IFOMC

11th International Fisheries Observer and Monitoring Conference

Harpa | Reykjavík | Iceland | 19.-23. May 2025

# Proceedings of the 11th International Fisheries Observer and Monitoring Conference

Edited by


**Dr. Lisa Borges**

FishFix, Portugal


Reviewed by

The 11th IFOMC International Steering Committee


**Preferred citation:**

Borges, L. (ed.) (2025). Proceedings of the 11th International Fisheries Observer and Monitoring Conference, Reykjavík, Iceland. ISSN: XXXXX, 242 pages.

**Example of preferred citation of a paper within these Proceedings:**

Lopes dos Santos, M., Begoña Santos, M. Carocci, F. and C. Morgado (2025). Evaluating compliance in fisheries. Pages 14-17 in Borges, L. (ed.) Proceedings of the 11th International Fisheries Observer and Monitoring Conference, Reykjavík, Iceland. ISSN: XXXXXX.

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## Acknowledgements

We would like to express our deepest appreciation to all those who participated in and supported the 11th International Fisheries Observer and Monitoring Conference. In particular we acknowledge the Conference Steering 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 hosts, the Directorate of Fisheries in Iceland (Fiskistofa) who supplied all kinds of assistance and staff before, during and after the event.

Our conference PLATINUM sponsors NOAA Fisheries and AG-Fisk a Working Group for Fisheries of the Nordic Council of Ministers, deserve special mention for assisting the event financially and other support. Our BRONZE sponsors The Nature Conservancy (TNC) and A.I.S., Inc. also contributed significant funding for the event. We would also like to thank the Ministry of Industries of Iceland for both its positive attitude and contributions to the conference

In addition, our exhibitors, Anchor Lab, Archipelago, Integrated Monitoring, Pinpoint Earth, Satlink, Teem Fish, Trackwell FiMS and Zunibal, 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 would like to thank our volunteer session chairs that have accepted to take on the job when Steering Committee colleagues were unable to attend: Bubba Cook, Catherine Benedict and Melanie Williamson. We also would like to acknowledge our volunteer rapporteurs who took detailed notes of all the many lengthy discussion sessions during the conference. These were: Martin Beach, Steve Todd, Lauren Trainor, Ivanna Diaz, Mack Hardy, Lauren McGovern, Alyssa Lambert, Sarah Williamson, Shane White, Vaughn Koh and Kevin Stockman.

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 four workshops and the many discussion periods supplied the main intellectual substance of the conference and, as a result, these proceedings.

## Sponsors

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## Exhibitors

## The 11th 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 11 themes and 2 workshops that ran throughout the meeting. The Steering Committee members were:

- Viðar Ólason (Committee Chair), Fiskistofa, Iceland
- Björg Þórðardóttir, Fiskistofa, Iceland
- Kristófer Leó Ómarsson, Fiskistofa, Iceland
- Lisa Borges, FishFix, Portugal
- Luis Cocas González, Undersecretariat for Fisheries an Aquaculture, Chile
- Lesley Hawn, NOAA/NMFS, USA
- Kenneth Keene, NOAA/NMFS, USA
- Mark Michelin, CEA Consulting, USA
- Amanda Leaker, Fisheries and Oceans Canada (DFO), Canada

And those who couldn't make the actual conference:

- Isaac Forster, CCAMLR, Australia
- Jason Jannot, NOAA/NMFS, USA
- John LaFargue, NOAA/NMFS, USA
- Amy Martins, NOAA/NMFS, USA
- Justin Clement, Ministry for Primary Industries, New Zealand

# Executive Summary

The 11th International Fisheries Observer & Monitoring Conference took place at the Harpa, Reykjavík, Iceland from 19th to 23rd May, 2025.

The overarching vision of this conference series is: to develop, promote and enhance effective fishery monitoring programs to ensure sustainable resource management throughout the world.

The conference was the most successful of the series so far involving 225 participants from 34 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 one distinguished keynote speaker, presented papers and posters, panel discussion sessions, workshops and less formal settings, such as trade exhibits, poster sessions and social events.

As for previous conferences, the heart of this conference was our Observers who have what is becoming accepted as one of the most challenging and dangerous jobs in natural resource management. Indeed, this conference series always devotes significant time and energy discussing ways to enhance Observer safety, well-being and security through training, support, policing and legislation.

As for recent conferences, this meeting also had a significant focus on the growing role that technology is playing in the monitoring of fisheries, through communications, video, satellite, drones and other high-tech means.

The conference consisted of a keynote address, 11 themes, our 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 summaries of each presentation, the 2 workshops and commentaries obtained during the Open Discussion periods.

## Opening Session

The opening session of the 11th IFOMC featured three distinguished speakers who warmly welcomed participants to Reykjavík, Iceland and set the tone for the week ahead. It began with a welcoming address from the Conference Chair, Viðar Ólason, followed by Kolbeinn Árnason, Director General, Department of Resources, Ministry of Industries of Iceland.

This greeting was followed by the Conference Keynote Address by Dr. Guðni Th. Jóhannesson, former President of Iceland (2016 – 2024). The following is the transcript of the welcoming speech from Viðar and Kolbeinn, and a summary of Dr. Guðni's keynote presentation.

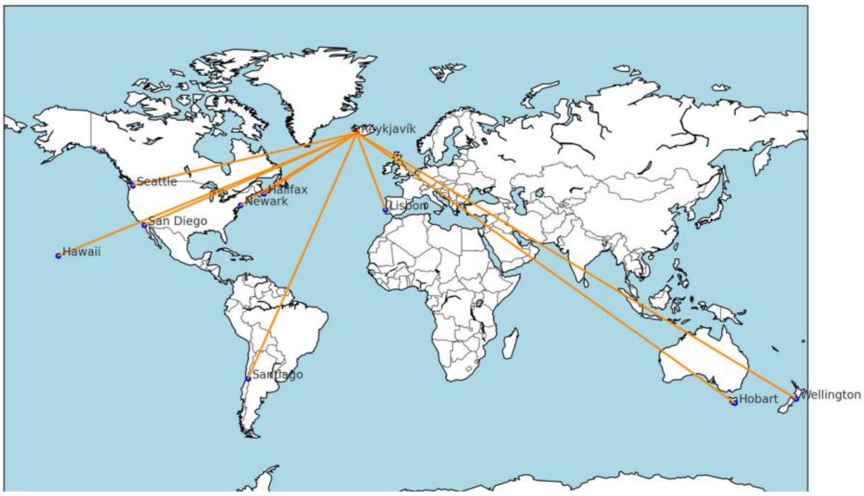
**Viðar Ólason**

**Chair of the IFOMC 2025 Steering Committee**

**Director of Surveillance, Directorate of Fisheries in Iceland**

Viðar Ólason opened the conference with a heartfelt welcome to all guests, setting the tone with a mix of insight and humour. He introduced the keynote speaker, Dr. Guðni Th. Jóhannesson, and reflected on the path that led Iceland to host the 2025 conference, a role originally planned for Hawaii. When a request came from the United States to switch years, Iceland, initially set to host in 2027, simply said yes. As Viðar remarked, this decision perfectly captures the Icelandic mindset embodied in the phrase "Þetta reddast" a uniquely Icelandic expression that conveys the belief that things will somehow work out, even if not everything is entirely in place.

Viðar acknowledged the many hurdles along the way and expressed genuine gratitude for seeing everyone gathered in Reykjavík. He introduced the 14 members of the Steering Committee, noting the impressive global coordination it took to plan across time zones, with members from "Down Under" already in tomorrow, and Hawaii waking up in the past. Somehow, it all came together beautifully.




He also shared a personal story about his early connection to the sea, starting with childhood fishing trips on a small wooden boat with his grandfather. While the details of the fishing itself faded, he vividly recalled the cocoa and sandwiches packed by his mother, and the seasickness that often sent him lying down in the bow. Later, he spent about two decades as a fisherman, much of that time as chief mate and captain on a bottom trawler.

Viðar then provided a brief overview of the week's program and highlighted the importance of cod to Iceland's fisheries with a photo of the species. As a closing gesture, he asked all observers and all former observer in the audience to stand and invited the audience to give them a warm round of applause in recognition of their role in promoting transparency and cooperation in fisheries management.

He then introduced the next speaker.

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**Kolbeinn Árnason**

**Director General, Department of Resources, Ministry of Industries of Iceland**

Kolbeinn Árnason delivered a clear and informative presentation on the economic and cultural importance of fisheries to Iceland. He noted that while fisheries currently account for about 40% of the country's export earnings, the figure was significantly higher in the past, exceeding 90% in some years. He emphasized the essential role of science-based management and effective monitoring in securing the sustainability of Iceland's marine resources.

Kolbeinn highlighted that most commercially important fish stocks within Icelandic waters are now sustainably harvested. He also spoke about the growing focus on full utilization of catches, ensuring that as little as possible goes to waste. As strong examples of innovation and value creation, he pointed to Collab, a popular Icelandic beverage made with marine collagen, and Kerecis, a biotechnology company producing advanced wound care products from cod skin. These two companies, among many others demonstrate how by-products from fisheries can fuel thriving businesses in both consumer goods and medical technology.

## Keynote Address

**The cod wars: Iceland’s fight for sovereignty over its fishing grounds**

**Dr. Guðni Th. Jóhannesson**

**Former President of Iceland (2016 – 2024) and Historian**

Dr. Guðni Th. Jóhannesson delivered a captivating keynote address titled “The Cod Wars: Iceland’s Fight for Sovereignty Over Its Fishing Grounds.” He examined Iceland’s decades-long effort, from 1948 to 1976, to assert sovereign rights and exclusive jurisdiction over its coastal waters and marine resources. With a blend of scholarly insight and compelling storytelling, Dr. Jóhannesson explored both the myths and realities surrounding Iceland’s stand against larger powers, highlighting the geopolitical and symbolic importance of fish to a small nation’s identity and independence.

His talk drew powerful connections between history, national pride, and modern fisheries management, reminding the audience that fishing and surveillance are not only economic matters but also deeply tied to sovereignty and self-determination. His keynote left a lasting impression and was still being referenced by participants several days later.

## Session 1. Why observe and monitor fisheries? The importance of at-sea monitoring

**Leader: Lisa Borges**

This session explored some of the underlying reasons and requirements for monitoring fisheries. Through a series of case studies from around the world, it examined some of the key issues that have led society, fishing industries, governments, NGOs, ecolabels, etc. to require fisheries to be monitored. It examined the many and increasing types of information needed from monitoring programs - for scientific, compliance and management purposes, to monitor bycatches of general discards and charismatic species, to monitor bycatches of general discards and charismatic species, to monitor human rights abuses, pollution, seafood traceability, eco-certification, etc. By sharing information about the lessons learned, and fostering increased collaboration among the world's observer community, this session introduced elements that permeated throughout the rest of the conference.

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## Oral Presentations - Extended Abstracts

**The FAO Deep-sea Fishery Project: supporting fisheries observers beyond national jurisdictions**

**Keith Reid, Eszter Hidas**

**Common Oceans Program, Deep-Sea Fisheries Project, Food and Agriculture Organization (FAO), Rome, Italy**

Introduction

The Common Ocean Program Deep-sea Fisheries under the Ecosystem Approach project (DSF Project) has a major focus on observer programmes as a key source of data to improve sustainable management practices for deep-sea fisheries in areas beyond national jurisdiction.

As part of meeting their obligations to manage fish stocks most RFMOs have requirements for observers to record catches and/or to collect associated biological data.

The DSF project is undertaking a review of the how RFMOs that have responsibility for the management of deep-sea fisheries implement observer programmes, including the different roles, levels of observer coverage required and how observer data are used.

Methodology

The initial element of this review is to examine how RFMOs specify the requirement for and the roles of observers and how these obligations are set out in management measures that also define the data that should be submitted and centrally managed in the RFMO Secretariat. In this context it should be noted that contracting parties may have their own requirements to deploy national observers on their vessels while fishing outside of their domestic EEZ, and that the data collected by these observers is frequently presented in papers to relevant RFMOs.

As part of a preliminary analysis, we have used the data collection requirements to describe RFMO observer schemes according to whether they provide data on fishing operations (gear, time, location and catch data) and/or biological data (length, mass, otolith/stomach sample collection etc).


Figure 1. The observer programme requirements in RFMOs that manage deep sea fisheries in ABNJ. NO – no observer programme, Op – observers collect fishing operations data, Bio - observers collected biological data. * CCAMLR is not an RFMO but is included here as it shares many of the characteristics of an RFMO especially in the context of fisheries observers.

Results and Discussion

Based on the requirement for the collection of operational or biological data it is apparent that there is a distinct difference between the RFMOs in the northern and southern hemisphere (Figure 1). In general, for those RFMOs that have an observer scheme, the role of observers in northern hemisphere are dedicated to observing fishing operations while those in the southern hemisphere collect both fishing operation and biological data. None of the RFMOs programme provide for observers having an inspector or enforcement role on the vessel, however, the data that they collect may be used as part of an assessment of compliance with management measures.

The difference in the roles of observers in the northern and southern hemispheres almost certainly reflect a range of factors, not least the relative spatial area of the RFMOs and the greater availability of fishery-independent biological data and associated research. The relative similarity in the formulation of observer requirements in the southern hemisphere RFMOs may also reflect the adoption of the approach to scientific observation implemented by CCAMLR in the early 1990s that was subsequently adapted by those RFMOs in the areas adjacent to CCAMLR.

It is important to acknowledge the difference in the roles of observers in different regions in order to avoid confusion in generalised expectations of observers. In particular, in the current discussions taking place in RFMOs on the potential role of electronic monitoring (EM) in observer programmes. Where the role of observers is restricted to monitoring fishery operations then much (if not all) of their role could potentially be replicated using EM. However, where there is a requirement to report on both fishing operations and to collect biological information then only a subset of the overall data collection requirements could realistically be gathered using EM.

The DSF Project is also engaged in activities to build capacity in observer programmes and in December 2024 it delivered a three-day workshop in Port Louis, Mauritius, with observers and observer managers from Parties to the Southern Indian Ocean Fishing Arrangement (SIOFA). This training workshop included classroom, vessel and fisheries laboratory sessions and discussion are ongoing with other RFMOs on similar capacity building opportunities. The project has also developed a web-platform to promote discussions and sharing of information, initiatives and lessons learnt related to the sustainable management of deep-sea fisheries and welcomes contributions from all interested parties.

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**A North Atlantic tale: valuing and promoting sustainable fisheries through a Regional Fisheries Observer Program**

**Miguel Machete[1,2], Jorge Gonçalves[3], Pedro Capela[4], Paulo Avila[4], Rogerio Veiros[5], Phillippine Wouters[6], Alexandre Morais[7], Luis Rodrigues[8], Andreia Henriques[9], Luis Costa7, Gilberto Carreira[10]**

**[1] IMAR, Horta, Portugal.**

**[2] OKEANOS, Horta, Portugal.**

**[3] Azores Fisheries Federation, Horta, Portugal.**

**[4] Tuna Producers Association, Horta, Portugal.**

**[5] Canning Industry Association, Horta, Portugal.**

**[6] IPNLF, london, United Kingdom.**

**[7] Regional Secretariat for Fisheries of the Azores / Regional Directorate for Fisheries, Horta, Portugal.**

**[8] LOTAÇOR, Ponta Delgada, Portugal.**

**[9] Regional Secretariat for Fisheries of the Azores / Regional Directorate for Fisheries, horta, Portugal.**

**[10] Regional Secretariat for Fisheries of the Azores/ Regional Directorate for Maritime affairs, Horta, Portugal**

Introduction

Fisheries observer programs worldwide are typically managed by government agencies, departments, or private companies contracted specifically for this purpose. Their primary objective is to monitor fishing activities by collecting critical data—such as fishing gear and operational details, bycatch, and interactions with ETP (Endangered, Threatened, and Protected) species—to support the effective management of fisheries and the sustainable use of marine resources (Hidalgo et al., 2025).

In contrast, the Azores Fisheries Observer Program (POPA) represents a distinctive model. Established nearly 30 years ago to address the unique monitoring needs of this outermost region (Figure 1), POPA now holds the largest fisheries observation database of its kind in the North Atlantic pelagic region, with over 5 million records. Funded by the Regional Government and managed by the Institute of Marine Research (IMAR), the program is governed by a structured framework consisting of an Executive Commission, a Scientific Council, and a Supervisory Commission—which includes representatives from producer organizations, industry associations, and the regional government.

POPA's primary focus has been the pole-and-line tuna fishery, the most emblematic fishery in the Azores. Through its long-standing monitoring efforts, the program has played a key role in securing essential ecological certifications for both the fleet and the industry (Kennelly & Borges, 2018). Its innovative approach—based on the principle of "collecting but giving back"—demonstrates how scientific monitoring can be meaningfully integrated into sustainable fisheries development.

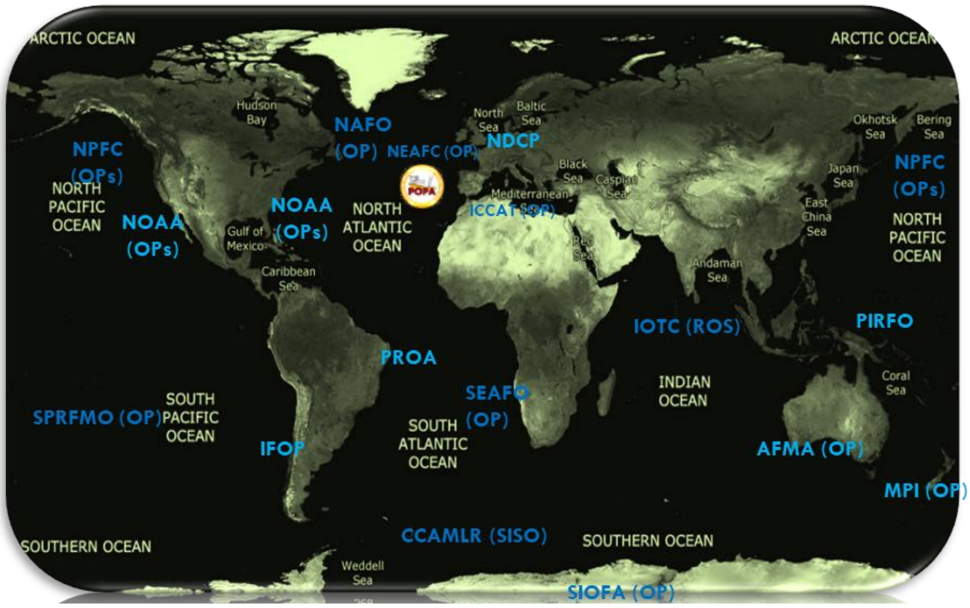

Figure 1 – major Fisheries Observers Programs global distribution map

<u>Results and Discussion</u>

A major illustration of POPA's foundational "collecting but giving back" principle was the significant revision of the Dolphin Safe (DS) certification system in 2022. During this process, the program committed to a minimum observer coverage of 27% for vessels over 14 meters in length, and, for the first time, implemented 50% minimum coverage of tuna landings by the smaller fleet segment through direct interviews conducted by the program coordinator. This effort - made possible only through close collaboration with the Azores Landing Network (LOTAÇOR) - marked a significant milestone, as the smaller fleet had previously remained completely unmonitored. Strong collaboration between fisheries associations and POPA led vessel owners to sign declarations of commitment, which formed the basis of a shared registry of participating vessels across the entire tuna fisheries sector. With the support of onboard observers, this collaborative approach enabled POPA to validate and strengthen certification compliance, reinforcing trust across fishers, industry stakeholders, and traders. In close alignment with the certification NGO Earth Island Institute, POPA also assumed responsibility for issuing the essential Dolphin Safe (DS) landing statements required by international markets. Beyond Dolphin Safe certification, the program actively supported the achievement of additional eco-labels—such as Friend of the Sea and

Naturland—by organizing and sharing essential fishery data, conducting descriptive analyses and reports for evaluation, and serving as a key advisor during NGO expert meetings and industry audits.

In recent years, POPA has also played a prominent role in tuna fishery value-enhancement initiatives. In 2019, a partnership with the International Pole and Line Foundation (IPNLF) and funding from the Waitt Foundation enabled the development of a ‘plastic fingerprint’ for the Azorean tuna fishery. The study revealed an extremely low plastic impact, with an estimated 0.3 kg of nylon waste per 1,000 tons of tuna caught. Encouraged by these results, a ghost gear (GG) recovery initiative was launched between 2021 and 2023, supported by Biocoop and Fish4Ever in collaboration with IPNLF, the Azores Sea Observatory, the Azores Fisheries Federation, and the Tuna Producers Association. POPA observers monitored and recorded GG collection efforts, resulting in over two tons of ghost gear removed during the campaign.

This initiative laid the groundwork for a global awareness campaign coordinated by IPNLF, presenting the Azorean tuna fishery as the world’s first Plastic Neutral Fishery. The campaign culminated in the production of the documentary A Truly Plastic-Neutral Fishery by filmmaker Pepe Brix, which was screened at several international film festivals and won the Environmental Awareness Award at the San Sebastián International Film Festival.

Since 2016, POPA has further reinforced its “giving back” mission through the annual publication of a dedicated bulletin for fishing professionals. This publication shares insights derived from onboard data, ranging from sustainability indicators—such as evidence that live tuna discard rates increase sharply after quota closures—to best practices in onboard waste management, promoted through a “Zero Waste” contest run in collaboration with the Regional Directorate for Marine Policy. The bulletin also includes monthly maps of tuna and live bait catches per season (Figure 2), offering fishers practical and actionable information directly relevant to their operations.

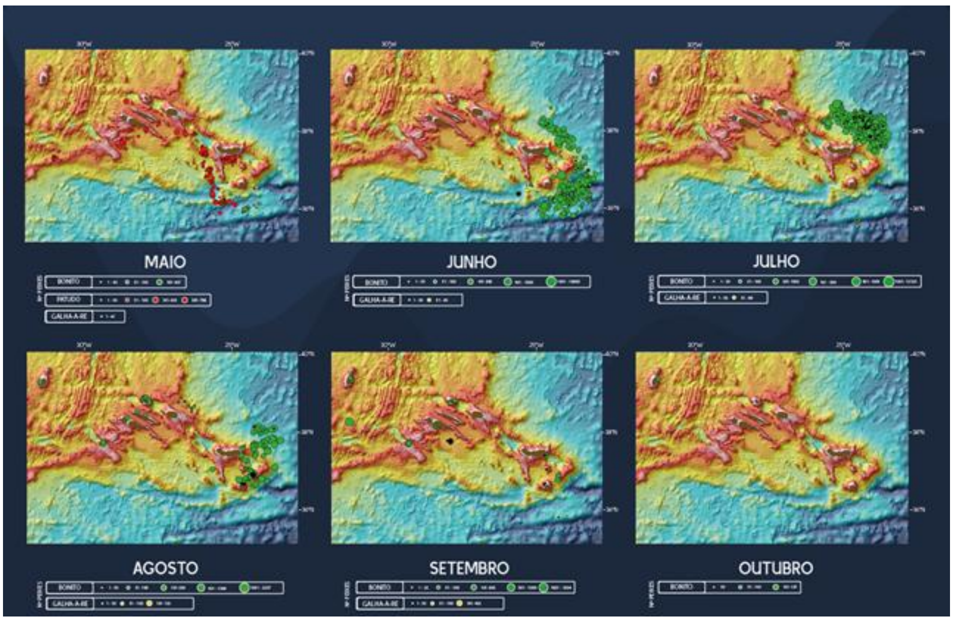


Figure 2 – example of tuna catch maps per month in each season, included in the yearly POPA publications

In addition to its previously mentioned contributions, POPA plays a vital role in supporting the tuna fisheries sector by providing robust, data-driven responses to proposed fishery management measures—both direct and indirect—that could negatively affect tuna fishing activities. A recent example is POPA's involvement in the revision of the Marine Protected Areas (MPA) framework in the Azores. To emphasize the importance of certain areas to the tuna fishery, POPA analyzed georeferenced tuna catch data from its long-term database, summarized the findings, and shared this information with relevant fisheries associations.

Conclusion

Despite the significant challenges currently facing the Azorean pole-and-line tuna fishery - including inexplicably low quotas for key target species, rising operational costs, and logistical constraints related to storage and management - POPA has consistently worked to strengthen the fishery's position. Through a range of initiatives in recent years, the program has helped highlight the fishery as a model of best practices in fishing techniques, resource management, habitat conservation, and environmental compliance.

Acknowledgments

We would like to express our sincere gratitude to the Regional Secretariat for the Sea and Fisheries for funding the Program. Our thanks also go to the Chair of the Azores Fisheries Observer Program and Director of IMAR for his continued coordination support, as well as to the Institute of Marine Sciences of the University of the Azores – OKEANOS.

We are deeply grateful to the vessel owners, captains, crews, and all the tuna fishing sector associations and entities for their essential collaboration. Most importantly, we extend our heartfelt appreciation to all the fisheries observers, whose dedication, sacrifice, and professionalism have placed them on the front lines of this Program—often under challenging conditions—collecting the robust and reliable data that is the basis of its foundation.

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

### The impact of observers in increasing compliance in the ICCAT & IOTC transhipment regional observer programmes

**Owen Kelley-Patterson, James Moir Clark**

**MRAG Ltd., London, United Kingdom**

Introduction and background

MRAG, along with our consortium partner CapFish, manage the ICCAT, IOTC and CCSBT regional observer programmes (ROPs), which involve deploying observers on carrier vessels (CVs) transhipping tuna and tuna-like species from longline vessels in the Indian and Atlantic oceans. The observer's responsibilities include performing inspections on board the vessels that tranship with the carrier vessel to ensure they are in line with the relevant conservation and management measures (CMMs). They check things such as the Vessel Monitoring System (VMS), the Authorisation to Fish (ATF), the logbook and the vessel markings. Observers will issue a potential non-compliance report (PNC) to the respective RFMO secretariat and vessel flag state if any potential infractions are observed.

Methods

We have analysed the observer data collected since 2013 by counting and categorising the PNC reports issued by ROP observers. These data were then normalised against the number of longliners inspected in the given year, to give a figure for the number of PNCs issued per 100 inspections in each PNC category each year between 2013 and 2023.

Results and findings

Having observers oversee at sea transhipments appears to have had an impact on the number of PNCs issued over time and improved compliance. This was most notable within the ICCAT ROP where 63 PNCs were reported per 100 longliners inspected in 2014 and only 8 PNCs were reported in 2022. In IOTC there is a similar trend, with around 44 PNCs reported per 100 inspections in 2014 compared to just 12 in 2022.

Conclusion

Looking at this reduction we can see the fundamental impact that observer programmes can have on increasing vessels' compliance with the CMMs put in place by the RFMO and the subsequent management of the fishery.

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**Evolution of fisheries monitoring programs in Chile (Observers and EMS)**

**Luis Cocas[1], Raul Saa[2]**

**[1] Subsecretaría de Pesca y Acuicultura, Valparaíso, Chile.**

**[2] Servicio Nacional de Pesca y Acuicultura, Valparaíso, Chile**

Within the framework of the implementation of a fisheries management strategy with an ecosystem approach and following the recommendations of FAO aimed at guaranteeing ocean´s sustainability and food security, Chile has developed since 2012 a process of diagnosis, reduction and control of discards and incidental bycatch in its national fisheries. This process has involved the joint efforts of the regulatory, research and control agencies along with collaborative work with the fishing industry, leading the country to the gradual solution of the problem.

Considering the challenges of controlling and registering discards and incidental bycatch at sea, Chile incorporated in 2020 the mandatory use of EMS (Image Recording Devices - DRI and Electronic Logbook System - SIBE) to control compliance, with differentiated application depending on the type of fleet and fishery, together with the maintenance and enhancement of human observation programs onboard for scientific purposes.

The results obtained to date have shown significant reductions in both discards an incidental bycatch, proving that the appropriate implementation of measures and its scientific and compliance monitoring may gradually solve the problem.

In addition, these new technologies to collect, register, manage and analyze fishing data are providing a set of possible solutions to update and modernize the fisheries data systems of the country and to significantly expand the collection and analysis of information, also for research and management, creating an opportunity to coordinate and enhance the work of the fisheries management agencies, around the maximization of the use of the information that can be obtained from these monitoring tools.

