly, Mr Luis Cocas, the Undersecretary of Fishing and Aquaculture in Chile gave a summary of what he saw as the outstanding features of the conference.

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### Wrap-up speech

**By Luis Cocas**

**Unidad de Biodiversidad y Patrimonio Acuático, Subsecretaría de Pesca y Acuicultura,  
Gobierno de Chile, Bellavista N° 168, piso 14, Valparaíso, Chile**

Good morning everyone and thanks to Dennis Hansford for asking me to give the wrap up speech, certainly an honour.

First of all I would like to acknowledge all the people who, whether through presentations, posters, exhibitions of equipment, questions, and open discussion, or simply through their attendance made possible this outstanding 8<sup>th</sup> Conference. I think we all learned a variety of amazing new things that are happening out there in terms of fisheries monitoring and observation and if it were not for the Conference we never had known. I'm sure we all go back to our homes more motivated than we arrived and full of ideas (and business cards) to continue our work with passion.

In a very particular way I want to highlight the efforts made by all the fisheries observers who managed to come here, since they are one of the most valuable inputs to the Conference. After all the sacrifice that means to be at sea for months, working hard, away from the loved ones, spending part of their precious time off and at their own expenses teach us a lesson of commitment.

Finally I would like to recognize the members of the Steering Committee for the enormous work and time they put into organizing this event, much of which is done behind the scenes and anonymous. They have allowed keeping alive this Conference for a 8<sup>th</sup> time and its projection into the future. And I said enormous time and work because I witnessed when they start planning this 8<sup>th</sup> Conference when we still were performing the last conference in Chile, 3 years ago. So let me ask a round applause for all.

After all the acknowledgements, I would like to wrap up this Conference with some questions that came to my mind during this week...

Why we all made the efforts I mentioned? Why are we here again? What brought together such a diverse group of people from different corners of the world?

There is no doubt that from its earliest beginning mankind has marvelled with the sea, has observed the sea, and has loved the sea. Because of the resources that sustained its existence, because it allowed discovering new lands and expands the boundaries of the

known world...or simply because of its beauty. The sea has sustained the mankind and somehow has determined its destiny. The fascination of which I speak is in the DNA of the humanity, but I think that this fascination is in a very special way in every one of us here today, and that is why at some point in our lives we decided to be either observers, fisheries scientist, managers or fishermen, in some way we found a way to feel or be near the sea.

However, the seas so plentiful of resources that for a long time seemed inexhaustible are now in trouble in most parts of the world. Lately it is becoming increasingly clear that current levels of exploitation are producing its exhaustion, and sustainability of fisheries is becoming seriously threatened. An important number of fishing stocks and their environments are now fragile and if no significant changes are made urgently and globally, fisheries may collapse in a near future. If this happens, there is no doubt that the effects will be catastrophic in terms of food security, social impacts and in the end, global stability. The humanity, and specially our generation has the moral duty to prevent this from happening. Then we have no choice but to ensuring the sustainability of the oceans and the road to do so is just through responsible management and rational use.

At this point there is no doubt that responsible management needs sound information to make the right decisions at the right time, and during the Conference we have learned that there are plenty of better tools than never before to accomplish this task. Some countries have made great progresses and the examples are substantial.

The human expertise is here, the tools and new technology are available at affordable cost, the know how is in this audience, but all of these elements are not going to work and solve the challenge we face unless the whole world is able to progress and use them. This is where the challenge from now on is, and where makes more sense than never before the fact of having an IFOMC every 3 years. If we are not able to share our knowledge, to share our experience, to facilitate the access to the tools we have seen, to other countries, especially to developing economies we will fail in reaching the ultimate goal that brought us here. It is essential the cooperation between institutions, between countries but above all, between people.

During this week we have greatly admired the progresses achieved since the last Conference, definitively there are a number of valuable advancements, but if we analyse a bit, easily can see that the vast majority of experiences presented, come from a reduced number of countries and the scope of our work only covers a limited part of the world's fisheries. There are many countries that are trying to take the right steps to sustainability but somehow need help in this process and here is the duty and the challenge for those of us who have some influence; to advocate for the transferring of knowledge, for the standardization of information, for the access to technology, for the exchange between observer programs, tasks that must go and follow beyond this Conference. It is quite true that new technologies and highly qualified observers are needed and available in some countries, but it is also true that we certainly must make adjustments to cover other realities out there. We are challenged to create innovative and cost efficient ways to gather information, involving and validating the own fishermen and even the communities where they live. However, this last challenge, and particularly for developing countries, depends on a cultural change, which was not even a topic of this or previous Conferences. Here, the observers may play a leading role, them with their experience and proximity with fishing



activities can be the best connection between managers, scientists and fishermen or even communities.

Certainly on the road of achieving sustainability we will have to take drastic measures to eradicate fishing malpractices and increase control. However these changes must be done responsibly and are conditional to providing the observers with greater support, better safety and better equipment. Is not enough saying over and over again that they are important; at this point they must feel it.

The duty to bring about the change will not be easy and certainly we cannot continue as we are, it will require generosity and it will require sacrifices. Here I want to stop to remember our beloved friend Keith, whose work as an observer and whose life are an example of these virtues and a proof that the world can be a better place, and the change is in our hands. Keith legacy and life must be an inspiration for all of us, Keith made the ultimate sacrifice in the line of duty, if we all put only a fraction of the commitment he put I am sure we will accomplish the challenges we face.

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## Open Discussion

The Open Discussion period that followed Luis's outstanding summary provided an opportunity for delegates to provide feedback to the Organising Committee about the conference and suggestions for future conferences. This feedback is summarized as follows:

- There should be sessions focussing on:
  - stock assessment uses of observer data;
  - data gaps that could be filled by observers and/or Electronic Monitoring;
  - small-scale subsistence fisheries – those that feed families;
  - a panel comprised and chaired exclusively by observers;
  - a panel discussing the use of observers as educators;
  - a panel to discuss “Are we achieving sustainable fisheries using observers?”;
- There should be more widespread use of social media and the internet before, during and after the conference, including perhaps live feeds for keynotes;
- More advance notice about the conference would have allowed for more attendance - especially for the individuals traveling from Europe
- Training materials for fishing crews could be made available that the observers could pass out
- More effort should be put into getting more fishermen attending the conference;
- Encourage more participation of observers
- Consider ways to record the positive things that occur during a trip – (like an incident report but for good things – not just bad).
- A silent auction to raise money
- A Working Group to increase opportunities for women in our field;
- Development of the Observer Professionalism Working Group
- The conference has a mostly western focus yet we saw that the west can learn a great deal from the fantastic observer programs occurring in the Pacific and especially Papua New Guinea.

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**The next conference:**

Two organisations put forward offers to host the next conference - the 9<sup>th</sup> International Fisheries Observer and Monitoring Conference in 2018. These came from Marine Instruments, Spain and the Council for the Commission for the Conservation of Antarctic Marine Living Resources, Australia.

The Organising Committee decided that, in the interests of holding the conference in a continent where we have not previously held the meeting (Europe), that the next conference will occur in **Vigo, Spain in 2018**.

So please, stay tuned ..... all delegates who attended the San Diego meeting will be contacted in due course as we arrange the next meeting in Spain.

## Conference Attendees



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