Details on the implementation of the monitoring programs, relevant results, lessons learned, challenges and recommendations will be presented to the audience to foster discussion.

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**Why management and surveillance - Short overview of fisheries in Iceland from settlement to modern time and the development of the current fisheries management system.**

**Erna Jónsdóttir**

**Fiskistofa, Akureyri, Iceland**

In my presentation I will have a short overview of fisheries in Iceland from settlement to modern time.

Fisheries are integral part of the Icelandic identity and history. Since settlement time fisheries have been vital part of Iceland's food supply. First only for domestic consumption but with more international sailing fisheries was Iceland´s most important product/commodity for international commercial. Fishery products paved the way for import of other products and thus contributed greatly to Iceland's economic and social development.

Fisheries were limited by open rowing boats and hard weather conditions. The need for some kind of fisheries management did not emerge until at the beginning of 20th centuries when motorised vessels were introduced with more capacity. I will try to shed a light on how the fisheries management system developed from free fishing to the highly regulated sector it is today. I will examine the objective and the protective interest of the fisheries management system in its infancy and compare it to the objective and the interest of the current fisheries management system.

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**Applying integrated scientific monitoring of sensitive species in Croatian fisheries: First findings of multi-methodological approach**

**Igor Isajlović[1], Ivana Vukov[2], Ratko Cvitanić[1], Damir Medvešek[1]**

**[1] Institute of Oceanography and Fisheries, Split, Croatia.**

[2] **Directorate of Fisheries, Ministry of Agriculture, Foresty and Fisheries, Zagreb, Croatia**

Monitoring sensitive species in marine fisheries requires tailored strategies to gather reliable data and address practical limitations in diverse fishing contexts. From 2022 to 2024, a comprehensive monitoring program was established in Croatia, targeting high-risk fishing gears. This program integrates diverse methodologies aimed at increasing data accuracy, contributing to bycatch mitigation, and enhancing fisheries sustainability.

Key methodologies for data collection included scientific observer sampling on-board fishing vessels, sampling and questionnaires at landing sites for vessels unable to accommodate observers, and self-sampling by fishermen using cameras during hauling operations on a subset of bottom trawlers. Fishery-independent survey data, including MEDITS and MEDIAS, complemented these efforts. Additionally, data from fishing logbooks, reports from ICCAT observers, and national observers deployed on bluefin tuna towing vessels were incorporated. Finally, information from Croatia’s national alert system for injured and stranded marine mammals and turtles further enriched the dataset.

This integrated approach enabled the collection of robust, multi-source data on bycatch, species composition, and habitat interactions. For instance, on-board sampling yielded comprehensive species-specific data, while self-sampling overcame logistical difficulties and strengthened fishers' engagement. Fishery-independent surveys and external data sources expanded spatial and temporal coverage, enabling a broader understanding of sensitive species interactions with fisheries.

Findings highlight the effectiveness of combining diverse methodologies in reducing monitoring gaps to efficiently support marine fisheries management. By integrating traditional and innovative techniques, this approach not only enhances compliance with regulatory frameworks but also aims to contribute to the conservation of marine biodiversity. The research emphasizes the importance of adaptable, multidisciplinary monitoring approaches, to balance fisheries operations with the preservation of marine sensitive species.

## Open Discussion Session

Ken Keene to Luis Cocas

Q: In two of your slides you show that there was a sharp reduction in discard and protection of protected species. To what do you attribute the decline?

A: It's a whole process, we can't give all credit to Electronic Monitoring (EM). The process began with making fisheries more transparent, increasing the ability to diagnose discard and incidental bycatch with the industry. In the beginning, we started with a non-sanctioned program. Industry was able to see the problem (which was originally taboo) and emphasize how big the problem was. The industry started taking action to reduce the numbers on their own. That's when we introduced mandatory measures to reduce issues as well. By the time the cameras started rolling, the problems were on the way out. It's a feedback loop: when we see an issue, we bring it to the industry. Lot of pressure from the market and from MMPA (Marine Mammal Protection Act) and incentives to stop killing marine mammals also contributed. The decline in discard is a combination of elements, but EM makes a big role, since they know we are watching every set.

Miguel Nuevo to Luis Cocas

Q: How will the hard-drive construction and distribution work? Seems like a lot of data to store in one space. Will you go to a more cloud-based system, or will you continue with hard-drives?

A: When we began in 2020, hard-drives were most cost-effective. In the past 5 years, we have run out of storage space (as we have petabytes of data). Consider: we have the entire fleet monitored, for every set, with 2 to 8 cameras per vessel. We acknowledge that hard drives are expensive, risky to move, etc. We are starting to use a cloud system, but there are challenges: internet infrastructure needs to be implemented, and a cost assessment shows high costs to cover 500 vessels. We are working on it, but we need to find a cost-effective system for a huge fleet. Once we find the new system, the entire EM system will be updated (old and new in artisanal fleet).

Hrannar Mar Asgeirsson to Keith Reid

Q: There has been no observer scheme for export fisheries in the Northeast Atlantic Fisheries Commission (NEAFC), but we have to have observers onboard. Contracted parties often have their own observer scheme. There is an international council for exploration of the sea. Role of observer schemes and conclusion from the compliance committee was not to include an observer scheme. The Northwest Atlantic Fisheries Organization (NAFO) has robust tools, Vessel Monitoring Systems (VMS), post trip measures, etc. The question is, what do you think is the main reason for more observer schemes in the North than in the South?

A: It is important to recognize: even if it's a fishery with no observer program (Regional Fisheries Management Organization, or RMFO), that doesn't mean there isn't data going into management. Northern Hemisphere RFMOs cover smaller areas. Other fisheries-independent science (historic and contemporary) shows prior activity. There's not as much fishery-independent science going on in the south, so observer programs were implemented. Each method is not better or worse, just different ways to manage data.

Elinor Brett to the panel

Q: What is the best use of data in response to the data you have been receiving? Are governments using the data well enough?

A: Keith Reid: One of the global examples where observers have contributed to collecting and translating data to management is Protected, Endangered, and Threatened Species (PETs) incidental bycatch, seabird data etc. Introduction of observers provided cultural shift in these fisheries, especially for vulnerable ecosystems. What used to be just an annoyance can now close a fishery. Observer data has tangible results in fishery management.
Miguel Machete: It depends on the government you're asking about. Keith's answer was broad, regarding to Fisheries Management Organization (FMO) observer programs. In Azores, the best available data you can get is from observers in all fisheries. The government should understand what is going on with their own fisheries and their fleets. Having this kind of data that is not available in every country or region should be analyzed and used by the government. To better understand how fishing operations work, how the fleets behave instead of going to other data sources. Why go to AES (Associação Empresarial para a Sustentabilidade) data when you have observer data? Personally, the government should be giving more attention to observer data.
Luis Cocas: There are many tools and technologies to monitor fisheries, but most depend on the behavior of fishermen. Observers play a key role—they can relay important information to the fishers. In spite of EM technology, we strongly promote the use of observer programs. The government is aware of the importance of people on vessels. Having a high-standard observer program deliver messages to the industry is vital.

Lina De Nijs to Luis Cocas
Q: Your example of an escapement panel on the trawl gear. Why is the escape window on the top of the net?
A: The example I chose for my presentation was one that was designed by the industry. The only rule is that an excluder is required, not what type of excluder or which design. Some fleets (like midwater vs. bottom trawl) put the openings wherever it makes most sense for them. For the example I used with the escapement hole at the top of the net, maybe they chose it because it is possibly easier for sea lions to escape from the top of the net instead of the bottom.

Viðar Ólason to the panel, but to Erna Jónsdóttir and Igor Isajlović.
Q: How important is it to have transparency in data for the public?
A: Erna Jónsdóttir: Very important. Data transparency increases trust for the system.
Igor Isajlović: Every data provided to European commission should be available for use. Sometimes the commission uses all data, sometimes just bits. But availability is important.
Keith Reid: When trying to map deepsea fishing beyond bounds, having data transparency is vital. It is hard to get global consistency for transparency, but we are working with industry to increase the positives. There are not many downsides to data transparency, and the industry is coming around to transparency as well.
Luis Cocas: Public data should be public. We have 32 partners, 10-15 countries, and only 1 public. Transparency can increase knowledge, but some items may need to remain confidential.

Kevin Stockman to Luis Cocas
Q: In your slides, I saw you have 200 observers funded by the government. Our program (West Coast Groundfish Observer Program) has a few long-term observers, but relatively high turnover rate. Are your observers long-term employees, and do you have problems with observer recruitment and retention?

A: I was an observer with the North Pacific Observer Program (NPOP), which had small 90-day contracts and few benefits. Ours is a quite different program, and the contracts are very different. Observers are permanent employees with the research institute. Some have over 20 years in the service and ready to retire. Rotation of observers is expensive, so our system is made to retain. Observers have regular job benefits and permanent contracts. They stay indefinitely.

Martin Beach to Igor Isajlović
Q: I'd like to know more about the collaboration of neighbours on the Adriatic Sea. How does your observer program support that collaboration?
A: The main topic to focus on is that we need to establish consistency across all programs. We are jointly involved, share data, and have workshops to analyze data. However, the General Fisheries Commission for the Mediterranean (GFCM) does not have the national support like the European Union. We only cover half the area, but others who cover the other half don't have the same support that we do.

Mack Hardy to Owen Kelley-Patterson
Q: There's a lot to be said about lack of compliance and safety in the transshipment program. There has been considerable speculation about the disappearance of Keith Davis, and more stringent compliance for vessels in the wake of that. I am interested in hearing more about the evolution of safety and compliance on transshipment vessels since that incident.
A: Owen Kelley-Patterson: I am unfamiliar with the Western Pacific program, but the International Commission for the Conservation of Atlantic Tunas (ICCAT) and the Inter-American Tropical Tuna Commission (IATTC) have good cooperation with vessels and no serious issues. There were some earlier issues with uncooperative boats, which were documented and entered as Potential Non-Compliances (PNCs). These get reported and resolved quickly nowadays. However, enforcement is complex, since those onboard a vessel are subject to the laws of the flag state on the vessel, and cooperation is handled by the secretariat of that nation.
Lisa Borges: There has been a certain decrease in law breaking. For Owen Kelley-Patterson: Are you seeing this as a change in behavior or is it just a change in knowledge of the rules?
Owen Kelley Patterson: It's a bit of both, I believe. Having a person onboard the vessel to document PNCs has definitely had an impact.
Miguel Machete: After the loss of Keith Davis, there has been a definite change. At that time, using a GPS device or having a Garmin InReach was not mandatory. However, afterwards everyone was given that equipment.
Lisa Borges: There have been significant changes to laws and program protocols as a result of the loss of Keith Davis. Bubba Cook and the Safety Panel will discuss these later in the conference, but the International Fisheries Observer and Monitoring Conference (IFOMC) has assisted with changes in laws to protect observers, including requiring more gear and legislation for their safety.

Jason Vestre to Owen Kelley-Patterson
Q: You mentioned that your observers must verify that the vessel has VMS onboard and that the power is on to the unit. Is there any other interaction with the observer program and VMS?
A: All our observers need to confirm is that the VMS control unit is on. Beyond that, who monitors it? At the national level, it's required by RFMO. Observers, however, can't tell if

the units are reporting and it is not practical for our observers to confirm that. So for now, the power light is the only way to tell. Vessel inspections are only one part of our observer duties, and dedicating more time to ensuring VMS is functional is not worth the extra effort. Unfortunately, some vessels don't have a control box onboard, and we still need to resolve how to check these vessels for compliance in the future.

Jason Vestre to Erna Jónsdóttir
Q: You shared some interesting information about the laws regarding the original rights for the people of Iceland. Do any of those original rights still remain, like fishing from shore or how whale strandings are dealt with on private property?
A: Yes, some still remain. Fishing on shore is for subsistence only, but is allowed. I am not positive about whale strandings on private property, but I think that those rights are still in place. However, there may be a lack of interest in using those whales for consumption, so possibly the rights still apply to the landowner's responsibility for the disposal of the whale.

## Poster Presentations - Extended Abstracts

**The shark research fishery: the achievement and value of observing sandbar shark (*Carcharhinus plumbeus*) longline fishing in the Southeast USA**

**Shane White**

**A.I.S., Inc, in support of NOAA Fisheries Office of Sustainable Fisheries, SEFSC Observer Program, USA**

Background

Globally, sharks are a common topic of discourse among scientists, the public, and the industry due to their ecological and economic significance. Shark roles include top-down ecological regulation, ecotourism, and as a food source.

In the USA, many species are considered at-risk of extinction, both by the IUCN and the CITES. Overfishing is the primary driver of shark population declines. Sharks are common bycatch across commercial and recreational fisheries in the Southeastern USA, raising concerns about shark regulation and sustainability. This is particularly challenging due to the underreporting of bycatch incidents, as well as many species having high rates of post-release mortality.

Due to their accessible proximity to shore (Figure 1) and their large dorsal & pectoral fins (Figure 2), sandbar sharks (*Carcharhinus plumbeus*) were a large financial incentive to retain and sell.

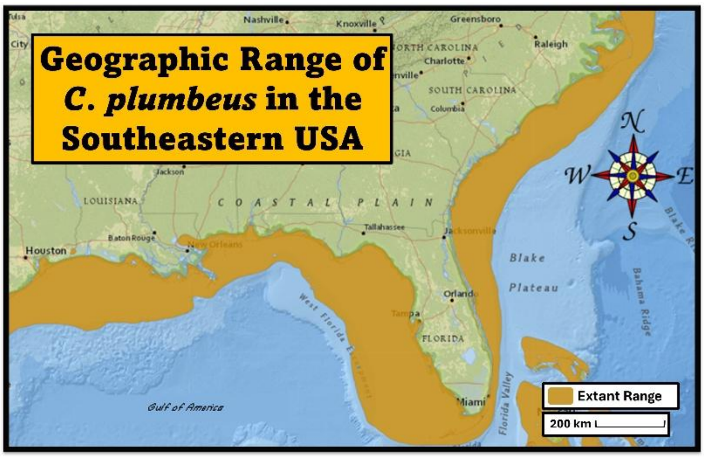


Figure 1 (Left): *Map of the geographic range of* Carcharhinus plumbeus *in the Southeastern USA (IUCN, 2020). Note the species' proximity to shore, making it more susceptible to fishing pressure, both as a target species before its prohibition in 2008, and as bycatch in current fishing efforts. Note C. plumbeus range is not restricted to the region shown.*

However, in 2006, a NOAA stock assessment classified this species as overfished. In 2008, the USA declared them prohibited to retain in federal waters. To promote sustainably harvesting the limited sandbar shark quota while enabling the collection of valuable data, the Shark Research Fishery (SRF) was implemented, allowing select commercial fishers to legally harvest and sell an otherwise prohibited species. These trips require a NOAA-approved observer present for every trip conducting SRF sets (100% coverage).

Methodology & Data

A robust set of data is collected on every SRF set. Abiotic factors include date, soak time, GPS, weather conditions, depth, and longline gear characteristics. Biotic factors include sex, fork length, and condition. Observers dissect randomly retained *C. plumbeus* specimens (Figure 2), to be later analyzed for life history purposes, as time and supplies allow.

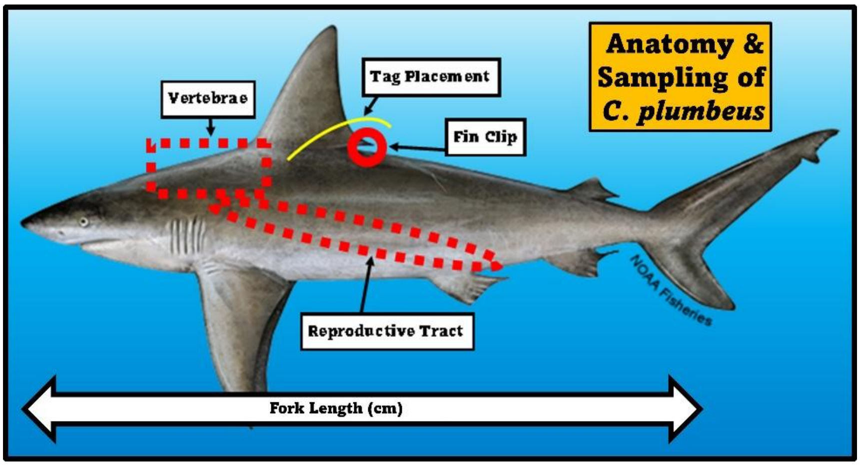


Figure 2 (Right): *Body plan of a typical female* Carcharhinus plumbeus *specimen, a large coastal shark found on the Atlantic coast of the USA. Note the large first dorsal and pectoral fins, making it valuable catch in the shark fin trade, before it's prohibition. An observer would randomly select retained* C. plumbeus *specimens in Shark Research Fishery (SRF) sets to be sampled for biological material, to be preserved and later analyzed in a lab. Several vertebrae are removed, which help in aging the individual. The reproductive tract is removed, which reveals the individual's sexual maturity, among other reproductive clues. A fin clip is also removed, typically from the first dorsal fin, which can be used in a variety of DNA, isotope, or contaminant analyses. Fork length (cm), sex, condition, and species are recorded for all catch of each SRF set, regardless of species and its selection to be biologically sampled. Since the SRF's start in 2008, 4097 individual* C. plumbeus *have been successfully sampled.*

Despite primarily targeting *C. plumbeus*, SRF trips have provided unique and otherwise difficult opportunities to collect data on incidental elasmobranch species of interest such as endangered dusky sharks (*Carcharhinus obscurus*) and critically endangered smalltooth sawfish (*Pristis pectinata*).

Dead bycatch specimens can be dissected for organs that provide insight into the animals' genetics, aging, reproduction, diet composition, and overall health (Figure 3). Living bycatch, if tagged, can provide insight to behaviour such as spawning, hunting, and migration (Figure 4).

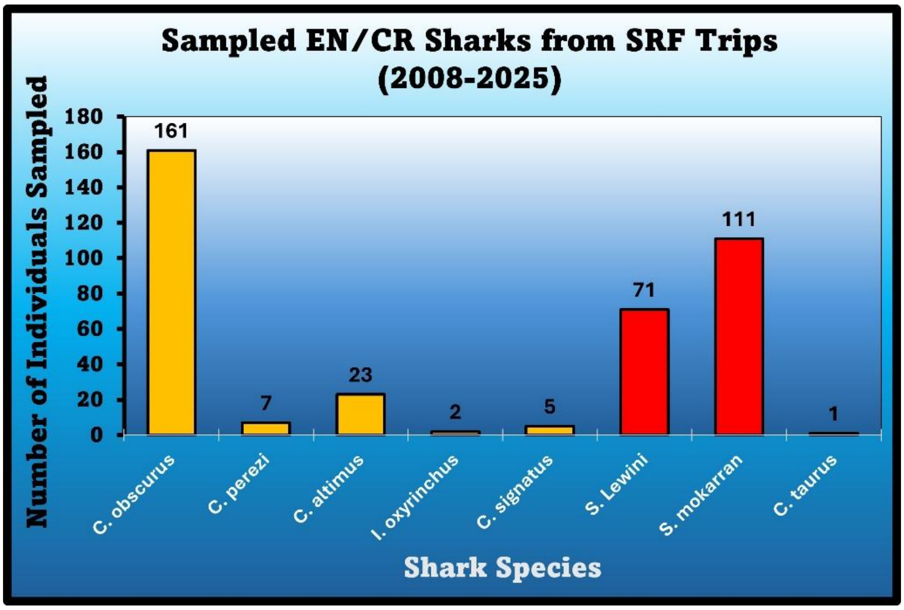


Figure 3 (Left): *Number of endangered (EN, orange) and critically endangered (CR, red) shark species incidentally sampled (n = 381) for vertebrae, among other organs depending on research goals, during Shark Research Fishery (SRF) sets since the*

*fishery's implementation in 2008. These shark species are prohibited to retain and sell, even with an SRF permit, so these samples were collected on the condition the animal brought to the surface was dead, thus impossible to release alive. Note that many other non-endangered species, such as white sharks (*Carcharodon carcharias*, n = 4, vulnerable), bull sharks (*Carcharhinus leucas*, n = 311, vulnerable) and tiger sharks (*Galeocerdo cuvier*, n = 42, near threatened), are not shown in this figure, but are still biologically sampled if caught dead on SRF sets, if time and supplies allow.*

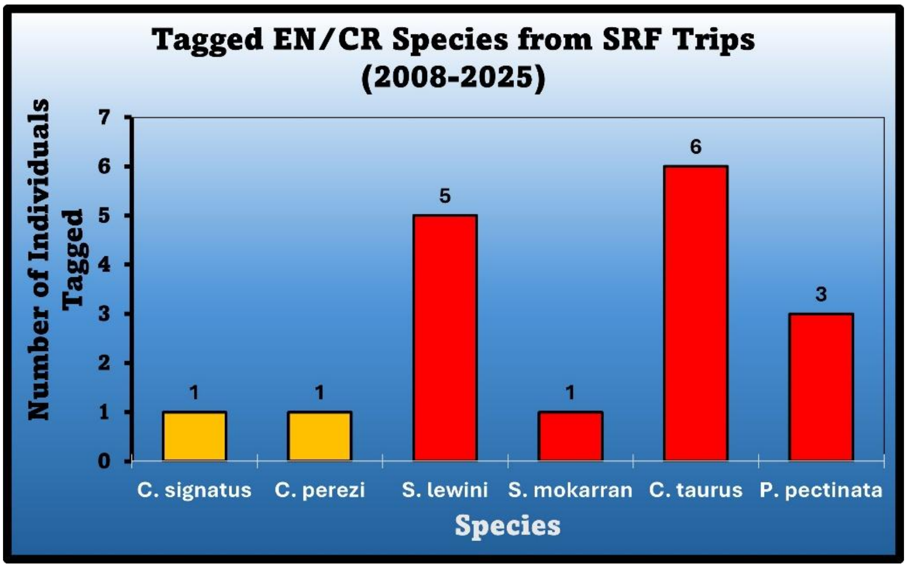


Figure 4 (Right): *Number of endangered (EN, orange) and critically endangered (CR, red) shark species incidentally tagged (n = 209) and released alive during Shark Research Fishery (SRF) sets since its implementation in 2008, with either passive or active tags. The number of individuals of tagged dusky sharks (*Carcharhinus obscurus*, n = 192, endangered) is omitted from the diagram due to it being a large outlier sample. Note that the number individuals of tagged smalltooth sawfish (*Pristis pectinata*, n = 3, critically endangered) is shown, despite it being a ray, not a shark. Passive tags are more common and often rely on the shark being recaptured or passing through specific regions, whereas active tags are more expensive, but collect more data and don't rely on the shark to be recaptured. Passive tags are useful for learning about a shark's long-term movement and growth. Active tags are useful in learning a shark's short-term behaviour, such as diving, hunting, and spawning.*

## Conclusions

The SRF is a highly regulated fishery with a unique position of benefiting many shareholders, while also being a comprehensive case study on fisheries management. Observers can provide scientists with vigorous temporal, spatial, and biological data of relatively unretained species, helping understand their conditions at the population level.

These continuous analyses and stock assessments help policymakers create management plans in response to animal & consumer needs, optimizing natural resources. Fishers holding SRF permits can make money from fishing for sharks sustainably and can be further incentivized through Electronic Monitoring (EM) and shark tagging programs.

The success and implementation of the SRF can inspire direction in other fisheries, particularly those involving at-risk and/or limitedly retained species. The SRF further validates the importance of fisheries observing, and the value of the data collected.

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

### Discard and bycatch assessment at austral demersal freezing trawling fleet in Chile, a contribution of at-sea monitoring

**Marcelo San Martín[1,2], Claudio Bernal[1], Juan Carlos Saavedra[1], Cristian Vargas[1], Luis Adasme[1]**

**[1]Instituto de Fomento Pesquero, Valparaíso, Chile.**

[2]Universitat de Barcelona, Barcelona, Spain

Discard and bycatch are a significant problem for world fisheries. The Chilean fisheries is no exception and during 2012 its fisheries law was modified incorporating special regulations to attend to these issues, including the generation of research and monitoring programs through scientific observers on board. With the aim of showing the evolution of this process in one of most important demersal fisheries in Chile, the assessment of discard and bycatch levels in southern freezing trawling fleet from 2015 to 2023 is presented. The monitoring program considered a cluster sampling design, where observers collected different data as, catches, discards, bycatch, causes of discard and operational data. Discard levels showed variations through the historical series, however, significant decreases were observed with proportions from around 20% to less to 3% of total catches toward the last years. Catches included forty different species, but the target species *Macruronus magellanicus* and Merluccius australis, were the principal discarded until 2019, mainly by commercial causes as small size and quality. From 2020, some deep sharks were included within the main species discarded, but lower values. Similar trend was observed in bycatch rates to seabirds and sea lions, the only species affected, achieving one of lowest values in 2023, with 0.003 and 0.008 seabird and sea lions by set, respectively. Results obtained by the monitoring program, have been important input to understand and assess the discard and bycatch in this fishery, helping to Chilean Undersecretary of Fishery establish reduction regulations as discard prohibition, adjustment of the non-target species catch rate, use of bird scaring line and excluder device to sea lions, and mandatory use of electronic monitoring. Whereas the permanent changes of fishing operation and environment, the success of this kind of process must include a constant monitoring and scientific observers are key to detect and report it.

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**Monitoring the Jabuka Pit FRA: ensuring sustainability and stock recovery**

**Damir Medvešek, Ratko Cvitanić, Igor Isajlović, Nedo Vrgoč**

**Institute of Ocanography and Fisheries, Split, Croatia**

The Jabuka Pit, a vital ecological and fisheries hotspot in the Adriatic Sea, plays a fundamental role in sustaining populations of commercially valuable fish and crustaceans. This study highlights the critical need for ongoing fisheries monitoring at sea as a cornerstone for maintaining the benefits of spatial fishery closures and achieving long-term sustainability.

The paper examines the key factors that led to the designation of the Fisheries Restricted Area (FRA) in the Jabuka Pit, emphasizing the pivotal role of scientific monitoring in identifying regions where restrictive fishing measures can drive significant stock recovery. Seasonal monitoring campaigns, conducted following the MEDITS protocol aboard research vessels, provide essential insights into biomass trends, species distribution, and fishing effort dynamics.

The findings reveal a steady increase in biomass for key fish and crustacean species, particularly within the designated No-Take Zone (NTZ). The observed "spillover effect" into surrounding fishing grounds demonstrates the ecological and economic advantages of the closure, underscoring its value as an effective fisheries management strategy.

This study underscores that the success of the Jabuka Pit FRA is closely tied to rigorous, long-term monitoring programs. Consistent data collection and analysis remain crucial for adaptive management, enforcing protective regulations, and safeguarding the ecological balance of this critical marine habitat.

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**Monitoring of the catch and bycatch of the small pelagic purse seines in Adriatic Sea**

**Vanja Cikes Kec, Goran Brzulja, Vedran Vuletin, Filip Rozic, Pave Kuzmanic**

**Institute of Ocanography and Fisheries, Split, Croatia**

Small pelagic fish species, the most abundant fish species in Croatian landings, have been investigated since the early 1900s. Biology, ecology and fisheries of the anchovy *Engraulis encrasicolus* and sardine *Sardina pilchardus* are studied at the species and at the gear levels. The main fishing gear targeting small pelagic fish species in the Croatian part of the Adriatic Sea -purse seine net “srdelara”- is surrounding fishing gear (mesh size 14mm) capturing target and bycatch fish that assemble under the artificial light during the night fishing activity.

Within the EU data collection framework, since 2013, the purse seine catch and landings samples are monitored monthly in the most important fishing zones. The catch composition, number of bycatch species, length, and weight distribution were analysed for twelve years. Additionally, analyses of the changes in the sampling scheme in the number of landing and on-board samplings were performed.

Results showed more than 70 different species detected in the bycatch in the selected period, varying in length from 1.5 (little squid) to 108.0 cm (swordfish) and in individual %of total weight from 3% for bogue and 0.2% for sunfish with the rest of species' below 0.1%. The number of species in the bycatch increased from low values at the beginning of the series to the highest numbers in 2016 and after showing a decreasing trend with few high values.

Number of the samples varied also during the years with a steady increase of the on-board sampling adding to the rise in the total number of samples targeting more bycatch species. However, no increase in the number of detected species was observed while increasing the number of on-board sampling, hinting at the possibility of switching to the increment of landing sampling as a time and money-saving option.

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**Swedish sea-sampling program**

**Magnus Andersson, Ronja Risberg, Axel Hjelm**

**Swedish University of Agricultural Science, Lysekil, Sweden**

Sweden started with sea-sampling in 1997 and where initially covering demersal trawl fisheries in the Baltic Sea and in Kattegat with the purpose to estimate volumes of discards. The sea-sampling has since developed to encompass more areas and types of fisheries. The purpose has also expanded to e.g. bycatches of sensitive species, primarily in the gillnet fisheries, and species composition in large scale (from a Swedish perspective) pelagic fisheries. Presently we have observers on-board approximately 240 trips yearly.

The coverage of the on-board sampling program is ranging from 1% to 10 % of the total trips conducted in the covered fisheries. To ensure a representative sample of fishing trips, vessels are randomly selected for on-board sampling based on their fishing activity in previous year. Therefore vessels with higher fishing activity have a greater likelihood of being selected for sampling. A vessel that is selected is required to allow observers on-board to maintain its license.

The goal of an observer trip is to estimate the total catch, species composition, including potential presence of sensitive bycatch species, and size distribution within each species. In addition, individual sampling, including extraction of otoliths, is conducted for a selected number of species.

Trips range from 1-20 days where the majority of trips are between 1-2 days long.

There are two observers on each trip, except for smaller vessels fishing with passive gears where space is limited. In Sweden, permanently hired staff carry out the on-board sampling. The same personnel participate in scientific surveys and are involved in other tasks such as biological and statistical analyses and report writing.

The group currently consists of approximately 20 people, of which the majority have fieldwork accounting for around 50% of their employment.

Electronic monitoring is complementing observes schemes to cost effectively increase the coverage in some fisheries.

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**Impact of observer coverage on reporting of Patagonian toothfish bycatch in the Falkland Islands calamari trawl fishery (2012-2021)**

**Toni Trevizan, Frane Skeljo**

**Falkland Islands Fisheries Department, Stanley, Falkland Islands (Malvinas)**

In the Falkland Islands, a Marine Stewardship Council (MSC) certified longline fishery targets the adult component of the population of Patagonian Toothfish (*Dissostichus eleginoides*) in waters between 800 and 2000m. However, notable quantities of juvenile toothfish are taken as bycatch in the shelf-based (<400 m depth) finfish and calamari trawl fisheries. In the calamari fishery it is usually discarded, due to the small size of the specimens. Therefore, juvenile toothfish bycatch in the calamari trawl fishery is a waste of their potential commercial value as well as an impact on the population.

Toothfish bycatch in the calamari trawl fishery and its monitoring and reporting practice went through three distinct phases over the last ten years.

The early period (2012-2015) spanned 8 seasons, characterised by low reported toothfish bycatch weight, infrequent reports of toothfish bycatch, and low observer coverage (<10%).

it appears that a daily bycatch was reported only when >50 kg. Throughout this period, toothfish bycatch was reported on 0-10% vessel-days per season.

The transition period (2016-2017) spanned 4 seasons, characterised by high reported toothfish bycatch weight, frequent reports of toothfish bycatch, and low observer coverage (<10%). Throughout this period, toothfish bycatch was reported on 12-38% vessel-days per season.

The recent period (2018-2021) spanned 8 seasons, characterised by low reported toothfish bycatch weight, frequent reports of toothfish bycatch, and high observer coverage (100%). This period saw an almost 10-fold increase in observer coverage due to the introduction of the contract observer programme. Toothfish bycatch was reported on 18-48% vessel-days per season, although total catches decreased to the levels of the early period. Reporting frequency now included even the smallest catches of <1 kg.

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**From fishermen to the lab: understanding broadbill swordfish (*Xiphias gladius*) stomach samples**

**Ivanna Diaz**

**Franks Orth and Associates, Long Beach, USA**

Introduction

The dietary habits of broadbill swordfish (Xiphias gladius) were studied in 2023–2024 through detailed stomach content analysis, utilizing samples collected by fishery observers aboard commercial fishing vessels, consisting of drift gillnet, buoy gear, and longline. This study focuses on examining stomach contents through sieving and microscopic inspection to identify stomach contents, including small or partially digested prey items that might otherwise go undetected.

Methods

Data derived from these analyses were utilized for individual and integrative statistical methods to explore dietary patterns and ecological interactions. For this presentation, particular attention was given to the stomach contents of a specimen obtained during a buoygear trip in 2024, demonstrating the link between field observation and scientific investigation. Stomach samples were conscientiously analyzed to identify prey items, which included fish species such as sardines (*Sardinops spp.*), anchovies (*Engraulis spp.*), and various cephalopods, including market squid (*Doryteuthis opalescens*) and jumbo squid (*Dosidicus gigas*).

Findings

The diet composition was assessed using statistical frameworks, revealing how prey availability and diversity are primarily influenced by geographic location and environmental conditions, indicated by swordfish size. Preliminary observations specify that larger swordfish tend to consume larger prey, such as jumbo squid (Dosidicus gigas) and large Pacific hake (*Merluccius productus*). The presence of other noticeable species, e.g., market squid (Doryteuthis opalescens), reflects prey variety and predator adaptability. Temporal shifts in prey availability may occur, with prey species becoming more or less prevalent during different oceanic conditions.

Conclusion

The findings contribute to a deeper understanding of swordfish feeding ecology, shedding light on the factors shaping their dietary preferences. Establishing standardized procedures will improve comparisons with future studies, offering further understanding of swordfish-prey relationships. Ultimately, this study contributes to a better understanding of swordfish feeding dynamics and emphasizes the importance of monitoring dietary changes over time to support sustainable fisheries management.

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**Monitoring and bycatch calculations of ETP species in gillnet fisheries**

**Lotte Kindt-Larsen, Gildas Glemarec, Mollie Broocks, Anne-Mette Kroner, David Lusseau**

**Technical University of Denmark (DTU AQUA), Kgs. Lyngby, Denmark**

Since 2010 Denmark has had a long-term monitoring programme to collect bycatch data on Endangered, Threatened, and Protected (ETP) species in gillnet fisheries. The programme is using electronic monitoring (EM) to collect data on ETP species bycatch and gillnet fishing effort at a fine spatial and temporal scale, including time and position of each net-set and net-haul, together with every associated bycatch event. We used these observations to model ETP species bycatch rates, given the operational and ecological characteristics of each haul observed in the EM programme. Furthermore, data on overall fleet effort were collected to model ETP species bycatch in gillnets and estimate (predict) species-specific bycatch at a regional level. The results demonstrated that fishing characteristics, hereunder, vessel length, mesh-size, net-length, soak-time, depth, time of year, and year are key determinants of ETP species bycatch and that classical approaches that ignore these features – like scaling up observed bycatch rates to fleet level – would produce biased estimates. This emphasizes the need for efficient and informative monitoring methods to understand possible conservation impacts of ETP species bycatch and to implement appropriate mitigation methods.

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**Half a century of hard work! Observers in the at-sea hake fishery off the U.S. West Coast**

**Vanessa Tuttle, Jeannine Memoly, Cassandra Donovan**

**NOAA Fisheries, Seattle, USA**

140,000 hauls, 1,800 observers, 60,000 sea days, and 50 years. NOAA Fisheries has been deploying observers in the at-sea hake fishery off the U.S. West Coast for half a century. Although much has changed for observers during that time, the core mission remains the same: collecting unbiased fisheries data to inform sustainable management of our prized marine resources. Pacific hake (*Merluccius productus*) is harvested off the Washington and Oregon coasts. Known for their large, dense schools and mild white-fish flavor, the fishery catch has grown significantly from the early years. The fishery evolved from foreign vessels to joint venture fishing to a domesticated fishery. Observers are the common thread through all that change; highly trained scientists who can handle everything life at sea throws at them. This overview illustrates the mountain of data made possible by the hard work of thousands of observers over the last 5 decades.

## Session 2. Data management

**Leader: Björg Þórðardóttir**

Efficient data handling, database design, electronic data storage and archive systems are critical to modern data management in any field including fisheries management. This session explored how these elements ensure that monitoring data are collected, processed, stored, and retrieved efficiently and securely while remaining accessible for further analysis and decision-making.

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## Oral Presentations - Extended Abstracts

### Trends in bycatch of fish, marine mammals, sea turtles, and seabirds in U.S. commercial fisheries

**Andrea N. Chan**

**ECS Federal in support of NOAA Fisheries Office of Science and Technology, USA**

Introduction

Sustainable fisheries management requires that the bycatch of fish and protected species be estimated, tracked, and minimized to the extent practicable. In commercial fisheries, data on bycatch - or the discarded catch of any living marine resource - is primarily collected by independent fisheries observers on a portion of total fishing trips. In the U.S., the Maguson-Stevens Act, Endangered Species Act, Marine Mammal Protection Act, and Migratory Bird Treaty Act provide necessary protections for fish and marine megafauna that are discarded or harmed during fishing activities. NOAA Fisheries is responsible for ensuring adequate data collection for priority bycatch species, and producing bycatch estimates using the best available science. Bycatch of fish (including ESA-listed species), sea turtles, seabirds, and marine mammals remains one of the greatest threats to conserving these important species for the benefit of current and future generations. Thus, NOAA Fisheries has prioritized the development of robust observer programs for major U.S. fisheries to support accurate assessments.

NOAA Fisheries Office of Science and Technology (OST) is in the process of improving the timeliness, transparency, and communication of updated bycatch estimates from all U.S. regions in one centralized database. Since 2011, NOAA Fisheries has published estimates of bycatch in U.S. fisheries through a series of National Bycatch Reports. However, compling bycatch estimates for fish, marine mammals, sea turtles, and seabirds from all regions for one report resulted in substantial delays. NOAA Fisheries science center staff and affiliates are still estimating and reporting bycatch at the regional level, but additional work is required to present a more complete picture of national progress towards bycatch reduction goals.

Methodology

To improve timeliness, we are building a relational database that will directly capture peer-reviewed and/or published fish and protected species bycatch estimates from regional databases as they are available. Once data synthesis and analysis are complete, the new

National Bycatch Report fisheries module will be publicly available on the NOAA Fisheries One Stop Shop (FOSS ), which already hosts data on commercial and recreational landings, foreign trade, ports, processed products, and more. We published a technical report summarizing all of the estimation methods used to produce bycatch estimates for our federally managed fisheries (Chan and Benaka 2024); these metadata on methods are also being integrated into FOSS.

In addition to providing the initial estimates, we are exploring methods for analyzing trends in bycatch data, when appropriate, while accounting for any changes in bycatch estimation methodology over time. Using the bycatch data we have in FOSS currently, we applied Theil-Sen regression to time series of species bycatch at the fishery level in all U.S. commercial fisheries over time to designate time series as increasing, no significant trend, or decreasing (Theil 1950, Sen 1968). Short time series with fewer than three observations were removed. Due to variations in data transmission status for each region, time series lengths varied (Table 1), with shorter time series for regions that do not have post-2015 bycatch estimates integrated in FOSS.

**Table 1:** The number of fisheries in each region included in the analysis, along with the minimum and maximum year of bycatch data included.

| Region | Number of Fisheries | Min-Max Data Year |
|---|---|---|
| Alaska | 43 | 2005-2015 |
| Pacific Islands | 3 | 2005-2023 |
| West Coast | 17 | 1990-2023 |
| New England/Mid-Atlantic | 56 | 2004-2015 |
| Southeast | 17 | 1995-2015 |

Results and Discussion

Trends were assessed for each species and species group (n = 896) in each fishery (n = 136) with three or more annual bycatch estimates. A total of 4,304 trend tests were performed, with 148 trends having probability values below a significance level of 0.005. Of these highly significant trends, 71.6% were decreasing while 28.4% were increasing, and a majority were for fish species (86.5%). All of these trends were from fisheries in the Pacific Islands (14.9%) and West Coast regions (85.1%), which was expected given the longer time series integrated in FOSS for those regions (Table 1).

The most significant trends were from the California drift gillnet fishery for swordfish and thresher shark, where bycatch of northern elephant seals (Figure 1A) and leatherback sea turtles (Figure 1B) have declined significantly since the 1990s. Previous work has shown that fishing effort has generally declined in the drift gillnet fishery, with fewer active vessels in recent years. Additionally, in 1996 acoustic pingers were adopted by the fishery as a bycatch reduction measure, which resulted in significant reductions in northern elephant seal bycatch (Carretta 2023). Implementation of the Pacific Leatherback Closure Area in 2001 shifted fishing effort to southern waters, away from preferred summer/autumn leatherback habitat, which contributed to the observed decline in estimated leatherback entanglements (Eguchi et al. 2016).

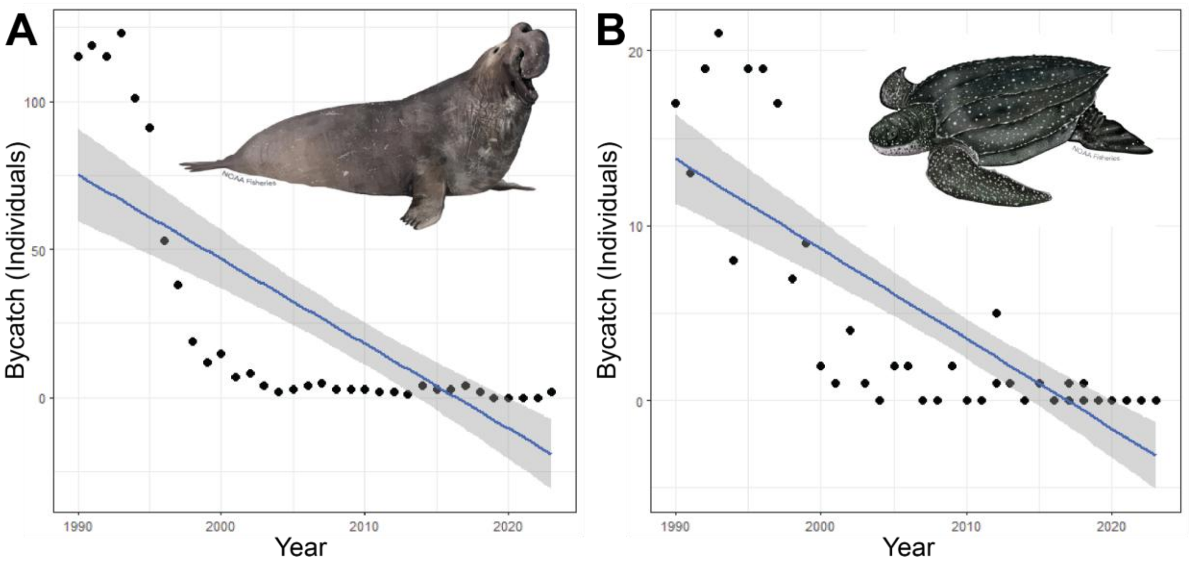


Figure 1: Time series of northern elephant seal (A) and leatherback sea turtle (B) bycatch in the California drift gillnet fishery for swordfish and thresher shark.

Once the National Bycatch Report dataset is updated with post-2016 bycatch estimates from each region and taxa group, we will synthesize bycatch trend analysis results with information on bycatch reduction measures, local population abundance, fishing effort, and observer/monitoring coverage levels to identify potential geographic shifts in bycatch hotspots and priorities for scientific research and/or management. By increasing bycatch data accessibility, applying appropriate statistical analyses, and communicating results to fisheries managers, policymakers, and the public, we can accelerate the pace of progress towards reducing global fisheries bycatch.

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**The challenges of past- and future-proofing data management in fisheries management software**

**Stefania Crotti; Felipe Tocornal**

**Trackwell, Reykjavík, Iceland**

Introduction

Since 1996, Trackwell has provided Vessel Monitoring System (VMS) software to several countries and Regional Fisheries Management Organizations (RFMOs), tailoring it to their shared as well as specific needs, all the while adapting to the considerable changes that fisheries monitoring has undergone in the past three decades. Keeping the data infrastructure dynamic yet easily maintainable has been a major challenge, especially when upgrading the solution to a Fisheries Management System (FiMS), which entailed expanding domain coverage while ensuring backwards compatibility.

Regulatory shifts have increased the need for cross-border collaboration and data exchange, which in turn started pressing for standardized data sharing protocols, strict governance policies, and the integration of new and dynamic datasets. Likewise, fisheries monitoring systems must remain reliable and performant, and cannot afford to blindly accommodate changes at the cost of robustness, especially when used for safety-at-sea or to oversee critical missions. Balancing prior and future solutions requires internal data standardization and a clear understanding of both historical workflows and emerging operational needs.

Methodology

Navigating the challenges of standardizing data sets while constantly adapting to regulatory and operational changes has been a complex and winding task. New requirements have repeatedly triggered infrastructure and code refactoring, introducing new obstacles with each interaction.

To manage this complexity, Trackwell's approach has been to focus on key methodological pillars, including data standardization, a microservice-based architecture, and general software development best practices. Further details and examples are outlined below.

- Data standardization

As a device-agnostic system, Trackwell FiMS interfaces with multiple sources that provide the same type of data (e.g. VMS positions, ERS messages, et cetera). It became evident early on that even relatively simple datasets could grow exponentially more complex when interfacing with several sources.

Taking positional data as an example, internally standardized measurement units had to be defined, which consequently introduced conversion errors when displayed to the user in a different unit. An agreement had to be reached with customers on how these trade-offs could provide acceptable precision tolerance. Additionally, it became necessary to store both raw and converted data to support auditing requirements.

Retaining both formats significantly increased the volume of stored data, which in turn placed greater demands on infrastructure and maintenance, increasing overall cost.

- Dataset expansion

It is common for datasets to expand over time due to changes in regulations or business needs. In many cases, the simplest and most logical way to accommodate these adjustments is to add new columns to existing tables and, where applicable, introduce auxiliary tables.

However, in some situations, the scale of dataset expansion is substantial enough to significantly impact the existing system. This increases the risk of integration pitfalls, which may temporarily compromise system reliability. A clear example is the adoption of the FLUX Fishing Activities standard, which increased data complexity and volume tenfold compared to the earlier NAF message format.

In such cases, we have found that designing a new, isolated architecture to accommodate the new data feed offers us a safer and more maintainable solution compared to retrofitting it into legacy data structures. The microservice-based approach still provides a seamless experience for users, although the user interface had to be reviewed and adjusted to fit the newly added data fields.

Results and Discussion

Historical and current regulatory changes have demonstrated that there will always be a need to integrate new datasets into fisheries management systems. Each new domain adds complexity to the underlying architecture, requiring continuous infrastructure and code maintenance, as well as regular reviews of system resources to ensure that performance and usability remain acceptable for end users.

To maintain a dynamic and flexible system, it is essential to standardize internal units and data formats, while maintaining clear communication with stakeholders regarding the trade-offs between different design and implementation choices.

Every architectural or infrastructure change brings both improvements and consequences. It is therefore vital that all stakeholders reach an agreement on acceptable levels of feature availability, system performance, and operational cost.

Lastly, analyzing the impact of changes beforehand is essential to minimizing risks and avoiding backlash, in order to maintain a reliable system trusted by its users.

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## Observer coverage - how much is enough?

**Kimberley Mackey**

**MRAG Ltd., London, United Kingdom**

Introduction

MRAG Ltd. was contracted by MSC to review observer and Remote Electronic Monitoring (REM) coverage levels required and implemented in a selection of (largely MSC-certified) fisheries across a global distribution and including a range of fishery scales and gear types.

This study builds on a 2018 MRAG review on how observer coverage levels should be defined.

Methodology

Over 50 fisheries were reviewed, categorised according to location, managing body, scale and fishery type. For each fishery, the means of monitoring were analysed, whether through self-reporting, observer coverage, REM or a combination. Trends were reviewed in various categories of fisheries, particularly the high seas fisheries managed by RFMOs, to assess whether their current observer and/or REM coverage would meet a 30% coverage requirement from MSC. Logbook verification was also recorded, being present in almost all fisheries reviewed, but methods for this were poorly reported and generally inconsistent.

Results and Discussion

One challenge identified was the lack of a standardised approach to reporting observer coverage, which leads to difficulties in comparing data across fisheries. When discussing fisheries monitoring it is important to define what is meant by coverage, as this will determine the level of data available and subsequently how effectively the fishery can be managed. A fishery may state 50% observer coverage, but this could mean having an observer present on 50% of trips, monitoring 10% of hooks retrieved during those trips. Similarly, REM coverage may be 100% of fishing recorded on camera, but only 5% reviewed by human reviewers.

Observer and REM coverage was generally higher in those fisheries with a more compliance-focused monitoring objective, compared to science-focused ones. REM is a growing tool for fisheries monitoring and may open up more opportunities for increasing coverage levels in a wider range of fisheries going forward, as the costs of hardware are lowered and review software advances. REM is currently more prevalent in large-scale, high-seas fisheries or those under stricter international regulations. There is no substitution for onboard, independent observation; however, this is not always possible due to logistical, physical and financial constraints. Larger vessels operating further from shore for longer periods tend to be better placed for observer deployments, making observer coverage requirements easier to achieve in these fisheries. Small-scale inshore fisheries, especially those with lower levels of bycatch or limited ETP species interactions, tended to have lower coverage, likely due to the constraints mentioned, paired with less pressure for a high coverage rate. Our research showed that fisheries operating in high seas generally achieve a much higher level of observer coverage.

Fisheries management is ever evolving, and monitoring practices constantly adapt accordingly to ensure effective data collection, compliance, and sustainability. While the use of observers and REM is expanding, barriers to widespread adoption persist, and coverage levels need to be more consistently reported. Addressing these will be essential to strengthening fisheries monitoring programmes and ensuring regulations are upheld.

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

**Regional data governance: from policy to dashboards**

**Tiffany Vidal**

**Pacific Community (SPC), Noumea, New-Caledonia**

Introduction

Effective data management to support the largest tuna fishery in the world, spanning a geographic area covering 20% of the globe, with diverse membership and participation, is not trivial. Data governance, developed in consultation with stakeholders, underpins the ability to collect, safeguard, manage, and disseminate data to support the work of the Western and Central Pacific Fisheries Commission (WCPFC) in a transparent manner. Here, we describe how a regional data integration platform, developed to implement robust data governance practices, has transformed fisheries data management and empowered stakeholders throughout the Pacific.

Methods

TUFMAN2 (T2), one of the flagship platforms of the region, was developed with an aim to link policy frameworks, database systems, and reporting tools. T2 is a SQL Server database with a web-interface allowing for data entry, review, editing, and reporting of member data. The platform is integrated with a suite of e-reporting (ER) applications for the collection of logbook, observer, and port sampling data, and leverages VMS data to identify missing and misreported information. User roles and visibility rules enable efficient sharing of information with multiple members and flag-states, as appropriate, mitigating the need for redundant data entry or management. Integration, flexibility and regional collaboration capture the essence of T2's success.

Results

T2 has dramatically reduced the amount of time members spend entering data. As a result, stakeholders can now spend more time utilising these data to generate insights and improve their fisheries management, both regionally and at a national level.

Conclusion

Stakeholders throughout the Pacific recognized the growing data demands to ensure sustainable management of the vital tuna fisheries in the region. Collectively, with SPC/WCPFC support, an effective and integrated data management platform was built that not only enhanced data quality, timeliness, access and utilization, but also streamlined data governance from policy to dashboards.

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**Data quality and security management in electronic monitoring programs**

**Gonzalo Legorburu**

**Digital Observer Services, Bilbao, Spain**

Fisheries data managers face new challenges in handling the growing volume of fishing effort and catch data from Electronic Monitoring (EM) programs. This complex environment demands well-defined stakeholder roles, clear communication procedures, and robust data management strategies. The scope and objectives of EM projects shape the range of stakeholders involved, from vessel operators and fleet managers to fisheries administrations.

Effective data management must ensure both accessibility and security at every stage, including onboard recording and storage, data transmission, and submission to a database for analysis. A tailored data management plan and database design are essential to establish these attributes while maintaining confidentiality and regulatory compliance.

Building on multidisciplinary expertise, this study explores how data management varies across different EM project designs. It tracks the evolution of data handling practices—from early systems that required manually swapping hard drives to modern fully remote solutions—while assessing security measures, confidentiality protocols, and compliance with quality management standards, data protection regulations, and information security certifications. Findings indicate that manual procedures tend to introduce more quality issues, especially when applied to lower-value tasks, where remote data processing methods perform more efficiently. However, for high-value automated tasks, manual verification remains essential to ensure data quality. From a data protection and information security perspective, modern remote data processing enhances security while better aligning with the multi-stakeholder structure of EM programs, compared to early manual systems.

Furthermore, the growing emphasis on interoperability in EM programs requires in-depth analysis to assess its feasibility across diverse project structures. This study identifies key challenges and emerging best practices in EM data management, contributing to the development of standardized methodologies in the field.

## Open Discussion Session

Björg Þórðardóttir to Gonzalo Legorburu:
Q: how are AI tools used?
A: We use AI and manual tools, some data reported produced by machine learning right now we assess and double check everything. We are facing results that are improving but there were issues

Anna Sigríður Vilhelmsdóttir to Tiffany Vidal
Q: for countries that need to share data, are there any easier avenues?
A: We have clear governance data policy- who can access, etc. As data managers they have a public domain, but they get requests for data and they can't always share it due to different countries' rules

Miguel Machete to Stefania Crotti
Q: Do you notice any improvements in data where service teams were implemented?
A: I don't know about better or worse, but there is more data… maybe Tiffany can answer from 'logbook' side.

Miguel Machete to Kimberly Mackey
Q: I have questions about the data from the Azores because they do have VMS and observer programs (and the data does not show that).
A: I don't know about every fishery we have in our dataset.

Njáll Ragnarson to Kimberly Mackey
Q: Referring to the slide with the pilot project t- said that was red and was wrong - mentioned consistency is needed but there's different requirements
A. Many fisheries didn't report on observer coverage and there is a lack of public information.

Njáll Ragnarson to Stefania Crotti
Q: Can I hear more about FLUX? So much data, how will performance stay up?
A: We are seeing that it requires integration and large volumes of data, we have experience to foresee where we're going.

Lisa Borges to Kimberly Mackey
Q: I believe you looked only through MSC certified fisheries, which addresses Azores comment (fishery is not MSC certified) but I do have a comment to the conclusion of less observing in N. Hemisphere: in EU we need a paradigm change to higher levels of data, 'you can monitor any fishery, you just haven't found good ways to implement MCS systems'
A: It's not one size fits all, difficult to standardize best practice.

Luis Cocas to Gonzalo Legorburu
Q: How do you scale up EM? What are the challenges?
A: We face every report as fast as we can, but it takes hours, so we are utilizing machine learning. Storage capacity needs to adapt to more and new types of data.

Tim Park to Gonzalo Legorburu

Q: When we look at proportions of "double-readings" (double check), when is it necessary? 10-15%?
A: We need to get confidence on those results, don't go lower than 98%, more used in internal processing. We are using 20% of double check right now, maybe in future it can be lower.

Tim Park to Gonzalo Legorburu
Q: TUFMAN2 use by 3rd parties, not just data recording but record security and a comment on how it can be hard.
A: "matter of ... if data shared, I have access to more information, I don't know how to answer.

Hrannar Mar Asgeirsson for Tiffany Vidal
Q: Does risk assessment come into consideration in MSC? Should it have been?
A: High level of data, didn't get into risk or many types of observer coverage types.

Hrannar Mar Asgeirsson for Tiffany Vidal
Q: 30% of minimum at-sea monitoring coverage? why not 20%?
A: MSC certification could.

Maria Jose Pria Ramos for Tiffany Vidal
Q: One Country gets sent to other county then back… did you run into data legislation difficulties?
A: They agree to terms that let us verify catch and others see where they're fishing. Happy to look into it more

Björg Þórðardóttir to Andrea Chan
Q: Do you use data to see where observers should go?
A: NOAA doesn't control observer coverage. Political reasons for higher coverage levels, we have some flexibility but not historically how we've operated

Colin Bishop to Andrea Chan
Q: What is barrier to standard collection format?
A: Federal fisheries managed regionally historically, every region has staff limitation, lack of inertia with new data models. We are limited in our staff to standardize information.

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

**Compass: a flexible web-based application for fisheries observer data**

**Amy Westell[1], Russell Blanc[2], Christopher Dixson[2], Darryl Gifford[2], Thomas Liebert[2], Brant McAfee[3], Matthew Turczmanovicz[2]**

**[1]Lynker in support of NOAA Fisheries, NEFSC, Woods Hole, USA.**

**[2]TechGlobal Inc in support of NOAA Fisheries, Woods Hole, USA.**

**[3]NOAA Fisheries, NEFSC, Woods Hole, USA**

Fisheries observers around the world cover a wide variety of fisheries, with varying levels of detail and requirements that can rapidly change. Responding to these changing requirements tends to promote the proliferation of requirement-specific systems, which can be difficult to maintain and update. In the Northeast region of the United States, the shift towards electronic data reporting led to an explosion of applications, each meant to handle a small portion of the data processing requirements, leading to a complicated, unwieldy legacy system architecture. Project Compass aims to address this issue by using the Strangler Fig approach coined by Martin Fowler, and will incrementally modernize and replace elements of our legacy observer systems while preserving existing functionality so we can simultaneously continue to collect and process observer data.

Compass is an integrated web-based application designed to consolidate and replace legacy systems currently supporting the Northeast Fisheries Observer Programs. Utilizing modern frameworks such as PHP (CodeIgniter), JavaScript, and the U.S. Web Design System (USWDS), Compass aims to streamline data entry, auditing, and reporting into a single, cohesive system. This effort will sunset outdated, single-purpose applications for data entry, editing, auditing, and reporting and drastically reduce the time between fishing trip and data availability.

The Compass application's unique architecture allows it to present data entry/edit forms that are customized based on data collection program, gear type, and a variety of other attributes. This flexibility combined with the accompanying relational database structure to enforce data integrity and system coherence provides a foundational application that can easily accommodate changes to existing data collections over time, and new monitoring programs in the future with simple configuration changes.

## Session 3. Observer's tools of the trade and novel applications of at-sea monitoring data

**Leader: Amanda Leaker**

Observers are increasingly relying on technological tools to enhance data collection, efficiency, personal safety, and other workplace issues. Observer programs offer valuable insights into various technology choices, particularly regarding their integration and the resulting benefits. This session focused on the operational impacts of technology, rather than on the specific features of the technology itself.

In addition, at-sea monitoring programs are designed to observe and collect data related to fishing activities, typically with a focus on catch composition, bycatch, and compliance with fishing regulations. However, these programs can collect additional data, and while not directly aligned with the primary objectives, can provide significant insights into broader environmental and social issues. For example, documentation of marine debris, gear conflicts such as entanglements with other marine operations and human welfare. This session also explored these alternative and very often novel uses of complementary data that is collected in many programs around the world, and its potential diverse uses.

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### Oral Presentations - Extended Abstracts

**Streamlining debriefing using onboard electronic reporting and dedicated data review applications**

**Ryann Turcotte[1]; Charles Villafana[2], Jody Van Niekerk[2]**

**[1] Pacific States Marine Fisheries Commission, USA**

**[2] NOAA Fisheries, West Coast Region, USA**

Introduction

In 2021, field testing for the Onboard Record Collection Application (ORCA) began in the West Coast Region's deep-set buoy gear (DSBG) fishery. Since the initial rollout, two additional versions of the application have been developed to expand electronic data collection. Dedicated applications are now used by observers in the pelagic longline fishery and will be launched this year when coverage begins for new exempted fishing permits. Transitioning from paper forms to app-based data collection paved the way for developments of additional applications used to streamline the debriefing process and simplify workflow.

Methodology

Program staff use a suite of applications to track communications and review trip data. When the captain notifies observer providers of an intended trip, that communication is logged in the Trip Notifications Application (TNA). Communication with observers is also logged in the TNA. Once the trip is created in the TNA the observer can import trip details to ORCA.

Trip data is collected on a tablet and uploaded by the observer when they return to port. Once uploaded, the trip's data populates in the Debriefing Application (DA) and program staff can begin QA/QC data checks. Having the ability to upload trip data from the tablet eliminates the need for observers to report to the office allowing them time to rest and readjust to life on land. Data review by program staff begins sooner and can be accessed from any location. Summary views of trip activities assist with the data review process. If errors are found, the observer can open the trip in ORCA, make corrections and re-upload.

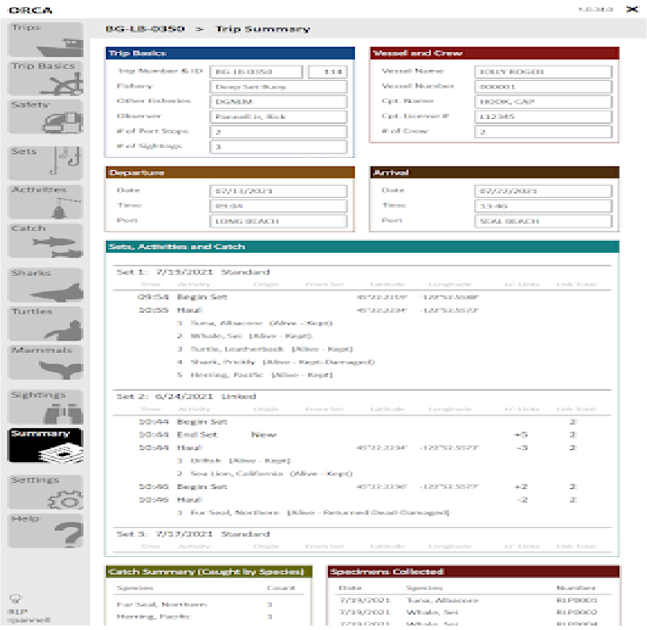


*Figure 2: Trip summary tile in ORCA provides a summarized view for observers allowing them to error check data without having to click through each tile. Validation points remind observers of required fields that need data entered.*

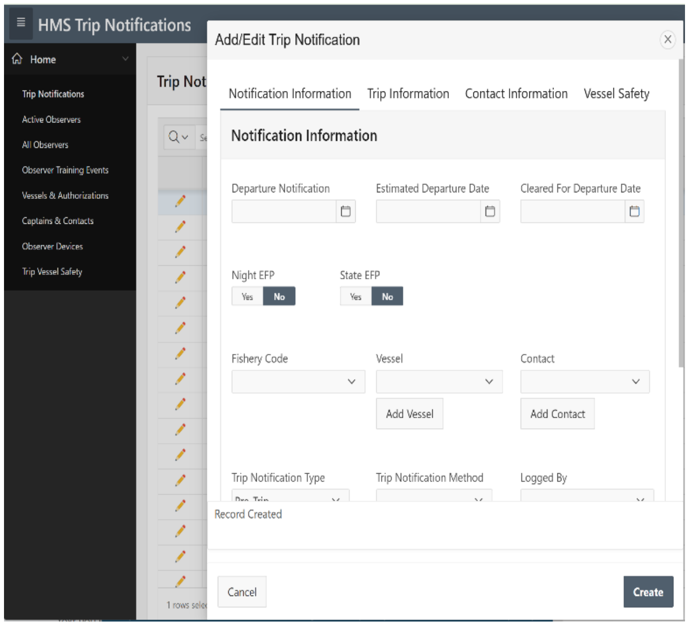


*Figure 1: Communication between program staff, vessels and observers is logged using the Trip Notifications application.*

## Results and Discussion

Transitioning to app-based data collection and review has reduced the time it takes to debrief observers and streamlined the debriefing process. Data review begins as soon as the trip is uploaded and the need to perform data entry from paper forms has virtually been eliminated. This has reduced the time spent debriefing observers from 2 weeks down to 48 hours. Since data corrections are addressed before the debriefing appointment, that time is now solely focused on the observer's experience on the vessel.

Additionally, data is available to users much sooner. Trip data is populated on integrated reports and available to users within 24 hours of the trip being approved. Implementing app-based data collection and review has streamlined the workflow of program staff, reduced time commitment for observers and improved data access for our data users.

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## Monitoring for change: insights from a pilot on electronic monitoring and wi-fi solutions for social responsibility


**Sunny Tellwright[1], Meghan Fletcher[2], Gabrielle Lout[3]**

**[1] Conservation International, Arlington, USA.**

[2] **The Nature Conservancy, Arlington, USA. 3 Ocean Outcomes, Portland, USA**

[3] **Ocean Outcomes, Portland, USA**

Introduction

A key issue on legally licensed large-scale fishing vessels is a lack of independent monitoring. Without verifiable on-the-water monitoring, illegal activities can go unnoticed and unpunished. This undermines the effectiveness of conservation and management measures, weakens governance frameworks, and introduces environmental and human rights risks into global supply chains.

To combat these issues, many entities have turned to the use of electronic monitoring (EM) which involves the use of onboard video cameras, gear sensors, and GPS to monitor, verify, and transmit data about fishing activity. EM has been demonstrated to improve transparency, enforcement, and data quality for better fisheries management. However, few studies and pilot projects have explored using electronic monitoring to identify labor indicators as a tool for social responsibility.

**Project Aim:** Pilot EM and Wi-Fi technologies on tuna longline vessels to combat both illegal fishing practices and human rights abuses, and research how EM might integrate into a wider systems approach to improve crew welfare.

Methodology

We evaluated how EM can be used to monitor labor indicators (i.e., human rights violations, safety, and working conditions) and track progress towards social responsibility. The project was conducted between November 2022 and January 2025, involving:

- Desk-based research on ethical considerations of surveillance, privacy, and consent.
- Identification and mapping of labor indicators.
- Stakeholder interviews.
- Installation and testing of EM and Wi-Fi systems on three Taiwanese-flagged tuna longliners.
- EM video review and data analysis.

We trialed both EM and Wi-Fi systems on three Taiwanese-flagged tuna longline vessels and used a typical EM program design for monitoring environmental-focused fishing operations to assess if status quo EM program set-up could be used for monitoring labor indicators, or if entirely new EM system layouts would be needed. To help inform our approach, we mapped out labor indicators that could be successfully captured through EM video review. The pilot project lasted six months (March 2024 – August 2024) and we reviewed 20% of all fishing operations plus randomly selected 24-hour assessments of worker activities. To gain valuable insights from vessel owners, captains, crew, and other industry stakeholders, we performed over 50 pre and post trip interviews.

Results

EM can feasibly capture on-the-water labor indicators, including accidents, injuries, presence of personal protective equipment (PPE), work/rest hours and trip length. However, several critical indicators such as sanitary conditions, verbal abuse, access to food and water, medical supplies and child labor, were not visible due to camera placement, privacy accommodation, and the lack of audio recording. Importantly, certain labor violations, such as forced labor, require additional verification mechanisms beyond video review via worker interviews and grievance mechanisms.

Wi-Fi is a critical intervention for crew welfare. Through this project, Wi-Fi access emerged as one of the most impactful interventions for improving crew well-being, enabling real-time communication with family, grievance reporting, and financial management. On average, monthly crew and captain data usage combined was 283GB and average monthly crew use alone was 98GB (for Vessel 2), equating to an average of 7.5GB of data per crew member per month. Crew members reported feeling safer and more connected to the outside world when they had access to Wi-Fi, reducing isolation, and expressed a preference for working on vessels with Wi-Fi. However, inconsistent connectivity, slow data speeds, signal strength and access restrictions created uncertainties and/or frustration among captains and crew members. Some captains and vessel owners expressed interest for clear policies on Wi-Fi management due to lack of awareness and standardized procedures.

EM review rates and costs may pose challenges for wider uptake and scaling of this technology. Standard EM environmental monitoring programs typically review only 20% of fishing operations, meaning that some labor-related incidents may be missed. More frequent reviews (e.g., 35% or more) would improve monitoring accuracy but may significantly increase costs for vessel owners. Adding labor indicator review accounted for approximately 24% of the total review time, indicating that higher costs will be associated with EM programs reviewing data for both environmental and labor indicators. The manual review process is time-consuming—automated AI-based monitoring could improve efficiency but requires further development and validation.

EM footage is seen as valuable evidence to help settle disputes. Both captains and crew viewed EM footage as a valuable tool for resolving disputes, providing verifiable evidence in cases of accidents, safety violations, or conflicts. Some captains saw EM as "insurance" to protect themselves from false accusations, while crew saw it as protection against mistreatment. However, sharing and using EM data as evidence to address grievances still needs to be tested and proven.

EM for social responsibility requires careful consideration and ethical implementation to minimize potential harms of surveillance. Policies should be in place to ensure video data is used ethically and not used to unfairly target or discriminate against crew members. The impact on personal privacy is a key consideration, and typical solutions to reduce privacy impacts for environmental monitoring will need to be adjusted to monitor labor indicators. Data protection measures must be in place to safeguard personal information, and there should be accountability mechanisms to prevent misuse of surveillance data. Transparency on the use of surveillance technologies and obtaining informed consent from those being monitored is crucial.

Scalability requires stronger policies and industry commitments for improved labor conditions. Without regulatory enforcement or buyer demand, vessel owners have little incentive to invest in EM and Wi-Fi. Integrating EM into labor standards, certification programs, and trade policies could drive wider adoption. Government and industry collaboration is necessary to establish standardized protocols for labor monitoring, Wi-Fi provision, and grievance reporting.

Recommendations

This pilot demonstrated the potential for EM and Wi-Fi to enhance transparency and working conditions in large-scale fisheries. While EM has been proven to be an effective fisheries management tool, Wi-Fi access emerged as a crucial factor in improving crew welfare, safety, and communication, and is a fundamental component of an effective EM for labor monitoring system. As such, Wi-Fi access for crews should be a priority for industry stakeholders, regulators, and technology providers. Despite challenges and concerns of applying EM solutions to labor indicators —including the cost of EM implementation, accessibility, privacy concerns, and enforcement gaps—this study underscores that by pairing EM with Wi-Fi, fisheries can improve oversight, empower workers, and create safer, more transparent working conditions. Moving forward, more research is needed to collect evidence on the impact of EM and Wi-Fi on crew welfare, and if shown to be positively impactful, labor indicators should be integrated into EM programs, alongside the use of Wi-Fi for crew.

Key recommendations include:

Bundle EM with Wi-Fi: Pair EM with Wi-Fi to enhance crew communication, enable real-time reporting of labor violations and timely EM video review. Buyers and retailers should provide financial incentives for vessel owners to adopt EM and Wi-Fi systems, to reduce harmful downward price pressures.

Develop Comprehensive Social Responsibility Approaches: Integrate EM footage with formal grievance reporting systems to allow workers who report mistreatment to have accompanying video evidence, and integration into broader human rights due diligence programs. Third-party labor review groups should be involved to access and review EM data relevant to reported cases of misconduct, to assist with case resolution and remediation.
Ensure Ethical Use of Surveillance Technologies: Implement best practices for ethical data use, including privacy protection, data protection and informed consent. The application of surveillance technologies warrants careful consideration, as the datafication of labor issues carries risks which may further harm vulnerable and marginalized communities.

Strengthen Policies & Agreements: Develop enforceable agreements between vessel operators, industry stakeholders, and governments to ensure compliance with social responsibility standards. Use pilot projects and studies like this to advocate for policy changes that require EM for both fisheries management and labor monitoring, as well as Wi-Fi access to crew members. Establish clear policies on Wi-Fi access to balance worker needs with operational concerns, and EM data sharing agreements for grievance resolution.
Enhance Cost Efficiencies: Define appropriate review rates and explore automation and AI-assisted video review to reduce review costs. Also, optimize transmission of EM records over Wi-Fi to lower data and storage costs.

Conduct Further Research & Pilots: Moving forward, it will be important to trial these tools across different vessel types, fleets, and geographies to refine best practices, study the global impact of EM adoption on crew wellbeing and retention, and evaluate long-term cost-benefit scenarios for integrating EM with broader social responsibility initiatives. Evidence substantiating the positive impact of EM on crew welfare will be crucial in proving this as a suitable tool for social responsibility.

This pilot project demonstrates the potential of EM and Wi-Fi technologies to improve social responsibility in the fishing industry, highlighting the need for comprehensive social responsibility systems, ethical considerations, and further research to scale these solutions effectively.

Full report linked here.

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**Observers' potential role in monitoring effects of temperature on marine pathogens**

**Sarah Williamson[1,2], David Páez[3], Malina Loeher[1,3], Courtney Grady[3], Nathan Wolf[1], and Paul Hershberger[3]**

**[1]Alaska Pacific University, Fisheries, Aquatic Science, and Technology Laboratory, 4101 University Drive, Anchorage, AK 99508.**

**[2]North Pacific Observer, Saltwater Inc., 733 N St., Anchorage, AK, 99501.**

**[3]US Geological Survey, Western Fisheries Research Center, Marrowstone Marine Field Station, 616 Marrowstone Point Rd, Nordland, WA, 98358.**

Introduction

Understanding the potential impacts of climate change on marine systems is essential for managing ecologically and economically important resources (Studer & Poulin, 2013). One such area is marine host-pathogen dynamics, which are complex systems with significant influence over marine processes, such as community structure and biogeochemical cycles (Burge et al., 2014). As individual pathogens and hosts have unique responses to temperature changes, thermal variation can cause mismatches in host-pathogen interactions and disrupt ecological balance, potentially leading to epizootic events with severe consequences for fish populations (Mihaljevic & Paez, 2022). Given the potential severity of these disruptions, studies and monitoring programs are necessary to quantify how temperature influences host-pathogen dynamics, forecast epizootic outbreaks resulting from climate shifts, and inform resource management strategies (Burge et al., 2014).

Fisheries observers play a vital role in collecting at-sea and shoreside data for fisheries management, protected species monitoring, and special scientific research (NOAA, 2023). Their extensive training in biological sampling makes them well-positioned to gather critical data to study host-pathogen dynamics, forecast potential pathogen outbreaks, and inform management. Relevant samples may include blood, skin scrapes, and various organs or tissues, with the type and frequency dependent on the pathogen and host species and study design and objectives.

Here, I provide an example of a potential avenue for observer participation in marine host-pathogen research using my master's project – *Effects of temperature on in vitro replication and seawater inactivation of viral hemorrhagic septicemia virus, with insights into the in vivo infectivity of temperature-inactivated virus to Pacific herring (Clupea pallasii)*. This study uses viral hemorrhagic septicemia virus (VHSV), a cold-water adapted virus (Wolf K, 1988), and Pacific herring as a model system to address the following questions: 1) does temperature affect the *in vitro* replication and inactivation of VHSV, and 2) does temperature-treatment affect *in vivo* infectivity of VHSV in juvenile Pacific herring. This presentation will focus on question 1, as question 2 is in the initial analyses phase.

## Methods

The effects of temperature on replication and inactivation of VHSV were assessed in vitro using genotype IVa VHSV from Elliot Bay, Washington Pacific herring in 2002. Replication and inactivation samples were stored in five incubators (Beckman model H220HC) each set to a different temperature (6, 8, 10, 15, or 20°C) at the United States Geological Survey (USGS) Marrowstone Marine Field Station in Nordland, Washington. To assess replication, each temperature treatment was comprised of 8 replicate 25 cm2 flasks; of which 5 were infection replicates in which a known quantity of VHSV was plated onto nominal *Epithelioma papulosum cyrini* (EPC) cells (Fijan et al. 1983, Kim et al. 2011, Winton et al. 2010), and 3 were control replicates containing only cell media. EPC cells were stored at 15°C for 24 hours prior to inoculation to allow the cells to adhere and grow within the flask. Samples were collected from each flask every 12 hours for the first 2.5 days (0, 12, 24, 36, 48, 60 Hours); every 24 hours for Days 3 through 7 based following Kim et al. 2011.

The same methods were employed to assess VHSV inactivation, except the 8-replicates used 25mL centrifuge tubes that contained 19mL of filtered UV treated seawater from Puget Sound, Washington instead of EPC cells. The centrifuge tubes were given 24 hours to acclimate to the incubator temperatures before inoculation. Inactivation samples were collected every 12 hours for the first two days (0, 12, 24, 36, 48 hours); and single samples were taken on Days 3, 5, and 7 following Kocan et al. 2001.

Samples from both experiments were subjected to 10-fold serial dilutions and plated for plaque assays. The plates were stored at 15°C for seven days after plating to allow plaques to develop (Batts & Winton 1989, Kim et al. 2011). On the seventh day, the plates were fixed, stained, and plaque forming units (PFUs) were counted.

## Results

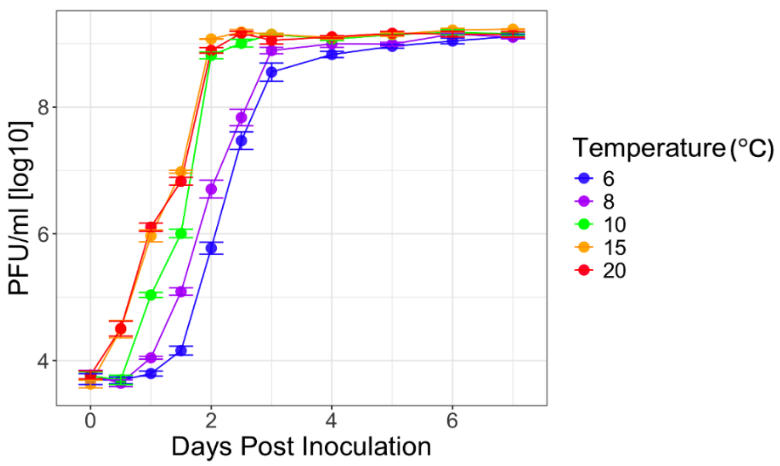


Figure 1 VHSV Replication

Results of the replication experiment showed that PFU density increased more quickly in warmer temperature treatments (Figure 1), indicating that VHSV replicates faster at warmer temperatures than cooler temperatures. Maximum density (as indicated asymptotically) was reached ≥ 1 day faster in the 10°, 15°, and 20° C treatment groups compared to the 6° and 8° C groups. However, maximum density was similar among all treatments.

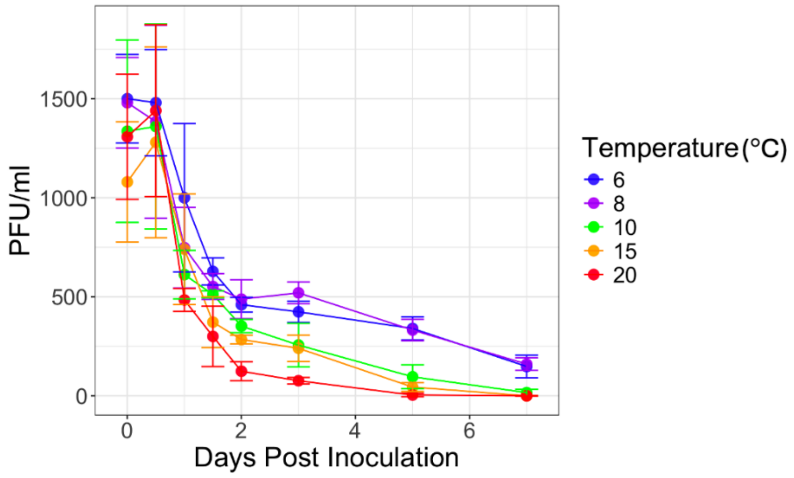


Figure 2 VHSV Inactivation

In contrast, in the inactivation experiment, PFU density decreased more quickly in warmer temperature treatments (Figure 2), suggesting that VHSV inactivation occurs more quickly at these warmer temperatures. After 7 days post-inoculation, no active virus remained in the 10°, 15°, and 20° C treatment groups, while active virus could still be found in the 6° and 8° C groups.

Discussion

Our results indicate that VHSV replicates and inactivates more rapidly at warmer temperatures; thereby 1) demonstrating the potential effects of climate change on VHSV, 2) corroborating previous research showing potential thermal adaptations by both hosts and pathogens (Greenspan et al., 2017), and 3) emphasizing the uncertainty climate change poses to marine ecosystems. Observers can play a large role in mitigating this uncertainty by providing real-time field sampling and reporting in specialized areas, including areas associated with health monitoring plans designed to predict disease outbreaks and track geographical shifts in host-pathogen dynamics. In addition to their role in providing samples and observations, observers assisting in developing health monitoring protocols (e.g. sample cross-contamination management in field settings) can acquire new skill sets and enhance job security. Given their broad skillset and specific expertise, observers can play a crucial role in assessing environmental impacts across multiple disciplines and improving preparedness and management for impacts associated with global climate change.

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

### Optimizing fisheries data collection: the smartfish approach to accuracy, efficiency, and user-friendliness

**Laura Lemey, Wim Allegaert, Els Torreele**

**Flanders Research Institute for Agriculture, Fisheries and Food (ILVO), Ostend, Belgium**

During our Belgian at sea sampling program and surveys, conducted under the Data Collection Framework, we collect length and weight data from certain fish species aboard commercial fishing vessels. A subset of the samples are brought to our ILVO labs, where we collect additional biological information on individual fish. In the past, these parameters were monitored manually using paper and pencil, then transcribed into Excel with the disadvantages of being time- consuming, prone to errors and less efficient. To address these challenges, we developed the innovative in-house Smartfish data platform. The platform stores and organizes data collected during sampling at sea. The data includes biological metrics (length, weight, sex, etc.), but also include stomach sampling, litter and water samples. Two types of software applications were developed, a Windows desktop client for at sea (Smartfish@sea) and a web application for managing the data in the office (Smartfish@office). Smartfish@sea is optimized to run on ruggedized tablets to be used under rough weather conditions. The tablets are connected with our digital measuring board to sample lengths, weights and counts. The measuring board works with a magnetostrictive linear position sensor and is developed in house. Once a trip is completed, the data is synchronized and becomes available in our Smartfish database. The data can be further managed in the Smartfish@office web application. In MS Power BI all Smartfish data can be visualized per trip, such as haul locations, length-weight keys per species, etc. These visualizations are also used for initial data quality checks. Additionally, a Smartfish R package was developed that unlocks the data for further in-depth analysis and report creation. To conclude, the Smartfish platform enhances the efficiency, quality and accuracy of data collection, while also providing researchers with easy access to comprehensive datasets, facilitating improved analysis and advancing scientific research.

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**Seabirds, why we monitor them and how fishery observer programs support their conservation**

**Kevin Stockmann**

**Alaskan Observers Inc., San Francisco, USA**

Fishing interactions with protected species are observed and monitored to ensure that bycatch of protected species remains below a level that the species can withstand. Worldwide, the expansion of commercial fishing has impacted many seabird species. Seabird bycatch, accidental hooking or entanglement in fishing gear, is a threat to seabirds that is monitored and managed, with many contributions from fishery observers. Observer data supports and advances the science of long-term seabird conservation. Observer data plays a fundamental role in quantifying bycatch rates of seabirds and helps managers assess the effectiveness of seabird avoidance strategies. This presentation highlights significant past and ongoing observer contributions to seabird conservation and introduces possibilities for additional observer contributions across programs in the USA and the world.

Observer programs in North America, South America, Africa, Europe and Australia will be surveyed or interviewed. An overview of which seabirds around the planet are most imperilled by commercial fishing will be compiled and presented. A summary of how NOAA West Coast Groundfish observers are trained in seabird identification and data collection will be presented and compared to approaches taken by other observer programs around the world. Recent seabird publications that have relied on observer data will be highlighted and discussed. Seabird monitoring methodologies from observer programs around the world will be presented and compared. Results presented at the IFOMC will include assessment of seabird avoidance methods and how observer data has helped shape seabird avoidance. The idea of a more comprehensive global approach will be presented. A primary justification for observer programs is to monitor incidental takes of marine mammals, sea turtles and seabirds. This presentation will spark conference attendees to think creatively about managing commercial fishing impacts on seabirds worldwide.

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**Demonstrating the capabilities of electronic monitoring as a novel at-sea monitoring tool for litter observations from Scottish fishing vessels**

**Lauren Clayton, Helen Holah, Rob Fryer**

**Marine Directorate of the Scottish Government, Aberdeen, United Kingdom**

Information is sparse regarding the quantity, types, and sources of domestic litter from at-sea sources such as fishing vessels. Many people live and work at sea, producing waste that can enter the sea directly, suggesting there is an at-sea input of marine litter that is not well understood, monitored, or mitigated despite being illegal. Traditional marine litter monitoring utilises beach cleanup and / or seafloor survey data, which often cannot determine the entry point of litter into the marine environment. This is especially true for domestic litter (e.g. water bottles and packaging) which upon entering the marine environment are indistinguishable from litter from land-based sources. Typically literature regarding litter from the fishing industry focuses on fishing-related materials (e.g. fishing gear and PPE) due to the difficulties of distinguishing some sources of marine litter.

Electronic Monitoring (EM) has potential use beyond fishing activity estimation and catch quantification. This project reviewed historic EM video footage of fish-processing conveyor belts on-board Scottish bottom trawlers from 2016, originally collected to monitor the cod discard ban, for observations of litter items discarded. The aim was to evaluate whether EM systems could be used as a novel monitoring tool, comparable to traditional monitoring techniques, to identify and quantify litter discarded from fishing vessels.

All reviewed vessels (9) were observed to discard litter at sea. The majority of litter was “Plastic” (>60%) and “Domestic litter” (>50% of 1,200 items), i.e. not fishing related. Additionally, most vessels (7) discarded predominantly “new” generated litter, rather than re-discarding “old” passively captured litter.

This project demonstrates that EM has the potential to monitor at-sea sources of marine litter from fishing vessels. It also highlights that historically some fishing vessels were non-compliant with marine litter regulations. Hence, EM could act as a novel compliance tool to monitor adherence to litter management policies.

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**Near-real time monitoring of fishing effort using novel low-cost technology.**

**Maria-Jose Pria-Ramos**

**Archipelago, Victoria, Canada**

Collecting fishing effort data in an efficient and affordable way is important for managing fisheries, especially those with limited resources to implement complex and costly monitoring systems. Archipelago's FishVue LIME and FishVue Fleet deliver innovative, budget-friendly solutions that provide high-resolution fishing effort data, tailored to small-vessel or data-limited fisheries.

The Washington Dungeness Crab fishery offers a practical and impactful case study. Archipelago partnered with the Washington Department of Fish and Wildlife (WDFW) to implement an Electronic Monitoring (EM) program combining FishVue LIME and FishVue Fleet to provide near-real-time fishing effort data. Between 2021 and 2023, pilot projects demonstrated the system's capability to monitor vessel positional data, collect hydraulic pressure data to detect individual pots hauled. By January 2024, this cost-effective solution evolved into a regulated program and was seamlessly rolled out to over 200 vessels at an average cost of under $50 USD per vessel per month over a five-year program.

FishVue LIME serves as the vessel-based Remote Electronic Monitoring (REM) system, while FishVue Fleet, a web-based software, enables WDFW to calculate pots hauled through algorithmic analysis and generate actionable reports on vessel activity. This integration allows WDFW to monitor and enforce temporary management measures, respond to biotoxin risks, and track fishing activity relative to marine mammal interactions.

This presentation will explore how FishVue LIME and FishVue Fleet offer scalable, affordable solutions for small scale and data-limited fisheries, enabling fisheries management to achieve sustainability and regulatory compliance. By illustrating their successful application in Washington, this session highlights the transformative potential of these tools to modernize fisheries monitoring globally.

## Open Discussion Session

Eric Brasseur to Sara Williamson
Q: I have worked with taking samples on scientific surveys. One problem with getting observers out is supplying tools. Every scalpel has to be sterilized, etc. How do we do this?
A: There are easy ways to douse your equipment for some pathogens. Something like my virus, you can use your scissors, wipe down your tools with alcoholic wipes. With parasites, you clip, rinse your forceps, and move on. Yes there are contamination risks, but there are things we can do about that.

Eric Brasseur to Sara Williamson
Q: is there something we can do on the receivers side to record contamination?
A: if we can keep track of what fish at what point we can work our way back to see what is contaminated. Depending on how serious the infection rate, there is a potential for using certain testing to see if there is a concerning pattern.

Miguel Machete for Ryann Turcotte
Q: We still use paper, and for years people have been asking me why. I would like to know your opinion regarding that we have 14 different forms and some have 50 fields. Do you think that this software that you developed for different fisheries can handle massive quantities of records or forms?
A: Yes, a lot of our forms had redundant categories. One thing it does is tracks catch and haul to eliminate repetition. Our orca system matches up precisely to previous paper forms. A summary page exists at the end so that observers can easily error check. Certainly yes, paper forms were the backbone of how we designed the software.

Miguel Machete for Ryann Turcotte
Q: They record the data?
A: Yes, it is a touchscreen tablet

Miguel Machete for Ryann Turcotte
Q: And everything fits on the tablet, observers can easily use it?
A: yes, the tiles have been enlarged so they are easy to interact with. We have made textboxes bigger. We have added a duplicate catch so if they bring one thing over and over they can easily record it.

Lesley Hawn to Maria Jose Pria Ramos
Q: I love to crab. Do you know what the state of Washington uses on average for crabbing effort?
A: All of the catch data is coming from time of landing. So they are not trying to guess how many crabs are coming up in each pot.

Lesley Hawn to Maria Jose Pria Ramos
Q: so this is for position?
A: this is for position and number of traps, because all the regulations are based on that. Fishermen have a certain number of pots they are allowed to fish.

Tiffany Vidal to Maria Jose Pria Ramos

Q: $50 a month sounds great. We are dealing with artisanal and small-scale fisheries with thousands of ships. Are you aware of any even lower cost equipment?
A: We would have to talk about defining monitoring fishing effort. What we are doing with our equipment is about having a very enriched data set. I am not aware of any cheaper systems that provide that for much lower. I can say though that we are talking about a fishery with 200 vessels, and when you are looking at larger fisheries there are economies of scale that help drive that cost down.

Unidentified to Laura Lemey
Q: You say the data you collect is going through some quality checks. Can you please elaborate on how that is conducted?
A: Our quality checks are done twice, by observer and then in power bi. We see that the number of lengths add up to the weight, we look at the weight frequencies. The scientists re-check this again in more depth with R scripts. And then there is another check when that data is uploaded.

Unidentified to Laura Lemey
Q: So there is an automatic warning?
A: Yes, with our scripts we automatically see some things that are not correct

Drew Forward to Laura Lemey
Q: We are still using paper. Do you think you are getting more accurate information now that it is so simple?
A: Yes, I do think we are getting more accurate data. Sometimes when we do checks on old data we get a lot more errors. We also still have some papers at sea, and we double check the weights on paper and on the software, so we can check the discrepancies. I think it goes a lot quicker we can do more fish in shorter amount of time. It takes us about a couple of hours to check.

Viðar Ólason to Kevin Stockmann
Q: It was very interesting to see all these birds. My question is do we have any bycatch of the arctic tern?
A: I don't have any record of any.

Viðar Ólason to Kevin Stockmann
Q: Can you tell me a little more about the arctic tern?
A: it has two summers, it is here breeding in May, and will spend august on the Antarctic ice. It has one of the longest migrations. We don't have interactions with most seabirds but for the ones that we do it is a very critical issue

Lisa Borges to Laura Lemey and Sunny Tellwright
Q: You were talking about the value of EM, do you believe that they might evolve to assist in activities beyond fish catch observation?
A: Sunny Tellwright: It can be used to integrate labor standards. We are seeing new labor standards. I see an opportunity to align. Right now observers are not trained to look for this data, we need to see training, clearer reporting requirements, and agreements on action. We should not see labor violations and then just sit on that data. I do see that as the future.

Laura Lemey: we are looking into using EM data in our smartfish database. We will still monitor with our observers at sea and then combine that with the EM data. Looking towards the future, it would be great to see it in the future. But for my project, this project was born from seeing litter on the belts. There are so many potential uses of EM but we need to have standards for the litter monitoring

Sara Williamson to Lauren Clayton
Q: The litter that comes up on the conveyor belt, am I correct in saying that all the litter on the processor is dumped overboard?
A: yes, in the end of the day it all goes overboard, we watched it go into the disposal chute.

Sara Williamson to Lauren Clayton
Q: can your EM have a compliance role?
A: yes we see it all the time that using EM has a compliance role.

Eric Brasseur to Laura Lemey
Q: what is the total cost of a gear set and two how often are you seeing equipment failure?
A: I don't know the exact cost, near 3000 euros. We do get some errors now and then, so we always have paper. We have extra sets of batteries and sensors. We had one trip done manually because of system failure. We are looking into making a maintenance schedule. We are trying to make it as easy as possible for observers to fix issues on board. You really have to listen to your observers to make it as easy as possible. We are doing something similar, but we are using electronic scales. Ryann, our observers take an extra set of batteries on the field, so they can easily swap out during long shits

Catherine Benedict to Kevin Stockmann
Q: Has there been any movement on observer data being used for endangered birds?
A: The short-tailed albatross drives most of the monitoring on the west coast. It is making a slow comeback. I think having observers out there reporting sightings is useful for that info.

Sam White to Kevin Stockmann
Q: With such a high rate of bycatch, do you know what the mortality rate of that bycatch?
A: For albatrosses it is 100%

Sam White to Kevin Stockmann
Q: Have there been any mitigation strategies, changes in the gear?
A: Yes, thank you. There have been lots of efforts, and observers have had a leading role in seeing what methods work. There has been a lot of international success in preventing overfishing?

Jason Vestre to Maria Jose Pria Ramos
Q: I live on the central coast, so domoic acid affects my life. I've seen entire season closures for crabs. Is there any talks of moving those technologies south?
A: Thanks for the question. The technology is being deployed in California.

Jason Vestre to Maria Jose Pria Ramos
Q: How long has it been there?

A: Since early last year. The program is a little different from Washington state, through California's Department of Fish and Wildlife. They use the data slightly differently.

Miguel Machete to Sunny Tellwright
Q: I completely agree that observer security and labor conditions are important, but I would like to know how do you, you said that you analyse privacy consideration, how can you establish a criteria, it is a sensitive question, this is people being seen by cameras, how do you deal with personal data and privacy protection policies in certain countries? you can protect and evaluate conditions, but there is always a dark side right?
A: I think the need for ethical considerations is so important. We piloted on Taiwanese longlines vessels, they have a vulnerable migrant Indonesian crew. For those reasons these marginalized crew, we need to be sensitive about how these EMs are employed. If we don't have safeguards in case, there is a chance bad actors could further harm these marginalized communities. We don't know what standards should be yet, we can look to other sectors do, like urban crime. Consent is really important, that crews know the purpose, the location of cameras, and that their livelihoods are not in danger for saying no - a lot of labor groups are very concerned about this as well. We need to share the data with response organizations. For abuse, we need to find and inform support organizations. I am glad you understood the importance of these ethical considerations.

## Poster Presentations - Extended Abstracts

### Evolving fisheries monitoring: integrating human rights and labor standards into observer programs and electronic monitoring

**Alfred Lee "Bubba" Cook Jr**

**Sharks Pacific**

Introduction

The increasing demand for robust data and information from fisheries observer programs reflects the growing need for integrated approaches to monitor and manage global fisheries (Benaka *et al*., 2021, Gilman, *et al*. 2022). Observer programs have traditionally focused on collecting biological and operational data for stock assessments and compliance with conservation measures. However, as the scope of fisheries governance broadens to include monitoring human rights and labor standards, these programs must also evolve to meet these new monitoring obligations (Danish Institute for Human Rights, 2021). This shift is particularly significant as fisheries management aligns with larger-scale monitoring initiatives, addressing cross-cutting issues such as sustainability, ethical practices, and social responsibility.

The integration of human rights considerations into fisheries monitoring represents a paradigmatic shift from purely biological and operational data collection toward comprehensive social-ecological system monitoring (Weston, *et al*., 2024). This evolution acknowledges that sustainable fisheries cannot be achieved without addressing the human dimensions of fishing operations, including labor conditions, worker safety, and fundamental human rights protections.

Methodology

This study undertook a desktop analysis of several observer programs to initially assess the presence and application of voluntary or obligatory data collection fields for addressing human rights or labor standards, as well as the existing practicality and feasibility of implementing those measures. We further assessed whether these measures could be transferred or translated across other observer programs either at the national or regional level. The analysis focused primarily on recent developments within the Western and Central Pacific Fisheries Commission (WCPFC) following the adoption of Conservation and Management Measure (CMM) 2024-04 in December 2024.

We examined the technological innovations, data-sharing mechanisms, and policy adjustments necessary to support the transition to incorporate human rights and labor data fields into existing observer programs. The methodology included evaluation of artificial intelligence applications for image and activity recognition in workplace occupational safety and health contexts, drawing parallels to potential applications in fisheries monitoring (The Nature Conservancy, *et al*, 2025). Comparative analysis was conducted across multiple Regional Fisheries Management Organizations (RFMOs) to identify trends and best practices.

Results and Discussion

Multiple RFMOs are considering analogous measures to those passed by the WCPFC in December 2024, including the South Pacific RFMO (SPRFMO) and Inter American Tropical Tuna Commission (IATTC). The WCPFC's CMM 2024-04, which becomes effective January 1, 2028, establishes modest labor standards requiring vessel operators to provide safe working environments, prevent forced labor, ensure written employment contracts, provide decent working and living conditions, guarantee regular remuneration, and facilitate crew member rights including access to communication devices and identity documents.

The proposed additions to the Fisheries Observer Minimum Standard Data Fields (MSDF) in response to CMM 2024-04 include specific compliance reporting fields addressing crew mistreatment, deprivation of basic needs, and workplace safety protections. These data fields represent a significant expansion of observer responsibilities, requiring training in human rights monitoring methodologies and potentially sensitive data handling protocols.

Fisheries observer programs are experiencing transformative changes through the expansion of emerging and advancing technology. Recent developments demonstrate the practical integration of social and ethical dimensions into traditional fisheries monitoring, setting a precedent for other RFMOs. Electronic monitoring (EM) technologies show particular promise for supplementing human observers in detecting and documenting labor violations, utilizing advances in artificial intelligence for image recognition and behavioral analysis. (The Nature Conservancy, *et al*, 2025)

The integration of human rights monitoring into observer programs presents both opportunities and challenges. Key technological innovations include automated detection systems for identifying potential safety violations, encrypted communication systems for secure reporting of sensitive incidents, and blockchain-based verification systems for maintaining data integrity. However, implementation challenges include observer safety concerns when documenting violations, jurisdictional complexities in international waters, and the need for specialized training in human rights law and documentation procedures.

Policies supporting human and labor rights in fisheries will continue to advance and expand across RFMOs. Existing technologies used in similarly situated occupational health and safety contexts have proven the utility and practicality of such tools and will support fisheries observers in supporting human and labor rights monitoring. The Social Responsibility Assessment Tool developed by NGO partners contributing to the "RISE" fisheries social responsibility platform demonstrates how systematic approaches to evaluating labor practices can be integrated into existing monitoring frameworks (The Nature Conservancy, *et al*, 2025).

The successful implementation of human rights monitoring in fisheries observer programs requires collaboration across sectors and jurisdictions, emphasizing the critical role of adaptive methodologies and technologies in meeting evolving demands. This transformation aligns with global priorities for sustainable fisheries and responsible labor practices, representing a fundamental shift toward holistic fisheries governance that encompasses both ecological and social sustainability.

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**Catching the right boat – minimising bias in vessel selection**

**Sam Birch[1]; Jon Elson[1], Richard Heal[1]**

**[1] Centre for Environment Fisheries and Aquaculture Science (Cefas), UK**

<u>Introduction</u>

The UK has a statutory requirement under retained EU law to monitor discards from commercial fisheries. The Cefas observer programme is the only source of commercial catch information for English fisheries that includes observations, length, and age data for the unwanted part of the catch. The primary aim of the programme is to provide discard information for stock assessments and generate catch advice to inform annual consultations. The programme is designed to try to cover all, or the best part of, what is being caught and landed. For observer-collected data to be robust, which is essential to underpin stock advice, the vessel selection method employed must minimise potential bias.

Cefas observers gain access to the UK fishing fleet on a voluntary basis. Owners and skippers are approached for permission to join their vessel if it is convenient. There are many things stacked against an observer when organising a trip, such as vessel safety, weather conditions, travel planning, the willingness of owners and skippers, bunk space, and aligning the availability of both vessel and observer for a given trip. Randomising the vessel selection adds another layer of complexity.

Sampling effort within the English observer programme is allocated based on size of the fleet, the landings, effort, and imputed discards over a rolling reference period. Vessels are stratified by their size and predominant activity and port region in the previous year. Teams of regionally based observers work to quarterly targets and select vessels, at random, using a bespoke 'Drawlist' app. This app was designed in-house and launched in 2023 to replace a series of Excel spreadsheets that were used historically.

Methodology

*App design*

The Drawlist app was built as a web-based application using RShiny and is published on the Cefas Posit Connect server, connecting to a bespoke PostGreSQL database when the user logs in. Access to the application and the database has controlled read/write permissions. The RShiny development was written in a modular format, with each panel of the app accessed by pressing a button on the main page, consisting of a separate module. The use of RShiny allows the incorporation of R scripts into the processing. The underlying code has a functional approach, with common processes coded as separate functions that are called within the code. The module and function code is fully documented with header information to allow future developers insight into what the code should do. This also allows easier testing, debugging, and generation of code documentation. Several R packages are used by the app, including Pool (for interaction with the database), data.table (for fast data manipulation), shinyjs (for incorporation of Shiny script code), and DT (for display of information in a tabular format). The Drawlist information is stored in a PostgreSQL relational database, containing four main tables:

1. Active Vessels

The Active Vessels table contains the list of vessels that are available for draw in the current quarter, as well as the outcome of previous quarters' Drawlist selections. As vessels are selected randomly from the Drawlist, the table is updated and a record of the selection is made. Vessels not drawn at random (the 'Offdraw' selections) are also recorded in this table. The vessel list in this table is updated quarterly to capture the polyvalent and seasonal nature of regional fisheries.

2. Communications

Following the selection of a vessel, all communications with that vessel are recorded in the Communications table. Reasons for not progressing a trip are recorded here too, including refusals and safety concerns about the vessel and/or its crew. All communications are linked to a vessel by the RSS number, allowing historical communication with a vessel to be displayed to the user in the app.

3. Organised Trips

When a trip has been agreed, the observer created a TripLog, and this is recorded in the Organised trips table. Here details about the potential trip are recorded, including travel dates, departure and return ports, gear type, and which observers will be on the vessel.

4. Safety Sheet table

Before embarking on a trip, the observer fills out a safety sheet which is linked to the TripLog. The details of this safety sheet are recorded in the Safety Sheet table and the app generates a partially completed safety sheet for the observer, based on the details supplied.

Following the trip, the Organised Trips table is completed as to whether the trip was completed or cancelled. This, in turn, updates the Active Vessels table, either keeping the vessel out of the Drawlist, or returning it, as appropriate. The database is updated quarterly with the new vessel Drawlist and new vessel information; at this point, the database can be backed up to a mirror database.

The Drawlist database contains sensitive information, so access to the app and the database is controlled. The first control point is controlled access to both the app, via Posit Connect log in, and between the app and the database. The second control point is control via user types. There are three user types with increasing levels of access. External (subcontracted) observers have limited access to functions on the app and an only select vessels and record communications. Cefas observers have a greater level of access within the app, including the ability to review and update vessel contact information. Finally, admin users have full access.

*App operation*

Users begin by logging into the app with a unique ID. Then, depending on their user type, they can perform a number of tasks, including updating vessel contacts information, selecting vessels, logging communications with vessels, generating safety sheets, and exporting information from the database (limited to admin users only). Each user has a 'Dashboard' which displays at-a-glance the status of their current vessel selections.

During the selection step, both random (Ondraw) and non-random vessel selections can be made within a stratum; non-random selections can be made for specified reasons (e.g., training). Following selection, contact details are reviewed (and updated where necessary), and a communications log is created for the vessel, whereby defined responses are selected and details recorded (Figure 1).

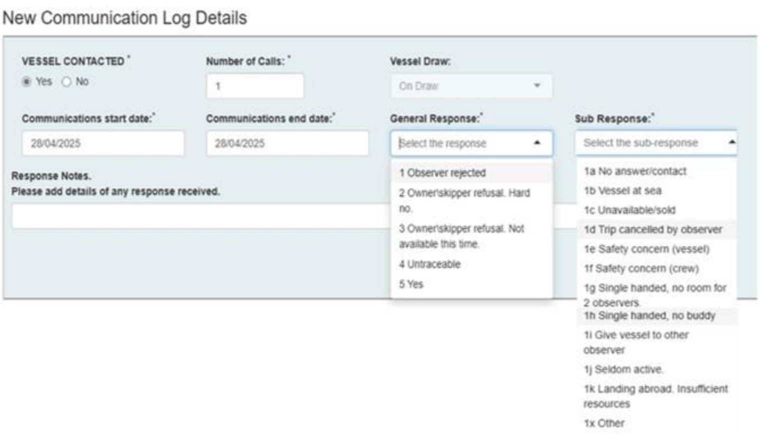

*Figure 3 Drawlist app Step 2 - communications*

A vessel is either rejected, or a trip is arranged. The details of arranged trips are added to the TripLog and a safety sheet is generated for the 24hr shore-based contact. When an observer returns from sea, they log that trip as completed in the app, which updates the record of trips sampled.

Programme coordinators can export information from the database using an administration panel, which enables them to track target achievement, adjust in year targets to manage resource, and make corrections/modifications to database entries.

Results and Discussion

The Drawlist app offers an automated and random vessel selection process which reduces a major source of catch sampling bias and improves the representativeness of vessel/trip selection.

The app was designed to replace a series of Excel spreadsheets, thereby improving efficiencies in administration and keeping all the data together in one system. As a result, the vessel selection process can be better managed and programme managers are able to report refusal rates (skipper and observer) as a quality indicator to end-users in a standardised manner. The system provides a key source for sampling probabilities which allows the data to be raised probabilistically and provide confidence limits around any derived estimates and enable better modelling of the sampling programme to improve/optimise sampling. It also provides a live record of the effort required to secure a trip and a useful reference in dialogue with fleet owners when trying to improve on refusal rates.

The bespoke design provides further operational benefits by housing a (GDPR compliant) vessel contacts list and logging observers' communications with vessels, including safety concerns. A communications log of all historic observer contact with each vessel, including alerts to historic vessel/crew safety concerns and industry refusals, aids observers in decision making and minimises risk by improving safety mechanisms.

The ability to also make non-random selections, in a standardised manner, provides flexibility when specific vessels/trips are required, for example, for training new recruits.

The Drawlist app is operational and fulfils its primary function, but there is scope for future development.

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

### Trash into treasure: insight into atlantic croaker (*Micropogonias undulatus*) fishery effort history in gulf of mexico, is it viable to reinstate one?

**Vaughn Kohl**

**A.I.S., Inc., Kemah, USA**

Atlantic croaker (*M. undulatus)* is a Sciaenid species of fish that is distributed across the Gulf of Mexico (GOM), and all along the eastern coast of the United States. Within the GOM, the species is most abundant in the northern GOM, within state waters, especially Louisiana and Mississippi. Although Atlantic croakers are valued within the recreational sector as live bait, they are primarily only encountered within the commercial sector as discarded by-catch in shrimp trawls. Despite its current status as solely by-catch, this “trash” fish used to be the targeted species of a dedicated fishery within the GOM, with recorded commercial landings dating back to the 1950s. In as little as two decades, however, the fishery began to decline and, ultimately, diminish into obscurity by the 1990s with minimal commercial landings (VanderKooy, 2017). In 2017, the Gulf States Marine Fisheries Commission (GSMFC) published a biological profile of Atlantic croaker in the GOM, largely in response to increased commercial landings of Atlantic croaker. The report compiles data from scientific papers, as well as personal interviews with those closely associated with the industry, and provides useful insight into the historical trends of the value and significance of a croaker commercial fishery in the GOM. Using the report, we can review historical trends of the fishery, which can allow us to better understand the factors that allowed for said fishery to exist, as well as the factors that led to its subsequent decline. Additionally, given that a significant amount of time has passed since its publication, it would be useful to reevaluate the current commercial landing trends of Atlantic croaker in order to assess the viability of an Atlantic croaker commercial fishery in the GOM.

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**The power of communication as a fisheries observer**

**Danielle Damato**

**AIS Inc. in support of NOAA Fisheries, Northeast Fisheries Science Center, North Dartmouth, USA**

Fisheries observers face many obstacles while deployed on a vessel, among them are the constantly changing conditions of weather and sea state, vessel layout and stability, personality types to work with, and modes of fishing. This project will explore observer confidence at sea with tools such as an inReach communication device via a set of interviews with current Northeast observers. The interviews hope to identify whether observers feel more confident at sea knowing they have a connection to land if needed. Through personal interviews of observer experiences at sea, backed by data quality statistics provided by program staff, a discernible pattern between observer communication and performance at sea may be noted. Thriving as a prepared, motivated, and effective observer can prove to be an immense challenge, considering the different industry priorities, the sometimes ostracizing work environment, physical hazards, and ultimate isolation that may accompany the job. Though some factors such as atmospheric conditions are beyond one’s control, through proactive planning and the employment of proper tools and communication skills, the enhancement of safety and efficiency become increasingly more controllable in this role. While the sometimes complex task of maintaining a positive attitude and outward motivation to accomplish the duties of an observer can feel daunting, with devices like the inReach some of these concerns can be mitigated. By equipping each observer with appropriate accessibility to technology with an emphasis on skillful practiced communication patterns, the effectiveness of each individual in that role can be expectedly maximized. When faced with less than desirable and unexpected conditions while working on board a vessel, the use of effective communication and communication technology at sea offers an incredible opportunity for critical guidance and can provide considerable changes in perspective in uncertain and withdrawn circumstances.

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**E-reg – Electronic Registration – A Swedish application for data collection in fisheries**

**Anders Svenson, Baldvin Thorvaldsson, Jan-Erik Johansson, Per Johannesson, Lisa Sörman, Malin Werner, Mikael Ovegård**

**Swedish University of Agricultural Science, Lysekil, Sweden**

E-reg is an in-house developed software application used at SLU Aqua. The current version is used for data collection on surveys and on-board sampling.

E-reg is used in combination with a rugged tablet (field computer) where equipment such as scales and callipers can be connected for direct data entry. Along with various mounting accessories, it is possible to set up an efficient workstation on most vessels.

The overall goal of the E-reg project is to "implement electronic devices for assisting the biological data collection of fish and shellfish", i.e. finding methods that reduce the need of pen and paper. Collecting data in a digital format makes it possible to meet these demands and increase the data quality by applying real-time computerised quality controls, increase data traceability and eliminate transcription errors.

Development of the application started 2010 and was initially tested and used on smaller surveys. After some refinement and updates, the software was tested on commercial vessel sampling. The device has since been gradually introduced to various commercial fisheries.

The major advantages of using E-reg are that it simplifies the observers' work at sea and reduces the risk of potential errors in data management. All data can be transferred automatically to our database.

There are several built-in quality controls in E-reg, including:

1. Identify "unreasonable" length-weight relationship
2. Visualise the length distribution of the sampled individuals in a subsample
3. The user can add a sampling target and get on screen information when the target is fulfilled
4. All mandatory information is registered
5. Collect geographic information, with built in GNSS, on fishing activity

Future development of E-reg means that more types of commercial sampling will be included, e.g. pelagic fishing, small-scale gillnet sampling and various gear trials.

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**The importance of observer data collection in the Pacific.**

**Lauren McGovern**

**NOAA PIROP, Honolulu, USA**

The Pacific Islands Regional Observer Program (PIROP) has just celebrated 30 years of monitoring effort in the Pacific. The data collected by observers in Hawai'i and American Samoa has been a vital part of studying highly migratory pelagic species, populations which have been difficult to study in the past. Very little is known of these species so any data which can be obtained can help with studies for years to come. This data has benefitted a variety of shareholders and allowed studies to collect valuable information on these species. Fishery dependent data collected by observers also helps to give a broad picture of trends within the fisheries as a whole.

One of the key roles of an observer is to collect specimens based on protocol and instruction for special projects involving shareholders outside of our offices. Whether it be for protected species, special interest fish, or rare/unusual encounters; these sampling efforts provide data that would be impossible to collect without observers aboard fishing vessels. The hard work of observers has been essential to the progress of marine research.

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**The Norwegian catch-sample lottery. A probabilistic survey method for at sea sampling of catches from commercial fisheries.**

**Tom Williams, Håkon Otterå, Sofie Gundersen**

**Institute of Marine Research, Bergen, Norway**

Reliable information on the age- and size-structure of the annual harvest of major commercial fish stocks is crucial input to analytical stock assessments. Such information is usually obtained from landing data (census of biomass) combined with biological sampling of selected landings. A novel new catch sampling method was developed for the major Norwegian pelagic fisheries and gradually implemented from 2018 (Otterå et al 2022). The new sampling regime gradually implemented from 2018 is based on three pillars: probabilistic sampling of hauls, use of electronic logbook, and co-sampling. By a minor modification of the electronic logbook the vessels in the pelagic fishery now report the catch quantity at haul level immediately after each catch operation. This electronic report is automatically submitted to the Institute of Marine Research (IMR), where a random draw by computer in real time determines if a small sample of fish should be taken from that haul by the fishermen and be frozen and transported to IMR for analysis. In 2024 IMR began a pilot project with three Norwegian vessels to test using a modified version of pelagic catch-sample lottery for obtaining biological samples of cod, haddock and saithe from the offshore demersal trawl fishery. Instead of taking a frozen sample of fish, the fishers onboard take otolith samples and length data of the catches requested by the lottery. IMR are also planning to trial a catch-sample lottery in the coastal fisheries for obtaining effort data and length data from data limited stocks such as monkfish.

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**The view from Dutch Harbor: maintaining fisheries observation technologies on the fishing grounds**

**Erik Sundholm, Jeremy Olden**

**Network Innovations Maritime, Seattle, USA**

We are proposing a poster that offers the perspective of the folks responsible for installing and maintaining the equipment that keeps observers working and fishing vessels compliant. In particular we would be discussing our experiences with observer cameras and recording systems, satellite communication VMS (Vessel Monitoring Systems) and NMFS certified marine scales. The poster would highlight the challenges, most common failure points and lessons learned to keep operations running in compliance. We would be approaching this from the perspective of the people in the middle, with the goal of serving both the observers and the fishermen We will highlight our experiences and observations, the challenges, successes and lessons learned from Dutch Harbor Alaska.

## Session 4. Monitoring artisanal and recreational fisheries

**Leader: Ken Keene**

Small scale artisanal fisheries occur throughout the world, ranging from one-man canoes in developing countries to greater than 20-m vessels in developed countries. They typically include a large number of boats and a diversity of fishing systems and gears, operating over wide geographical areas, making it difficult to monitor them for scientific and enforcement purposes. This session focused on exploring these challenges, providing an opportunity to discuss successful experiences and different approaches used. We examined methodological aspects, innovative solutions, the use of alternative sources of information, along with human, social and economic aspects that need to be considered when working in these fisheries.

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## Oral Presentations - Extended Abstracts

**Sacrois: A data cross-validation tool to enhance quality and completeness of fishing activity data (spatio-temporal fishing effort and landings by species). Application to the French Atlantic small-scale fleets.**

**Sébastien Demanèche[1], Eric Bégot[2], Antoine Gouello[3], Armelle Rouyer[1], Laurent Dubroca4, Jean Baptiste Lecomte[5], Youen Vermard[5], Aurore Chassanite[1], Emilie Le Roy[1], Emilie Leblond[1]**

**[1] IFREMER (French national institute for ocean science and technologie), Coordination et valorisation de l'Observation Halieutique (HISSEO), Plouzané, France.**

**[2] NORGAY, Brest, France.**

**[3] PLEGADIS, Saint Loup, France.**

**[4] IFREMER, Port en Bessin, France.**

**[5] IFREMER, Nantes, France**

Introduction

The French Atlantic small-scale fleet (SSF), defined here as vessels under 12 meters in length, is highly diverse. It comprises multi-species, multi-gear coastal vessels operating along the Atlantic coast from Dunkerque to Bayonne. These vessels use a wide range of fishing gears (such as pots, dredges, nets, …) and may operate year-round, seasonally, or part-time. This heterogeneity poses clear challenges for effective data collection and monitoring.

This fleet represents a major component of French Atlantic fisheries, comprising approximately 1,900 vessels, around three-quarters of the total fleet, and accounting for over 115, 000 tons of landings, nearly one-third of the total. The SSF has a significant ecological impact, contributing substantially to coastal species landings. This includes both EU-regulated species (e.g., European seabass, for which SSF accounts for 65% of total landings, around 1,500 tons) and regionally managed species such as Great Atlantic scallop (with SSF contributing nearly 20,700 tons, about half of total landings). Some fisheries, including those for glass eels or seaweeds, even rely exclusively on SSF. In addition to their ecological footprint, these fisheries also play a crucial socio-economic role, particularly with respect to the social and human dimensions within coastal communities.

It is imperative to accurately estimate the fishing activity of this fleet, encompassing spatiotemporal effort and landings by gear, métier, and species, in both volume and value. This is minimum baseline data required for effective management at local, national, and international levels. These core data are also foundational for extending monitoring to human, social, economic, and biological variables. However, due to limited institutional consideration and fewer reporting obligations (e.g., no geolocation requirements for vessels under 12m, no EU logbook requirement under 10m, following current EU control regulation) combined with the inherent diversity of the fleet, available data often suffers from major gaps and inconsistencies. The absence of a unique, high quality data source is a key limitation, particularly in contrast to the case of Large-Scale Fleet, which benefits from a more comprehensive and integrated dataset. This makes cross-validation methods necessary to enhance completeness, consistency, and accuracy.

Materials and Methods

To address these limitations, SACROIS (developed by Ifremer since 2009, in close collaboration with the French Ministry) was created. It is a cross-validation tool (Ifremer SIH, 2022) combining multiple data sources using robust rule-based algorithms to build the most accurate and complete reference dataset for French fisheries. SACROIS is particularly valuable for small-scale fleets, where, as previously noted, data collection is more difficult yet crucial for effective management and policy development.

SACROIS integrates and cross-validates the following data sources, often complementary yet sometimes inconsistent:

a) **French Fishing Fleet Register** – An administrative data source listing all French fishing vessels registered in the EU Fishing Fleet Register since 1983, including vessel characteristics (length, kilowatts, gross tonnage, age) and ownership/geographical information. This register serves as an exhaustive reference list of French vessels authorized to engage in commercial fishing activities.
b) **Sales Note Data** – Landing statistics from auction markets, detailing total weight and value by species (incl. processing state, presentation, commercial category and destination), per vessel and date. Value is specific to this source. These data are standardized back to 2000 but do not cover all French landings (e.g., non-auction sales).
c) **Vessel Geolocation Data** – Positional data (longitude, latitude, course, and speed) from geolocation devices (e.g., VMS), required in specific SSF fisheries under national rules (e.g., Bay of Seine scallop dredgers). This allows accurate estimation of fishing areas (including EEZ and regulatory boundaries) and effort (days at sea, fishing days and hours at sea), at the scale of individual fishing trip and sequence (by date).
d) **Fishermen Declarative Data** – EU logbooks (mandatory for vessels >10m, under EU regulations) and national monthly declarative fishing forms (for vessels <10m, under national legislation), providing landings (in weight) and fishing effort by species (incl. state of processing/presentation), gear (with dimensions/mesh size), and area, per day (monthly declarative forms) or trip/fishing sequence (EU logbooks). Gear

specifications and fishing trip details are specific to this source. Available (under a standardized/ harmonized format) since 2000 but requiring validation.

e) **Scientific Annual Census Survey of Fishing Activity Calendars** (Berthou et al., 2008) – A minimal but exhaustive (covering all vessels registered) annual survey capturing vessel activity (active/inactive) by month with, for active month, practiced métiers (gear/gear dimension and target species), main fishing areas (incl. range of operation), and fishing effort (fishing days). Data available since 2000. Conducted early each year by a set of fishing observers for the previous calendar year.

It is especially useful for small-scale fleets with limited declarative data, helping to identify fishing areas and métiers for example. It also allows to assess the completeness of the final dataset, which reached an estimation of over 95% coverage for the French Atlantic SSF in 2023.

SACROIS combines these declarative sources through a suite of rule-based algorithms (ISSG Métier and transversal variables issues, 2023 report) that:

1) **Link the various input data flows** (by vessel and dates), to infer individual SACROIS fishing trips, avoiding double counting. Species composition and landed weights are also used to reinforce these links particularly between fishermen declarative and sales notes data.
2) **Consolidate**, validate and adjust **total landings** and **species composition** by trip. It achieves concordance between species weight and composition across sources (e.g., fishermen declarative vs sales notes data).
3) **Consolidate**, validate, and adjust **vessel' fishing effort** (days at sea, fishing days, hours at sea and fishing hours) by trip. The process considers especially the existing geolocation data to cross-validate and control declarative fishing effort data and complete trips with no declarative data available (e.g., SACROIS fishing trips issued only from sales note data).
4) **Consolidate**, validate and, if necessary, adjust the **spatial information** by trip. The process considers especially the existing geolocation data and the scientific census survey to cross-validate, verify and refine the declarative spatial data available. Trips for which no declarative data is available are also supplemented (e.g., SACROIS fishing trips issued only from sales note data).
5) **Estimate the value of landings by species** based on existing sales note data (sometimes directly deducted from them) or on an average price' estimation.
6) **Assign "fishing metier(s)"** by trip based on dominant landed specie (or group of species) in value, scientific census survey and eventually the declared gear.

<u>Results</u>

The main outcome is a new reference comprehensive dataset, of a consistently formatted set of fishing trips (since 2000) with the following standardized information: a) trip dates (departure and return), b) fishing 'métiers' (gear types, and target species or species assemblage), c) fishing areas (incl. EEZs and regulatory boundaries), d) landings by species (in weight and value), e) gear characteristics (mesh size, dimensions), and f) effort data (hours at sea, fishing days, days at sea).

It compiles all available fishing information and may be constructed from one, two, or more sources. Each source contributes to describing the vessels' activity along with providing specific information (e.g., landing value is only available through the sales note data).

This unified, single, verified and quality-controlled dataset is now the official reference for French Atlantic SSF fishing activity, supporting a wide range of needs: Regulatory monitoring (e.g., quotas and fishing effort monitoring, EU DCMAP compliance, fleet capacity assessments), Communication to fish producers, Responses to official mandatory data calls to the UE, RFMOs, FAO, Eurostat, etc., National policy and fishery management implementation, and as a core database for Scientific advice and Academic research.

SACROIS has been demonstrated to significantly enhance the completeness of SSF data. For instance, SACROIS increased the number of fishing days from ~170, 000 (in declarative forms) to ~190, 000. Landings were also adjusted from ~40,000 tons (in auction sales) to over 115,000 tons. It also improved the data quality providing, for example, an estimated commercial value to each fishing trip, resulting in a total of €300 million in landings for the SSF in 2023. It also allows to consolidate and adjust individual species landings, for example: Atlantic mackerel landings increased from 1,200 tons (sales notes) to 1, 600 tons in SACROIS or Whelk landings grew from 6,800 tons (declarative forms) to over 7,100 tons in SACROIS.

Discussion

In the end, different types of SACROIS fishing trips are present in the dataset. They vary in quality depending on the number of cross-validated sources. Trips that integrate multiple source (e.g., declarative, sales notes, and geolocation data) are more precise (as most key variables have been confirmed across multiple sources) than those based on a single source. To ensure transparency, quality indicators are computed for each trip, helping end users assess data reliability. Cross-validated features are considered more accurate and consistent.

SACROIS is a fully operational tool, under continuous maintenance (both progressive and corrective). It will continue to evolve especially with the upcoming new EU control regulations incorporating: more comprehensive geolocation data, particularly for the SSF and declarations at fishing-operation level. The system also aims to include additional data sources, such as biological, on-board, or economic data sampling, in order to refine species composition, gear characterization, or value assessments. Finally, the SACROIS team is committed to a collaborative approach at EU/International levels, sharing algorithms and methods, to improve cross-country comparability.

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**The Solway lobster derogation project**


**Lauren Clayton, Helen Holah, Rachel Kilburn, Alexius Edridge**

**The Marine Directorate of the Scottish Government, Aberdeen, UK.**


Introduction

In May 2024 Scotland introduced new interim management measures for crab and lobster which included prohibiting the landing and retention of egg-bearing/ berried lobsters. There was feedback from a small number of fishers operating in a small region on the Southwest coast of Scotland called the Solway Firth (Figure 1), that egg-bearing/ berried lobsters represent a high proportion of their catches and that the prohibition would severely impact the viability of their businesses.  The Marine Directorate (MD) of the Scottish Government (SG) was tasked with exploring the these concerns. However, the landings in this region are very low compared to other areas in Scotland and as such are infrequently sampled as part of the MD Scottish fisheries data collection programme. A derogation for the Solway Firth was implemented in order to collect additional data from this region in order to compare it to the baseline data which had informed the interim management measures. Remote Electronic Monitoring (REM), of a subset of derogated vessels, was required and implemented to enhance data collection alongside increased shoreside sampling, with the aim of collecting sufficient data to compare the proportions of berried lobsters in Solway Firth to the Scottish baseline data.

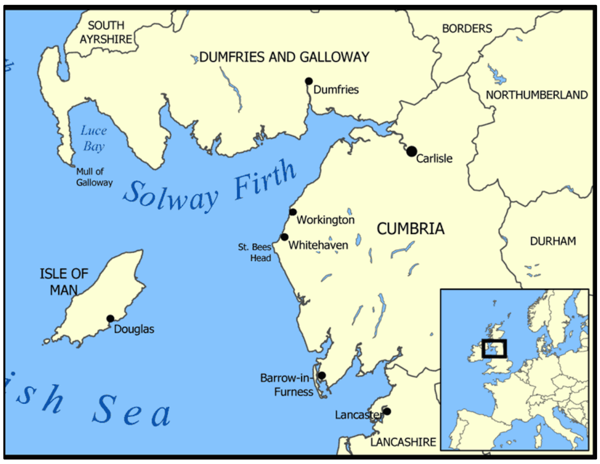


Figure 1. A map showing the Solway Firth. Map taken from Google

Methods

The REM system consists of a Samsung Galaxy Active Tab with Archpelago's FishVue Mobile application installed. The tablet is used in conjunction with flexible railing mounts that allow the fishers to temporarily and non-invasively install the tablet in the desired location to give an overview of the creel/trap hauling point and catch processing area (Figure 2). Catch handling changes were needed to follow the provided protocol, which consists of the fishers holding each lobster within the field of view of the tablet camera in order to be able to identify berried status and sex.

Figure 2 . The EM tablet system mounted on a boat railing, and examples of the field of view from the tablet.

There are currently 5 tablet REM systems in the field, fishers take a system on a rotational basis and for every trip when they have the tablet in their possession they are required to record video footage ensuring they follow the provided catch handling protocol to ensure optimum data quality. Following a trip fishers upload their data using Wi-Fi to a Microsoft Azure cloud where REM analysts download the data through Microsoft Azure Storage Explorer and review the trip in the FishVue REM analysis software. Here a feedback loop was implemented where any issues or changes needed to the data collection or tablet position are communicated back to the fishers, and so far this has been successful in improving data quality and rectifying issues. Following review, an image of each retained lobster is saved and analysed by experienced samplers to determine the sex and berried status of each individual where possible. This data is then summarised and shared with policy colleagues and stakeholders as required.

Alongside the REM data collection additional shoreside sampling is being conducted by colleagues to collect length and sex information, this has also acted as a ground-truth for the REM data.

<u>Results</u>

So far, it has been possible to identify the berried status in the vast majority of images.

Since the introduction of the interim management measures in May 2024 and the successful rollout of the tablet systems data has been received in all months (except September 2024. There has also been successful shoreside sampling in February, March and April 2025, resulting in some temporal overlap of REM and shoreside data which has shown comparable proportions of berried lobsters between the methods.

Recording consistent data using REM, particularly with a system such as FishVue Mobile which requires a high level of device interaction from the fisher, is often challenging. Even where participant engagement levels are high, conformity with protocols provided to participants can vary. As of March 2025 the MD had received 49 trips for which REM data had successfully been uploaded by fishers. Of these 49 trips most were suitable for analysis, those that weren't suitable were corrupted due to analyst error when downloading the data, or resulted from technical issues with REM equipment failures. Of the trips reviewed around half showed evidence of fishers not adhering to all required steps of the protocols resulting in incomplete or poor quality data, which was subsequently improved following feedback to the fishers.  It was also noted that some fishing events were impacted by poor lighting due to darkness in the winter months early in the morning or late at night. Where possible all data were reviewed and analysed with an understanding that where lobsters could not be identified or the protocols were not followed there would be no reported information or it would be categorised as 'unknown'.

Provisional data on the proportions of berried lobsters from the analysed REM trips so far show that there are some periods with higher proportions of berried lobsters accounting for up to 80% per trip of the numbers of retained lobsters (Figure 2). More data will be reviewed and analysed which will enable an analysis of any seasonality.

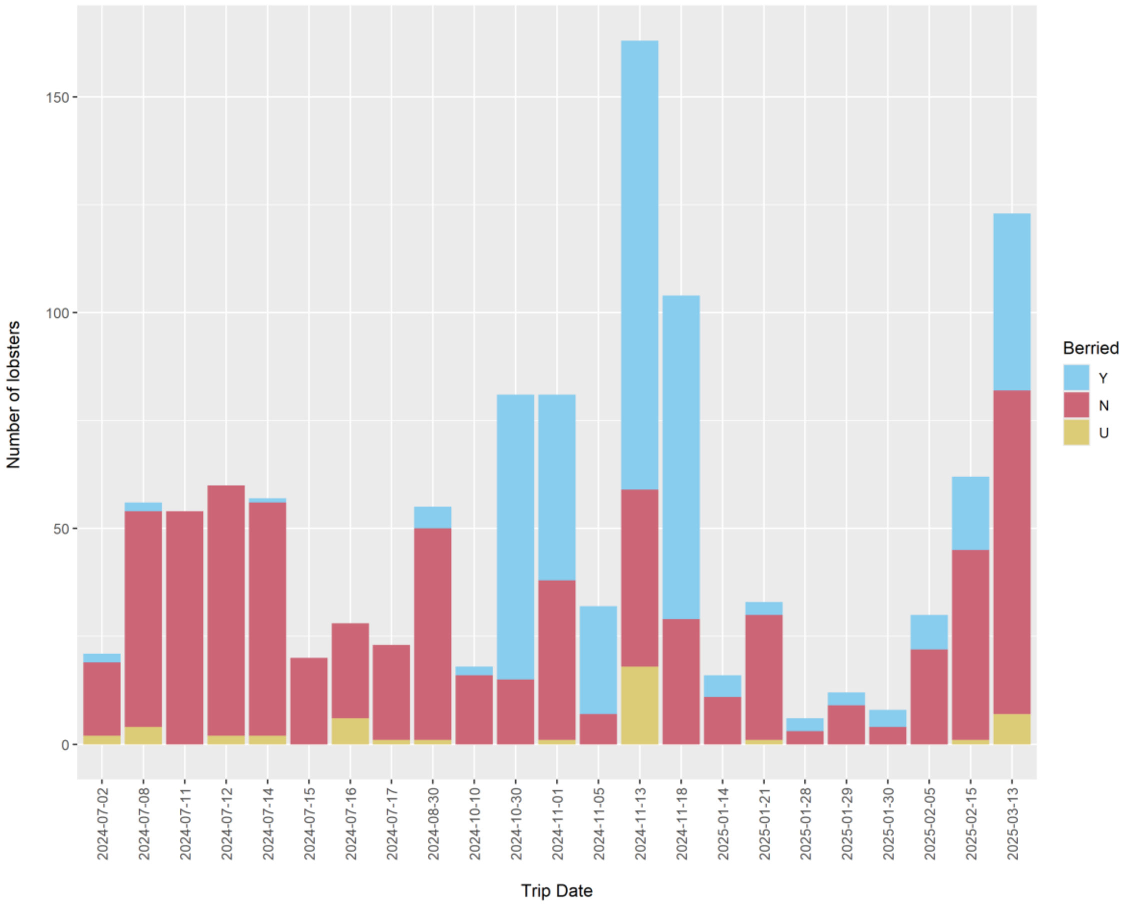


Figure 3. The provisional data for the number of lobsters and their berried/ egg-bearing status. The colour of the bars indicates if the lobster was berried or not. This data is for each trip with analysed EM data.

## Discussion

This trial has demonstrated that REM can be well suited to answer fisheries management questions such as those posed by stakeholders in response to the SG interim management measures, as in the case of the Solway Firth.

There has been varied experiences among fishers in regard to their ability to use the REM tablet and in their adherence with the catch handling protocols. This type of REM system requires a willingness from the fishers to facilitate data collection and continuous dialogue between fishers and programme managers to maintain and improve data quality.

It has also been demonstrated that REM can offer a cost-effective and scalable solution when quickly starting up a data collection programme in comparison to traditional shoreside monitoring.

The next steps for this trial are to continue to collect, process and analyse the REM data, to undertake a statistical comparison of the proportions of berried lobsters in the Solway Firth to the Scottish baseline data and make recommendations to SG policy makers on the suitability of the prohibition in this region.

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

### Lessons learned from developing and implementing an e-Log app for small-scale fishers in Iceland.

**Þorsteinn Ágústsson, Þorvarðu Sigurjónsson**

**Trackwell, Reykjavík, Iceland**

This lecture discusses the development and implementation of an electronic logbook (e-Log) application tailored to the needs of small-scale fishers in Iceland. The primary goal was to design a simple and user-friendly tool that enabled fishers to efficiently record essential catch data, including what was caught, where, and how much.

Among the lessons was the importance of involving fishers early in the design process. Their feedback helped make the app more practical and relevant to their daily work. Training and ongoing support were also critical to help fishers feel confident using the technology. This cooperation made it possible for the application to work for all kinds of small-scale fisheries including artisanal and recreational fishers.

For the government, the app provided reliable data for better fisheries management. For fishers, it offered a way to track their fishing history on a website, helping them make smarter decisions.

The project showed that simplicity, user involvement, and support are key to successfully implementing technology in traditional fishing communities. These take-aways can guide future efforts to improve data collection and sustainability in all types of small-scale fisheries around the world.

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### Toward fishing sustainability: electronic monitoring pilot project with the Chilean seabass artisanal fishing fleet

**Natalio Godoy[1], Alvaro Teran[2]**

[1] **The Nature Conservancy, Santiago, Chile.**

[2] **The Nature Conservancy, Midtown building, Costa Rica**

The Nature Conservancy (TNC) and partners such as Servicio Nacional de Pesca y Acuicultura (SERNAPESCA), Subsecretaría de Pesca y Acuicultura (SUBPESCA), and the Instituto de Fomento Pesquero (IFOP), and services provider as A.I.S., Inc (AIS) and Integrated Monitoring (IM) have studied the effectiveness of wireless Electronic Monitoring (EM) in the artisanal Chilean Sea Bass fleet. This pilot tested the cost and scalability of an EM system which increased transparency in fishing operations, improved at-sea data collection and moved beyond antiquated EM by using cellular data transmission for wireless data management. The project produced data on fishing effort, protected species, kept, and discarded catch, and gear use from vessels located along 2800km of Chile's coastline. IM installed systems on three vessels, located in north, central, and southern Chile. The IM systems recorded and wirelessly transmitted video of fishing activity from 16 trips, spanning 283 days, including 245 fishing days and 409 hauls. AIS annotated every trip for gear setting, gear recovery (hauling), and issues. The AIS reviewers then reviewed 172 hauls spanning 810 hours of video. The blended average review rate of the hauls for the three vessels was 0.524 review time/haul time. The implications of this, near half review rate, demonstrated the effectiveness of the video, review platform, and reviewer capability. This rate improved over time, and the recommendation for future work includes a burn-in trip for initial camera placement improvement, crew feedback reports to minimize camera view interference, and health checks of the system during fishing events to monitor for system issues. In the future, the scale of the project will impact in the transparency of Chilean and world fisheries.

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**Southern California artisanal: fisheries, markets, and monitoring**

**Steven Todd**

**Alaskan Observers Inc., Seattle, USA**

Catches from artisanal fisheries account for up to 40% of the global annual catch. They provide subsistence, employment, food security, and healthy protein for local and regional communities. The widespread nature of fishing efforts and gear types presents many challenges for management, including identifying fisheries and fishermen, monitoring and catch sampling, and defining and applying regulations.

In the U.S. West Coast Groundfish Observer Program (WCGOP), many observed fisheries in southern California are characterized as artisanal due to the small size of vessels, gear types, and small-scale landings. These fleets are essential to their local communities, supplying locally sourced, fresh, and sustainable catches sold at numerous dockside markets. Direct retail markets have proven to be a key component for economic stability for fishermen. In addition, they provide one of few opportunities to recruit new fishermen into an aging fleet.

The Open Access permit is the most accessible and affordable option for new fishermen in the United States' west coast fisheries. It also serves as the most common pathway into commercial groundfish fisheries and represents the greatest artisanal fishing effort. Typical small-scale fishing vessels range from 7 to 10 meters in length and are often single-crew operations. These smaller vessels present various unique challenges for management and

observers. Everything from sampling gear to safety equipment and personal items is customized for each trip. With over 20 years of experience on fishing vessels, I have gained numerous insights, both practical and psychological, for ensuring trip success.

Case studies from interviews with vessel operators will illustrate the mutually beneficial relationships between fishermen and WCGOP and the advantages of dockside markets. Additionally, I will share insights from my experience with trip preparations, sampling strategies, and working effectively and safely on small vessels.

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**Collaborative development of electronic monitoring programs for first nations**

**Fraser Stobie, Jillian DiMaio, Amanda Barney**

**Teem Fish, Prince Rupert, Canada**

Indigenous Community Based Fisheries (CBFs) provide opportunities for small-business fishers to participate in commercial industries while maintaining respect for their traditional values and fishing methods. This model is designed to support thriving multi-species, mixed gear, small-boat (<40ft) enterprises, lowering the barriers to industry participation for shareholder Nation citizens.

Teem Fish Monitoring Inc. (Teem Fish) has partnered with First Nations in British Columbia (BC), Canada to test and codevelop 'right-sized' electronic monitoring (EM) pilots in a range of CBFs where other EM options are poorly suited. Our collaborative approach to EM program development is outcome-focused, meaning that we design our solutions around delivering critical information needs that support effective indigenous-led resource management and compliance. Working with First Nations partners, we seek to identify and minimize the barriers to monitoring requirements through EM adoption, acknowledging the context-specific constraints and nuanced needs of individuals. Key challenges encountered include: fragmented and diverse fleets, varied vessel configurations and gear types, low catch revenues that make EM investment unviable, limited capital, and resistance to at-sea observations.

To address these challenges, Teem Fish employed a three-pronged approach: 1) developing deep understandings of the fishery; 2) flexible financing; and 3) providing fit-for-purpose, cost-effective hardware. Equipment lease options along with software discounts reduce upfront costs for pilots, and our portable EM product enables multiple vessels to share a system for lower individual costs. By working with Indigenous fishery managers we aim to avoid 'penalising' small scale fishers, ensuring the cost burden is accommodated fairly. The learnings from these pilot programs further highlights the important benefits of empowering artisanal fleets to proactively consider EM programs and invite regulators into the conversation where Nations can lead by example and develop an appropriate EM solution rather than waiting to react to dictated requirements that may not suit their community.

## Open Discussion Session

Tiffany Vidal to Sébastien Demanèche
Q: Can you provide details on consensus consideration on successful project?
A: Something doing every day on the beginning of the month. Exhausting and we have observers but its mostly activity data. We do not have any landings some information on fishing days and it is very useful to define the fishing gear and area and its useful and we use it to estimate completeness and we when we don't have that we use some assessment but in France Atlantic we have that we can assess.

Lauren McGovern to Lauren Clayton and Natalio Godoy
Q: what is your experience with the captains having these cameras on board and was it difficult having the approval for this camaras?
A: Lauren Clayton: the fisherman had a bit of pushback but lots of the boats have small crew and for them is being a collaborative effort to verify the claims and they are surprised of how happy they are with this. It is a good experience so far. When it comes to privacy not bad because it's a selfie camara and when the face is in the camera they don't care. They forget it is there, and we censor to not be able to see the people. Normal censorship.
Natalio Godoy: It is very important with the community to explain on the better way about the privacy because it's on work. it is my work and I work enough. When you explain on the market access it changes a bit. I can improve my fishery and improve the income. The market approach ads well.

Teresa Athayde to Natalio Godoy
Q: it seems that before the project the fishers did not have a good opinion did it change?
A: we explore the perception of people and we have different perception. The captain has different perception than the one from the owners or the crew. When we install the camara and have a pilot they have problem on high seas and they have interest that will help them connect with family, when people spend all in one minute that another story, but the perception is good.

Teresa Athayde to Natalio Godoy
Q: Cost efficiency in the EM because I work in Africa a lot and is one of the things that is a vision, the use of EM in small vessels and the impact on safety, what's the idea since same problems, it is something viable?
A: super important is costs in this area because you have the chance to talk to fisherman or the fisher or it sonly for the fisherman. The cost is high because of the cloud because there is a ton of basic and it's a lot more. A problem is transmission because you have the reception in different ports. If you have vessel all coming at once the internet collapse. We adapt and its around 2 have million and we try to get the figure out funding for technology.

Holly McBride to Jilian DiMaio
Q: Support and training to set up and are you comfortable that they were able to take video?
A: Standard set up on protective case and they are battery powered and is required. The biggest part of the training is to change the battery. They do day trips but they have to remember. The set up has std systems and offers flexibility and it can be transfer around. It is not bad for operation so far other than charging and when they have to turn it on.

Beginning thy were turning on for hauling so loss of data. This provides them a way to help because it is voluntary and they are willing to help us out.

Luis Cocas to panel
Q: Best advice to deal with artisanal fisherman, as a human sector is a hard way to deal, how you deal?
A: Steven Todd: I come with a heart and build relationship and bring food for them. It is diverse community and I bring things they do not have before. Treat and then work. small vessels and we have to be respectful of their space and their set boundaries that's good.
Lauren Clayton: Collaboration and building trust, listening to the specific needs to tweak process to give the support to really understand them and how to work together and have the solution. Working with CBFs it's a long start up and you have to build trust, and provide something they want to continue is good.
Sébastien Demanèche: good way to keep relationship and we share the data and we can do that to have their feedbacks.
Lauren Clayton: build a relationship with them, anxiety around the camara but explain well about privacy and problems. With Solloway project and we have a good relationship with the vessels and that helps with success of the project. We have people that are happy. It is expanding the sampling.
Natalio Godoy: include the local ecological knowledge in the design. And trust the fisherman and to not view isa the best way to address
Þorsteinn Ágústsson: Involve them on the design is important.

Viðar Ólason to Þorsteinn Ágústsson
Q: You mention in your presentation the average user age of your equipment that was not so old, so why do you believe they are having trouble? are they more stubborn than lacking technical skill, can they improve with the years?
A: Less phone calls, users that are old and not good tech, it is a challenge but we help them through here and the family helps as well but so far it improves and there are less problems. (Viðar Ólason) more flexibility.

Viðar Ólason to Steven Todd
Q: what is the length of the trip of the vessel and an avg facility that we have on board as observer?
A: I have work on vessels all over my career, there is no space for us then or not safe then I can determine when I go and not go. Homemade boat thru surf and we fish at night and they bring their catch to dory market a people line up for the food. They are all mostly day trips I go there overnight or come back in the afternoon and that is good.

Miguel Machete to Jilian DiMaio
Q: Trying to launch a pilot project on the tuna fishery for the vessels below 40 m , we try to cover all the fleet, and try to implement the project on small boats, what are the things that we have to get data on interactions with interactions, they can occur there besides the vessel, do you think the EM systems could be and have that range and get this data?
A: Marine mammals interaction is a very common data to be recorded. The info you can see in the camara and determine. You can see what the camara sees and their e is different things to consider but to see interactions we have good success with them. I will say it is difficult when you see them and not in the gear, wider cameras with more dedication might be difficult.

Jason Vestre to Jilian DiMaio

Q: Do you have an idea on what is the range of the image quality to understand and analyze the data to have definition of image?

A: Jilian DiMaio: Biggest impact is the field of view, the wider the less details. using more cameras that have different field of views is important, there is the need of experimentation to make different set ups to be flexible for those programs but we have good success to see marine mammals. Right configuration is that most important part but also knowledge of behavior.

Lauren Clayton: if that's your objective you have to put them in a location where is good. Because interactions are very hard but its what is the objective and the vessel size. 15 cameras for big boats. Its never be a no but difficult if that is your approaching objective, more success if the camara is just looking for that interaction.

Colin Bishop to Steven Todd

Q: Steve is an observer before the m was added, that's 25 yrs, you are a trip shy of 1000 in our program. Question you are the only not EM here, what are the challenges in small boats and how they change in the last 25 yrs?

A: build momentum overtime, we have cross overs and they are very successful and I take small steps to work with them. The selection period is 2 months and they might be having other trips, but I build confidence with them, I make myself small and there is some psychology. Emotional intelligence is important to have to talk to them and when not to. Key is to find common interest, to figure out what to talk about with them and I build small. Fisherman are resistant with camaras and observer. They prefer none.

Bryan Belay to panel

Q: what are the data products that play themselves as incentive for the data?

A: Natalio Godoy: talk to fisherman when you work with them. The best thing is when they recognize the good practices and they want to show you and other colleges, it is a good thing to reinforce it and a good pt of the camara.

Þorsteinn Ágústsson: fishing vessels can go to the website to see the data, we are moving for small scale fishers and is a smaller version but they can see what and when are they fishing.

Lauren Clayton: we are not doing for the compliance, that is a good incentive. Small artisanal vessel we do and create a data that they can download for the public. That is small reduction for problems on that fishery and that helps. Questions about small scale fishers to use spatial data's to prove the fishery place. We work with the fishers to prove the areas to see how that affects them

Sébastien Demanèche: combine the data to recollect the data and useful to improve and asses the fishing area and data. With new evaluation we will introduce in order to consolidate and is very useful to define the vessel and we use all of this info to try to finds the vessel on the area.

Jilian DiMaio: data integrations with other products to provide substantial use and we create data sets to be able to use the data. They need to record data on their terms to use the since behind to visualize the hot spots for the fishing spots. Incorporating AI for the business and switch the switch and a good opportunity.

Sébastien Demanèche: quotas are specific, value fisheries and they mark the sustainability, they have seafood watch and most of those are good. Fisherman think they are very good and they use for marketing and use it for social media.

Unidentified to Lauren Clayton
Q: estimated proportions do you think that they continue? will they use that as a tool for the berrying?
A: is it very much as a tool and we are in a position. There can be an extension for years to look at them and it will not continue. We will move forward that under 12 m will have trackers and camera wise I am not sure and we will talk about this. It is a concern of striping of barring lobsters. Hope of compliance on increase samples.

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

### Camera monitoring as a tool to map recreational fishery effort in the Borgund fjord, Norway

**Sofie Gundersen[1], Otte Bjelland[1], Nils-Roar Hareide[2], Jan Hinriksson[1], Kjell Nedreaas[1], Håkon Otterå[1], Jon Helge Vølstad[1], Keno Ferter[1]**

**[1]Institute of Marine Research, Bergen, Norway**

**[2]Runde Forsking, Runde, Norway**

Norway has the second longest coastline in the world and the highest participation rate in Europe of recreational sea anglers. The recreational fishery that includes substantial participation from foreign tourists is part of the "freedom to roam" legislation, and there is no mandatory registration for recreational anglers, although there is a mandatory registration of tourist fishing companies. The vast coastline, near universal access, high participation rate and no mandatory registration, makes the mapping of recreational fishery in Norway difficult. To map the recreational fishery, the Institute of Marine Research (IMR) has conducted several pilot studies to test different methods the latest one being conducted in the Borgund fjord in 2022 and 2023.

The Borgund fjord is a fjord system located outside the city of Ålesund in western Norway. The fjord system is a spawning area for northeast Arctic cod and has been closed for fishing with conventional gears in the spawning season (1. March – 31. May) since 2009. The fjord, however, is open for fishing with handheld tackle in this period. To estimate the effort and catches by the recreational fishers, IMR conducted a roving creel as well a camera monitoring study of the fjord in 2022-2023. Three cameras were put up at strategic locations, to cover the entire fjord system, and the number of boats was counted by trained technicians at randomly selected days, and at randomly selected times throughout the days. The roving creels were conducted simultaneously to collect data that the camera could not collect, such as the duration of the fishing trips, number of gears and catches. The study showed high effort in the beginning of the period, with the effort decreasing towards the end of the period in both years.

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### The potential impact on marine fish stocks by recreational illegal fishing

**Hans Jakob Olesen[1], Christian Skov[2], Casper Gundelund[1]**

**[1]DTU Aqua, 2800, Kgs. Lyngby, Denmark. [2]DTU Aqua, 8600, Silkeborg, Denmark**

Commercial fisheries in Europe are typically subject to thorough sampling and monitoring, whereas data on effort and catch in recreational fisheries are often sparse. Over the past few decades, the decline in commercial fishing pressure, partly due to reduced quotas, has led to a growing relative importance and potential impact of recreational fisheries on certain fish stocks. For instance, before the introduction of bag limits, recreational catches of Atlantic cod in the western Baltic Sea represented nearly one-third of the total catch. For other fish stocks, recreational fishers may be the sole or dominant users. This implies, that recreational fishing can have a significant negative impact on the

fish stocks if the fishery is of a certain dimension or/and the stocks being caught are in a poor state. The importance of having good data to be able to monitor the impact of recreational fisheries e.g. by inclusion in stock assessment work is now widely acknowledged.

In Denmark it is mandatory to hold a valid fishing license if going fishing in the sea. The list of license holders is used as a sampling frame for a recall survey targeting both passive gear fishers and anglers since 2009 in Denmark. A combination of this recall survey and an on-site survey has been in place since 2016 to ensure a more precise and accurate estimation of the Danish recreational catches of western Baltic cod and allow for inclusion of these data in the stock assessment work. However, there are a few legal exceptions to hold the obligatory fishing license. To be able to include the effort and catches from the recreational fishers not holding a license an omnibus survey was conducted. The survey was designed to allow for a calculation of the impact from both the legal and illegal fishing without license.

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**Effects of bag-limits and closures on catches in recreational fisheries**

**Hans Jakob Olesen[1], Christian Skov[2], Casper Gundelund[1]**

**[1]DTU Aqua, 2800, Kgs. Lyngby, Denmark**

**[2]DTU Aqua, 8600, Silkeborg, Denmark**

The commercial fishing fleets in Europe are generally subject to coordinated sampling and monitoring programs, whereas data on the impact from the small scale and recreational fisheries remain more limited. Over the past few decades, commercial fishing pressure has decreased for many stocks, partly due to reduced quotas, making recreational fishing an increasingly significant factor for some fish stocks. Between 2009 and 2016, before the introduction of bag limits, recreational catches of Atlantic cod in the western Baltic Sea accounted for nearly one-third of the total catch.

However, in response to a sharp decline in the stock, a bag-limit was introduced in 2017 for the recreational western Baltic cod fishery. Since then, bag limits have varied in size, and most recently, the fishery has been completely closed. Over the past 15 years, Denmark has conducted a national off-site recall survey targeting recreational fishing license holders to monitor fishing activity.

This study examines the potential effects of regulatory changes, particularly the impact of bag-limits, on the recreational Atlantic cod (*Gadus morhua*) fishery in the western Baltic Sea.

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**Is the angler motivation for catch and release, species or license –type specific?**

**Casper Gundelund[1], Hans Jakob Olesen[1], Christian Skov[2]**

**[1]DTU Aqua, 2800, Kgs. Lyngby, Denmark.**

**[2]DTU Aqua, 8600, Silkeborg, Denmark**

The potential impact of recreational fisheries is becoming increasingly important as society is focusing on ecological sustainability and animal welfare. Catch and release (C&R) is a common thing in many types of recreational fisheries and is important in terms of supporting a sustainable management of fish stocks. For many anglers the opportunity of releasing a nice meal is not up for discussion, whereas others would not dream of killing the catch. In some fisheries, the C&R is thought to be of minor importance where other species are almost exclusively C&R. We study two very common species caught in the recreational fisheries in Denmark; sea trout (*Salmo trutta*) and Atlantic cod (*Gadus morhua*) and investigate different motivations for C&R and if these potential differences are linked to the type of license purchased and angler heterogeneity.

## Session 5. Law enforcement involvement in monitoring and (de)briefing and mentoring of observers

**Leader: Catherine Benedict**

Many at-sea monitoring programs include an enforcement component, which may involve direct participation by enforcement agents in the monitoring program, training, and debriefing processes, or when an infraction is reported. Whatever the involvement, many programs depend on enforcement involvement for successful implementation of the monitoring program. Enforcement personnel, fishery managers, and observers all play crucial roles that require cooperation and open communication to be successful. This session explored the experiences of law enforcement in at-sea monitoring, highlighting both the advantages and challenges.

The second component of this session explored (de)briefing and mentoring of observers. Most observer programs after the completion of a trip require a formal, face-to-face debriefing with the observer to ensure observer safety and welfare, and to validate and ensure data quality standards were met. At the same time, some observers have reported being mentored before, during and after deployment by a more experienced observer. Both processes are extremely important in providing support, feedback, and ultimately improving the quality of data being collected by observers at sea. This session also examined examples of best practices of both approaches.

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## Oral Presentations - Extended Abstracts

### Enhancing observer safety by strengthening response protocols between agencies

**Monique Arsenault**

**Earth Resources Technology in support of NOAA Fisheries, Northeast Fisheries Science Center**

Introduction

Working in the capacity of a fisheries observer offshore on commercial fishing vessels comes with inherent risks and the potential to encounter several types of emergency situations. To help mitigate these risks, all incoming observers in the Northeast U.S. are required to attend a two-day safety training program as part of their overarching initial three-week training to achieve Safety I certification prior to deploying on their first trip. Observers are trained in emergency response procedures for fire, flooding, person overboard, grounding emergencies, cold water survival, and more. To emphasize the importance of communication with the Fisheries Monitoring Operations Branch (FMO), specifically in the event they encounter one of these types of emergencies, observers are also trained in at-sea communications and incident reporting. To help facilitate communication with FMO, observers are equipped with Garmin inReach devices, enabling them to report emergencies in real-time to program staff.

Despite the availability of this communication tool and established incident response protocols, FMO staff have identified a trend of observers not notifying program staff at the onset of an emergency. While observers possess the means for real-time reporting with their Garmin inReach devices, communication is sometimes delayed until they return to shore. This gap in real-time reporting often stems from external pressure by vessel captains aiming to avoid United States Coast Guard (USCG) involvement. The tendency of industry members to react negatively when fisheries observers followed their reporting protocols of notifying FMO staff of developing emergencies has often contributed to a more difficult work environment on the vessel for the observer, especially when the captain hasn't notified the USCG.

In response to these instances, FMO, with the support of USCG liaisons, has implemented several initiatives to better support observers during these difficult situations. One key initiative was the creation of the Observer Emergency List, which provides clear guidelines on when FMO staff should step in and alert USCG in the absence of captain cooperation for the safety of everyone on board, and when the response protocol should remain internal in an effort to maintain positive relationships at-sea while still ensuring the safety of observers and vessel crew alike.

Methodology

To better understand the extent of the effect non-reporting industry members may be having on observer reporting, incident reports from the Northeast Fisheries Observer Program (Maine to North Carolina) spanning a five-year period from 2020-2024 were analyzed. The study focused on five incident types: vessel mechanical issues, stability concerns, grounding of a vessel, fire, and flooding. Observers can select up to three incident types from a list of 31 options when they submit an incident report upon landing. These five incident types were chosen for this analysis due to their risk for potential severity and established reporting requirements to both the USCG per 46 C.F.R. § 4.03-1(a)(b) (Reportable Marine Casualties), and FMO per the Northeast fisheries observer program protocols. Incident reports that selected more than one of these 5 types (ex: one report with both 'grounding of a vessel' and 'stability concerns' selected) were classified as the single type that best encompassed the incident as a whole to avoid double counting.

Each identified incident was then categorized into one of four mutually exclusive notification statuses: FMO & USCG Notified, FMO Notified / USCG Not Notified, USCG Notified / FMO Not Notified, and FMO & USCG Not Notified (Figure 1). This categorization was based on information explicitly documented within the incident report and supplementary follow-up notes provided by the FMO staff assigned to the incident. Instances where the initial observer report and subsequent FMO staff notes did not detail whether USCG or FMO were notified during the onset of the emergency were omitted from the analysis.

During the qualitative analysis, special attention was paid to the incidents with a FMO Notified / USCG Not Notified categorization. Incident reports that fell under this notification classification were further analyzed to determine whether FMO staff who received the initial notification at the onset of the emergency then contacted the local USCG Command Center based on the information provided by the observer via their Garmin inReach device. This analysis was completed with only the facts reported within the incident report and the subsequent FMO staff notes. Observer and captain perspectives on USCG notification, as documented in the report as a whole, were also noted.

Results and Discussion

The analysis of Northeast U.S. incident reports from 2020 to 2024 reveals a concerning trend of underreporting of offshore emergencies to both FMO and the USCG at the onset of the incident. As shown in Figure 1, a significant portion of incidents within each of the five identified incident types did not result in notification to either agency. At 50% of all reported incidents, flooding events had the highest rate of non-notification to either agency, while fire related emergencies were more likely to be reported to FMO but not USCG. Grounding incidents showed more balanced patterns of notification, but still included a notable share with neither agency contacted. Incidents with vessel mechanical issues had the fewest instances of observer non-reporting in situations where the USCG was notified by the vessel captain, while stability concerns were most often reported either only to FMO or not reported at all. These findings emphasize the challenges observers face in adhering to established reporting protocols, often influenced by external pressures from vessel captains seeking to avoid USCG involvement.

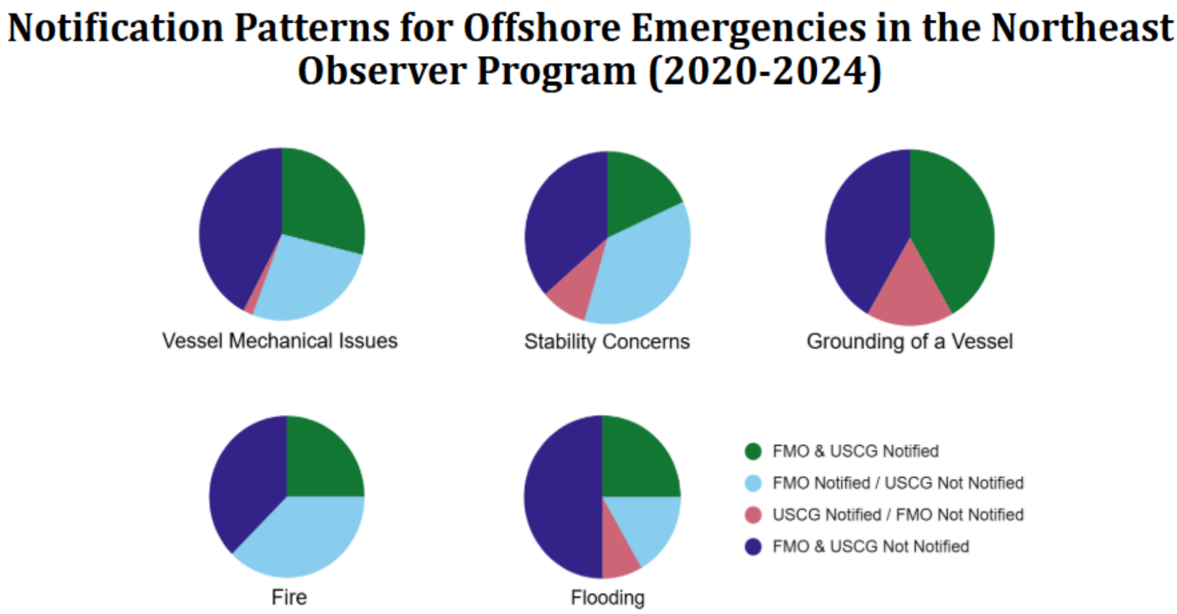


Figure 1: Notification trends for five high-risk emergency types reported by fisheries observers in the Northeast U.S. between 2020-2024, detailing the frequency of notification to the Fisheries Monitoring & Research Division (FMRD) and United States Coast Guard (USCG) during the onset of the emergency.

During the aforementioned at-sea communications session of their initial training, observers become familiar with preset messages that are programmed into their Garmin inReach devices, and scenarios on when to use each. However, the vague nature of the developed presets has led to confusion amongst FMO staff regarding urgency and nature of the emergency, either due to a lack of follow-up by the observer or the incorrect use of the presets relative to the severity of the situation. The Observer Emergency List, developed by FMO staff in 2024 and recently refined in 2025 with input from USCG liaisons, provides clear guidelines on when FMO should alert the local USCG Command Center for each incident type. The list includes key classifications such as “major” and “minor” for each incident type an observer may encounter while at-sea, and specific scenarios that would fall into each classification. With input from the USCG, part of the development of this resource included creating new presets for the Garmin inReach to align directly with the guidance outlined in the Observer Emergency List. These revised presets are more specific and concise, enabling FMO staff to make quicker and more informed assessments of the situation when determining if USCG involvement is warranted. In situations where immediate USCG notification is not initiated, FMO establishes a communication plan with the observer at intervals of 1, 2, 4, 6, or 12 hours, depending on the reported severity of the incident.

A 2023 flooding type emergency, classified as FMO Notified / USCG Not Notified, illustrated the challenges prior to the implementation of the Observer Emergency List. In this instance, an observer sent a high-urgency inReach preset without any subsequent clarifying messages. Unable to establish communication with the observer, FMO exercised caution and alerted the local USCG Command Center. USCG responders then contacted the vessel via radio to inquire about the situation, which by that time was under control and no longer considered an active emergency. During the incident debrief, the observer reported that the captain was extremely upset with the USCG involvement. The generalized anger and frustration towards the observer significantly strained the working relationship onboard for the remainder of the trip. This case highlighted the need for clearer inReach communication protocols, where more specific preset messages may have prevented unnecessary USCG involvement and the resulting negative aftermath.

In contrast, a 2024 fire emergency, also classified as FMO Notified / USCG Not Notified, demonstrated the benefits of the newly implemented Observer Emergency List. In this case, the observer contacted FMO after the fire had been extinguished and the crew was working to assess the damage. Once it was confirmed that the vessel remained seaworthy and the captain did not intend to notify the USCG, FMO established a 4-hour communication plan with the observer for the following 24 hours of the trip. Concurrently, an internal plan was put in place to alert the USCG Command Center only if the observer reported a reflash of the fire or any other deterioration of the situation. This approach allowed FMO to effectively monitor the situation from land, ensuring the safety of both the observer and the vessel unbeknownst to the captain, while avoiding USCG involvement that could have potentially created a difficult work environment for the observer.

In May of 2025, FMO ran its first at-sea communications training session utilizing the newly developed training materials, which included the refined, more concise preset messages that directly align with the Observer Emergency List. The overall impact of these initiatives within the Northeast U.S. observer program will become apparent in the coming years. A future reassessment of the notification rates to both agencies for each incident type, as well as the frequency of reported negative interactions stemming from USCG involvement, can be conducted from 2025 onwards to evaluate the effectiveness of these changes.

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**Defining the observer skillset**

**Sarah Williamson[1,2]**

**[1]North Pacific Groundfish Observer**

[2]Graduate Student, Fisheries, Aquatic Science, and Technologies Lab; Alaska Pacific University

Introduction

Observer data is the foundation of fisheries management worldwide. This critical resource is obtained by observers who work in isolated and high-risk environments while employing wide range of skills, many of which are unique to field work. Many observers spend days, weeks, and even months out at sea or in the field to be the 'eyes and ears on the water' for various government agencies (NOAA, 2023). Assisting observers identify and define these skills is an essential aspect of career development, investment on progression, and fostering new skills (Curnow et al. 2021).

Defining skillsets is a key part of assisting in recruitment while limiting skill mismatches that lead to loss in retention (Goulart et al. 2022). The observer skillset listed below will be provided to observers and program staff specifying the specific skills needed for success and advancement within the observer community or related careers. Program staff would be able to highlight key skills contained in this document to include in briefings/debriefings or as part of active feedback, which would aid observers in day-to-day performance and in becoming future leaders in the fisheries workforce.

Methods and Results

This framework of the observer skillset was created by examining daily observer tasks and responsibilities detailed in domestic US observer programs which were then categorized. Within the main categories, there are sub-definitions that explain the skills. Figure 1 illustrates the diversity of skills a single observer might have.

*The Framework:*

*Data Collection*
Observers collect large amounts of data throughout their career. They routinely conduct quality control checks and maintain overall organization of the data. Intensive training is necessary to prepare the observer to understand and implement sampling protocols and design that prioritize the data needs. Proper recording techniques are critical for maintaining records of sampling while multitasking. Observers must have a solid understanding of their field equipment to ensure proper utilization and maintenance while deployed.

*Biological Skills*
Biological knowledge is critical for species identification. Due to species identification's level of importance, all US domestic observer programs require a bachelor's degree in the natural sciences to ensure a base level of understanding biological processes (NOAA, 2023). These skills form the basis for the data collection aspects of the job. A baseline knowledge of how to use identification and data collection tools for species encountered in the field, including species anatomy and characteristics as well as collecting various biological samples. Proper handling of protected species is critical in the observer routine. This is due to management needs, health concerns (transmission of diseases), and general safety. Collecting and storing samples is a regular duty, and the observer should be aware of the protocols behind each collection, especially if chemicals are involved.

*Safety Skills*
Safety skills are amongst the most crucial for the observers' survival out at sea. Most programs go through an intense training course for observers to have the necessary survival skills. Survival training may include donning survival suits, mayday calls/emergency signals, and how to use a life raft. Some programs mandate first aid and CPR training. Observers gain knowledge of boat layouts to conduct safety checklist and other verification tasks. These safety inspections are important for the boats, crew, and observers' safety. Mental health awareness training has been increasing within observer programs and associated agencies, which is leading to development of this skillset. This includes developing healthy coping mechanisms, conflict resolution, and active listening skills to assist in addressing mental health. Additionally, observers can work on the deck of the boat and be exposed to the elements; this means they must have some weather awareness to maintain a safe working environment.

*Physical Fitness*
Observers work long hours with prolonged periods of standing while out at sea, which can be especially taxing. There is usually training on how to manage exhaustion, lack of sleep, various exercises/ stretching, and best practices of lifting/picking up. This helps the observer limit injuries while aboard a boat. Illness is another challenge that observers must manage while out at sea. There are proper strategies that can be used for sea sickness and care of other infections/diseases.

*Technical Skills*
Computer work is a routine duty out in the field to record and transmit data. Basic computer literacy is an important skill, and a deeper understanding of computer software systems is often beneficial. Maintenance of electronics can include, for example, working on environmental monitoring machines that collect salinity, temperature, turbidity, dissolved oxygen. If a program is using environmental monitoring machines, routine calibrations are necessary to ensure accurate readings. Navigation systems on boats are utilized for various haul information and location purposes; observers must have basic knowledge in reading and gathering this information to support data collection. Other technical skills include critical thinking, problem solving during data collection, marine mammal necropsy techniques, animal husbandry (i.e. care and handling of sea birds), and the ability to train other observers in the field.

*Transferable& Interpersonal Skills*
Transferable skills are abilities and competencies that can be applied across different roles or fields. This is not specific to a single job but is valuable across a wide range of contexts (Diamond E. 2024). These skills assist in the observer's overall ability to be employed across various careers. Interpersonal skills are critical for communicating and interacting with others (NACE, 2025). This allows observers to work effectively with agency, industry, provider, and other observers. They also may help create a positive working environment. These two categories tend to overlap with skills. While it is not an exhaustive list, Figure 1 is a good reference for these two categories.

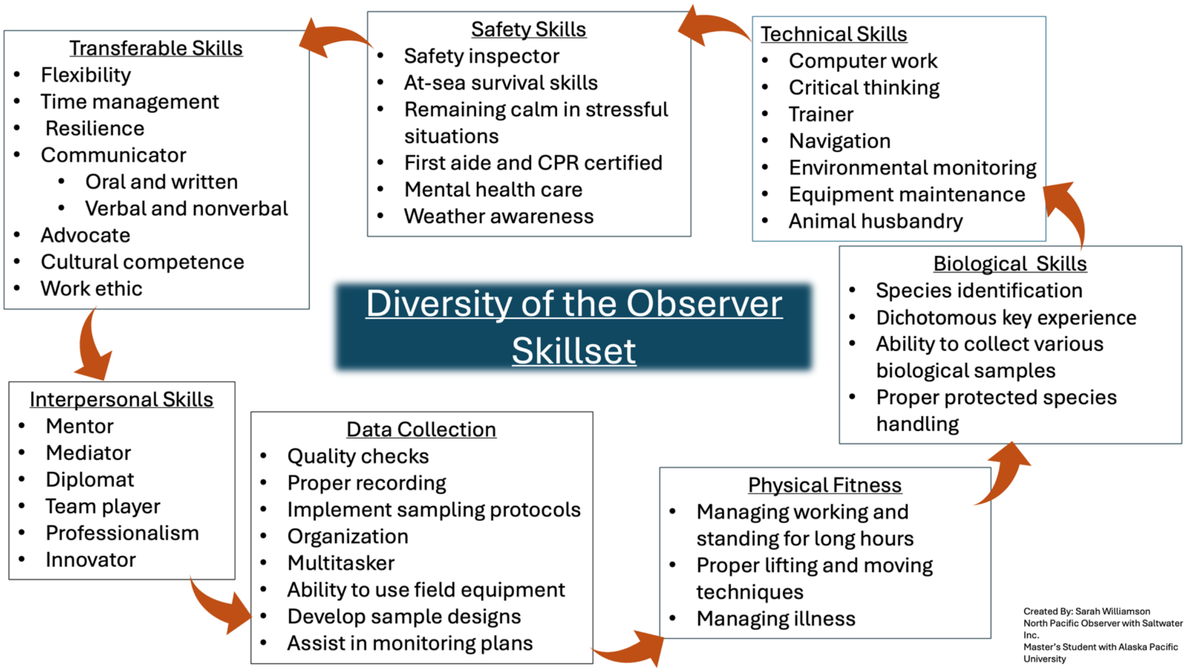


Figure 1: This is a simple map to show the diversity of the observer skillset that is gained throughout their careers.

## Conclusion

The learning, fostering, and tracking of skills utilized by observers helps increase awareness of progression while also providing an accurate assessment of one's capabilities (Curnow et al. 2021). Briefing and debriefing are key components of highlighting these processes by allowing observers to hone their skills, advance their careers, and be better prepared for field deployment. Active feedback from program staff creates transparency of the observer duties and their role in fisheries management. Incorporating structured self-assessment and guided reflection during debriefing further enhances observers' ability to identify strengths and areas for improvement. These practices also promote observer well-being, while also increasing retention and fostering confidence. Standardized tracking-forms (i.e. excel spreadsheets) support real-time tracking of competencies and enabling more precise training. Providing feedback not only supports individual development but also provides critical insights to improve program design and operation. These practices can establish clear career pathways, ensuring a more capable and motivated observer workforce.

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

### The Icelandic "no discarding policy" and enforcement

**Sveinn Andri Brimar Þórðarson**

**Directorate of Fisheries, Akureyri, Iceland**

The lecture is intended to shed light on the legal means of the Icelandic Directorate of Fisheries, as a monitoring agency, as a response to violations of the fishing legislation with an emphasis on discarding. Icelandic law stipulates strict penalties against discarding in accordance with the objective clause of the Act concerning the Treatment of Commercial Marine Stocks No. 57/1996, with the main goal of improving treatment of commercial marine stocks and encouraging their sustainable utilisation for the Icelandic nation. This session is intended to introduce the means of enforcement and actions available to the Directorate to ensure compliance with the discarding ban, e.g. with administrative and financial sanctions, police involvement and publications.

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### Greenlandic observer program.

**Jannik Holm**

**Region Nuuk, Nuuk, Greenland**

Here I'll present the historical timeline of our scheme and the impact of introducing observers in our domestic fishery.

Furthermore, I'll present the cooperation of the observers and the law enforcement agency in Greenland.

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### Pacific island regional fisheries observer (pirfo) debriefing and training.

**Siosifa Fukofuka**

**SPC, Noumea, New-Caledonia**

Observer debriefing for Pacific Island country observer programmes was first put in place in 2011.

PIRFO Debriefing is to provide principles of debriefing and guide to the processes and rules for debriefing.

Debriefing provides mechanism to provide data quality assurance; flag data that does not meet the specific quality requirements of data users; quickly report, and action if necessary, "critical incidents" that took place on the trip; give Observers timely direct feedback on how they can improve their data; give Observer Coordinators appraisal on their observers' performance; explore, through questioning, if additional information can be gathered about the trip; judge if the quality of the data has suffered through harassment of the observer and report if special consideration is necessary for future placements on the vessel.

Training of pacific Island fisheries observers to become a PIRFO debriefers is in three components, 1 Part A is an Introduction to debriefing training include debriefing policy, the steps required to successfully gain Debriefer certification, preparation for the debriefing process, identifying and prioritising incidents, critical incidents and infringements, communication skills, verification of data, recognising common errors made by observers, completing Debriefer form and Evaluation form, an understanding of how data is used by compliance and scientific personnel, data management and reporting, 2 on the job training – Part B and the final part C is the final workshop, review of part A and B with final assessment.

A placement meeting between observer and vessel take place prior to departure.

Pre debriefing and face to face full debriefing is recommended under PIRFO debriefing policy and guidelines.

Debriefers will carry out E-debriefing once they have completed training and conducted paper debriefings.

## Open Discussion Session

Miguel Nuevo to Sveinn Andri Brimar Þórðarson
Q: We have a landing obligation in the UE, is there any data on discard levels and what the catch is, and is it working? what are the structures for handling unwanted catches? what is an overview of how you manage the landing?
A: Most of the crime is happening without us knowing. We only know when it is discovered. Drones have been revolutionary in our efforts in keeping data on discards and how it ends. Is it working? Yes, we have seen a small slide down. Looking at footage, fisherman are looking up to the skies these days. I believe they are being more careful. There are restrictions. Publications are also helping. As for the last question, I do not know.

Miguel Machete to panel
Q: There is no legal standards or recognition of observers as a profession where I am from. There should be legal framework for the observer profession. Is this the same in your country? Does the observer job exist legally?
A: Jannik Holm: In the shrimp fishery, many years ago, there was a strong opinion (in Greenland) that observers should be protected by legislation and law. Though we don't have many observers in Greenland, we do important work.
Sarah Williamson: were very lucky to have law enforcement in observing, and in the US we have protections in the form of penalties and fines. So we have some representation that we enjoy

Jason Vestre to Monique Arsenault
Q: It seems on the east coast there are many serious safety incidents. Do you allow observers to use Garmin InReach's for personal use and is it available to anyone?
A: Yes, we use pre-sets most commonly, but if the situation is dire they can make a personalized message.
Observers can make personal messages for loved ones, but the messages are monitored.

Jason Vestre to Monique Arsenault
Q: How many dire situations occurred in the fishery to warrant Garmins?
A: 166 incidents

Teresa Athayde to Monique Arsenault
Q: Commenting on Miguel's question about observers, we developed legislation that mandates observer coverage. Are captains being informed about the use of InReach devices? Also, must observers send a message on InReach before departure?
A: We did identify that observers have a duty at the start of their trip to send a message, but didn't mention it as a safety requirement. We almost incorporated coast guard reporting requirements which would also include reporting to the captain.

Teresa Athayde to Sarah Williamson
Q: About safety awareness, do you conduct safety pre-checks?
A: In Alaska, we get a pre-trip checklist that observers have to adhere to. We have 'no go' items where observers can't board if one of these items exists. Observers can take notes in their logbook to record incidents.

Teresa Athayde to Siosifa Fukofuka
Q: how do you assess skills and experience, and how does it translate into pay and promotion?
A: Programs are different from one another, but promotions in my program are based on data quality. We have system of incentives rather than penalties, if you do well and collect good data, you are rewarded.

Drew Forward to Monique Arsenault
Q: I've been in several serious situations, and after experiencing them, I bought my own InReach because I had no way of communicating. How did you get the ball rolling on affording InReaches for your program? Was it easy?
A: Monique Arsenault: I'm sorry to hear you experienced those things. The Garmin InReaches were implemented because a seasoned observer was on a very bad trip where a crewman was injured gravely and the vessel was damaged. This situation started a conversation among management about having more connectivity from observers with debriefers. So our program started using InReaches as a result of that incident.
Sarah Williamson: Perhaps speak with your local government to see they can influence the implementation of InReaches. Get observers to band together with you.

Sunny Tellwright to Sveinn Andri Brimar Þórðarson
Q: I understand that you use drone data to enforce discards, do you think you could use EM to enforce? How could this data be used for crew labor enforcement issues?
A: Sveinn Andri Brimar Þórðarson: the evidence we collect today is clear and undisputed with drone footage. We are doing well with this evidence. 3 years we deployed EM on vessels but right now this footage cannot be used against fishers. For future, we are looking at AI to help.
Monique Arsenault: there are certain things that observers can report on regarding labor issues, but privacy is important to keep in mind. Typically, issues will be referred to another agency to handle. It gets messy with the privacy act and we work with NOAA law enforcement, and then an agent does stuff on the backend. There are reporting pathways for labor concerns.

Martin Beach to Sveinn Andri Brimar Þórðarson
Q: How are fees calculated for illegitimate catches?
A: The price comes from the fish market, and if the value cannot be ascertained, there are ways to determine it.

Elena Brett to Sveinn Andri Brimar Þórðarson
Q: I'm curious about the usage of surveillance equipment in applying penalties and fines, is this permitted in Iceland?
A: Yes, it is permitted and has been quite effective in mitigating illegal discard.

Eric Brasseur to Monique Arsenault
Q: how are you associating the Garmin device with the observer and vessel? How are you determining where the message came from?
A: The InReach is not moving around, the device is assigned to each observer so we know who sent the message. They must also send a message that identifies basic information about what boat they on, how many crew, etc.

Steven Todd to Jannik Holm

Q: Could you explain the international observer certificate? Is it difficult to receive?

A: Our observers have maritime background as a shipmate or someone who has skipper papers. Long ago, before my time, we had a large amount of skippers. The skippers were out of jobs and moved into observer positions. We trained them about legislation and the technical aspects of observing.

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

### Benefits of cultivating multiple support methods in managing fisheries observers and the impacts on individual welfare and data quality

**Meghan Miller**

**Southeast Fisheries Observer Program, Galveston, USA**

In fisheries observer programs, post-trip debriefings are conducted to ensure the observers are providing prime commercial fisheries data for each region. These debriefings provide opportunities for management staff to concentrate on an observer's strengths and weaknesses in the field, and finding ways to improve on offshore duties. Debriefings are essential in data management and can lead to other support efforts for observers including mentoring and coaching. Mentoring and coaching at sea fisheries observers can have an impact on data quality collection and individual assessment. Supplying a variety of support to newly employed observers can correlate in success of other professions. Creating a foundation of work ethics, morale, and a higher retention of valued observers benefits all observer programs. Research in other industries have shown debriefing enhances the ability of data collectors through goal oriented meetings and focuses on the capability of data collection and protocol techniques, whereas mentoring and coaching employees creates a higher functioning individual. Data from studies about systematic debriefing of qualitative data collection and examination from managerial leadership reviews have provided evidence that applying these techniques have shown to enhance data quality, harbor supervisor and employee

relationships, and overall lead to positive outcomes in both support and data standards. Through a survey answered by other National Marine Fisheries region's observer coordinators/debriefers and support staff, we are able to conduce the benefits of how all three support methods can have advantages and which programs have seen the most success in observers' careers.

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### Using the Chi-Squared test to detect possible data errors in codend mesh measurement data sets

**Elizabeth Ouellette[1], Debra Duarte[2]**

**[1]NOAA, Woods Hole, USA**

**[1]University of Massachusetts, Dartmouth, School for Marine Science and Technology, New Bedford, USA**

Detecting data errors, whether intentional or unintentional, in observer-based data is crucial for ensuring the reliability of reported measurements. This study proposes the use of the chi-squared ($\chi^2$) test to identify potential data errors in observer codend mesh measurement data sets. Observer codend mesh data are often subject to manipulation or inaccuracies that may compromise the integrity of fisheries assessments. The chi-squared test, a statistical method commonly used for assessing the goodness-of-fit between observed and expected frequencies, is applied here to compare the distribution of the last digit of a codend mesh

measurement against a theoretically expected distribution based on known sampling protocols and expected ranges for the fishery. Deviations from the expected distribution can indicate potential data falsification or measurement errors. The effectiveness of the $\chi^2$ test is evaluated through simulated data sets with introduced intentional errors, demonstrating its utility in detecting inconsistencies that might not be immediately apparent through visual inspection or simple descriptive statistics. The results suggest that the chi-squared test can serve as a robust, objective tool for flagging suspicious data of various types, helping to eliminate performance outliers that call into question the scientific integrity of an observer program, thereby enhancing the credibility of observer-based data in fisheries management.

## Session 6. The future of at-sea monitoring

**Leader: Lesley Hawn**

Across our oceans—from remote fishing grounds to bustling offshore wind installations—the ways in which we monitor, manage, and protect marine environments are undergoing rapid and remarkable change. As the demand for fisheries data grows, so does the adoption of new methodologies and technologies, and the need to integrate with larger-scale monitoring initiatives. This session highlighted the changes that have already taken place in some programs, explored potential future monitoring programs, and provided insights into new or emerging programs and the challenges they encounter.

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## Oral Presentations - Extended Abstracts

### From DNA to catch: unlocking the potential of molecular monitoring in fisheries

**Madeline Green[1,2], Alex Coutts[1]**

**[1]Forensic Fisheries Lab, Institute for Marine and Antarctic Studies, University of Tasmania, Australia**

**[2]Centre for Marine Socioecology, University of Tasmania, Australia**

Fisheries monitoring programs are evolving rapidly to meet increasing demands for transparency, traceability, and sustainability in global seafood supply chains. Traditional approaches such as onboard observers, electronic monitoring (EM), and logbooks each provide valuable data but can fall short in capturing species-level catch composition at scale, particularly for unobserved vessels, mixed-species catches, and cryptic products. Molecular monitoring (MM) offers a promising new layer of surveillance. It uses DNA extracted from fisheries samples to identify species present, enabling highly accurate and scalable insights into catch composition. MM is particularly well suited to fill key gaps in data quality, vessel coverage, and species-level detection, especially in remote or high-risk fisheries.

This presentation introduced the Forensic Fisheries Lab's applied research program in MM, with a focus on developing and validating protocols that can be implemented by observers, compliance officers, or port inspectors in real-world fisheries settings. MM workflows typically begin with DNA extraction from either single-source samples (e.g., fin clips, muscle tissue) or mixed-source samples (e.g., water from brine tanks or trawl hoppers, freezer residue). Depending on the objective, analysis can involve metabarcoding (universal detection of many species simultaneously) or rapid assays (e.g., LAMP or qPCR) that detect target species using fluorescence or colorimetric change.

The Forensic Fisheries Lab has built and validated MM protocols for multiple vessel types, including:

1. Brine tanks on tuna longliners in the Eastern Tuna and Billfish Fishery (ETBF), where water from the tanks that store frozen catch is sampled for DNA.
2. Trawl hoppers in the Northern Territory demersal fishery, where water left in the hopper post-sorting contains DNA from recently caught species.

3. Freezer scrape samples collected during high seas boarding inspections (HSBI) on distant-water vessels, where remnant blood, tissue, and slime from the freezer hold can provide DNA from previous hauls.

In each case, samples are returned to the laboratory for DNA extraction and sequencing. Two key genetic assays are used: a universal fish assay, which detects a wide range of teleosts and some elasmobranchs, and a tuna-specific assay, designed to resolve among closely related Thunnus species. Results are provided to fisheries management agencies as species detection reports and are currently being used to explore the development of predictive models to set confidence thresholds for species presence.

**Case study 1: Brine tanks – tuna longliners**

Brine tank samples collected from vessels operating in the Eastern Tuna and Billfish Fishery (ETBF) were analysed with both assays, with results compared against verified catch composition data. The universal fish assay accurately detected DNA from billfish (e.g., striped marlin, swordfish) and tuna in appropriate tanks. However, as expected, this assay lacked the resolution to differentiate between tuna species. The tuna-specific assay provided species-level resolution for yellowfin tuna (T. albacares), southern bluefin tuna (T. maccoyii), albacore (T. alalunga), and Pacific bluefin tuna (T. orientalis), with detections consistent with verified catch records (Figure 1). Bigeye tuna (T. obesus) was not reliably detected, which is believed to be a limitation of the assay rather than sample quality, highlighting the need for continued assay development.

Figure 1. Relative abundance of species detected using the tuna assay across various brine tank samples collected from the Eastern Tuna Billfish Fishery. Samples are grouped per hold with 3 repeats per hold. Note the mock community consists of known DNA to provide a positive control throughout sequencing.

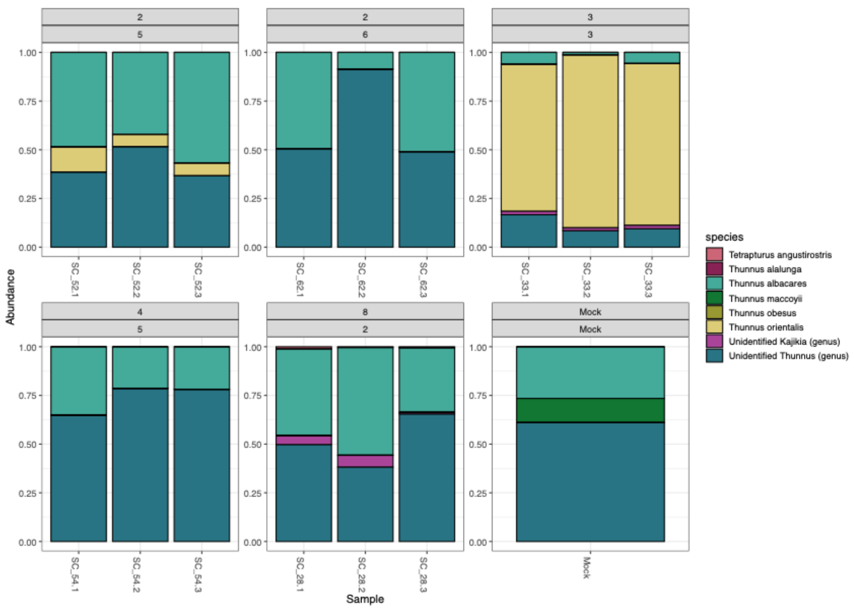


*Figure 4. Relative abundance of species detected using the tuna assay across various brine tank samples collected from the Eastern Tuna Billfish Fishery. Samples are grouped per hold with 3 repeats per hold. Note the mock community consists of known DNA to provide a positive control throughout sequencing.*

**Case study 2: Hopper water – trawl fishery**

Water samples collected from trawl hoppers post-sorting showed diverse species assemblages, reflecting the target and bycatch composition of this mixed-species fishery. The most abundant groups included Lutjanids (e.g., Lutjanus spp.), Carangids, sharks and rays, and various commonly captured fishes (Figure 2). Each trawl shot produced a unique species profile, demonstrating both the ecological variability of trawl operations and the fine-scale resolution of the MM method. Observer data from the same trips aligned closely with the MM results, providing validation of the method in a setting without direct catch composition data.

Figure 2. Relative abundance of taxa detected from hopper samples collected in the Northern Territory Demersal Fishery, Australia. Groupings represent the four different hoppers sampled with multiple repeats per hold.

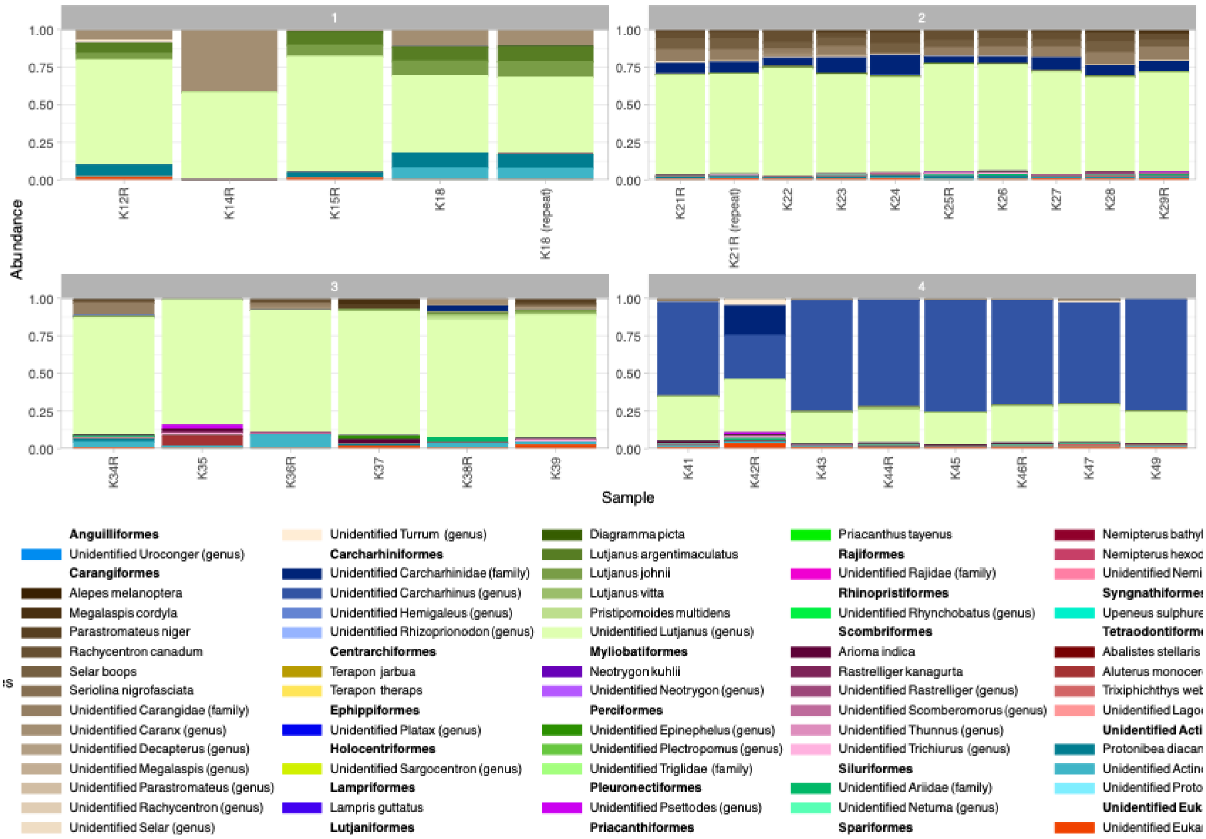


*Figure 5. Relative abundance of taxa detected from hopper samples collected in the Northern Territory Demersal Fishery, Australia. Groupings represent the four different hoppers sampled with multiple repeats per hold.*

## Scalability and implementation

The advantages of MM include its low time burden for sample collection (often <2 minutes), ability to detect degraded or trace DNA, and its adaptability to various fisheries and environments. As protocols become more established, efforts are underway to transition parts of the analysis workflow to port-side or at-sea settings, depending on infrastructure and end-user needs. Field-deployable MM tools, including portable DNA extraction units and handheld qPCR or LAMP readers, are being tested as the next frontier in rapid species detection.

**Looking forward**

The adoption of MM raises several important considerations for fisheries monitoring and compliance systems. First, standardisation of protocols, markers, and reference databases is essential to ensure consistency across jurisdictions. Second, clear frameworks must be established around the intended use of MM data—whether for compliance, scientific assessment, or trade monitoring. Third, there is a growing need to address data ownership, sharing, and sensitivity, particularly as MM becomes integrated into enforcement and regulatory pathways.

In conclusion, MM is emerging as a powerful complement to existing fisheries monitoring tools. It enhances species detection, increases data reliability, and can be adapted to vessel types and fishery contexts where traditional monitoring is limited or infeasible. With continued development, stakeholder engagement, and policy integration, MM has the potential to significantly improve our capacity to monitor, manage, and protect fisheries resources.

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**POMET - Charting new waters in a fisheries observer program: tracking megafauna from passenger decks**

**Gilberto P. Carreira[1]; Susana Simião[1]; Miguel Machete[2,3]**

**[1] Direção de Serviços de Biodiversidade e Política do Mar, Direção Regional de Políticas marítimas, Secretaria Regional do Mar e das Pescas, Government of the Azores, Horta.**

**[2] IMAR: Sea Research Institute, Horta Azores.**

**[3] OKEANOS: Institute of Marine Research of the Azores University**

Introduction

In 2019, the Direção Regional de Políticas Marítimas (DRPM), the current marine environmental authority in the Azores, launched *LIFE IP Azores Natura*—a major EU-funded conservation initiative. The project aims to implement the Natura 2000 Prioritized Action Framework (PAF) for the Azores, with a strong focus on marine conservation. Key activities include the monitoring of marine megafauna and seabirds, habitat restoration, and the mitigation of impacts from non-indigenous species and marine litter, among other environmental priorities.

The Azores is a remotely located Northeast Atlantic archipelago, surrounded by an extensive 1M $Km^2$ Exclusive Economic Zone. To adequately manage such a widely extensive area, the local authority needs to develop efficient and complementary options, when it comes to collecting biodiversity data on the field, thus allowing for an adequate reporting capability by the public authority under several legal frameworks (Marine Strategy Framework Directive, Habitats Directive, Birds Directive; Water Framework Directive; OSPAR).

Methodology

In order to develop a new approach to monitor marine megafauna and marine litter in the Azores, DRPM sought to create an observer program for megafauna and marine litter aboard passenger transportation vessels operating between islands. This program, known as POMET, is part of the EU-funded *LIFE IP Azores Natura* project, and addresses the monitoring needs of coastal and marine megafauna species (and marine litter), by structuring a low-cost program based on platforms of opportunity.

To achieve this, DRPM prepared and signed a memorandum of understanding (through the Regional Secretariat of the Sea and Fisheries) with the enterprise Atlanticoline S.A. and launched a public tender seeking to contract an entity with capacity, experience, and expertise to design a systematic data collection plan to monitor megafauna (cetaceans, seabirds, and sea turtles) through observers, which also implied the hiring, training, and management of the personnel involved. The Azores Fisheries Observer Program (POPA), originally established by regional ordinance in 1999 and currently serving as the primary fisheries monitoring tool in the Azores, was selected through a public tender and contracted by DRPM to manage this Program. POPA (and now DRPM's POMET) is managed by the Institute of Marine Research (IMAR), which brings over 20 years of extensive experience in recruiting, training, and managing fisheries observers, as well as in validating, compiling, and digitizing the data they collect.

Results and Discussion

While the scope of POMET extends well beyond fisheries—the traditional focus of POPA and IMAR—the ongoing collaboration between the two programs has proven highly valuable and shows strong potential for future synergies. The two entities, DRPM and POPA/IMAR, in close collaboration with Atlanticoline S.A., operates between five islands (Faial, Pico, S. Jorge, Terceira and Graciosa) (Figure 1), benefiting from the adaptation of POPA methodologies for training, operation, as well as management and data collection. These adaptations enabled this program to achieve significant spatial coverage, collecting relevant data that exceeded both DRPM's and POPA initial expectations.

POMET was so far able to cover more than 40,000 nautical miles of continuous observation (starting in 2021). Observers were able to identify 23 species (9 seabirds, 12 cetaceans and 2 marine turtles). With regard to seabirds, three species are observed more frequently (Figure 3). This program represents a rare and valuable opportunity to systematically monitor seabirds at sea throughout the year—particularly significant in the Azores, where most data on these species is typically collected at breeding colonies (Neves et al. 2012). The most frequently observed groups during vessel trips are cetaceans and marine turtles, with the common dolphin (*Delphinus delphis*) being the most frequently recorded species (Figure 2). This observation is consistent with previous findings for the Azores (Silva et al., 2014). Regarding marine litter, floating items were regularly spotted and classified as: general plastic, packaging plastic, rubber, wood, fishing gear, paper, or unknown. The most frequently spotted items were made of plastic (68%), which also confirms findings obtained through other methods (Chambault et al. 2018).

In conclusion, DRPM, as a public body, greatly benefits from the expertise and training provided by POPA/IMAR-UAc to operate POMET, a promising tool that is helping DRPM to build its capabilities to report. This highlights the value of opportunistic monitoring programs - such as those conducted aboard passenger vessels under POMET - in collecting valuable data on species' spatial distribution and seasonal patterns. Importantly, it also proves to be a very relevant opportunity to systematically monitor biodiversity during the winter at sea, when field work is particularly challenging in the Azores due to rough weather conditions.

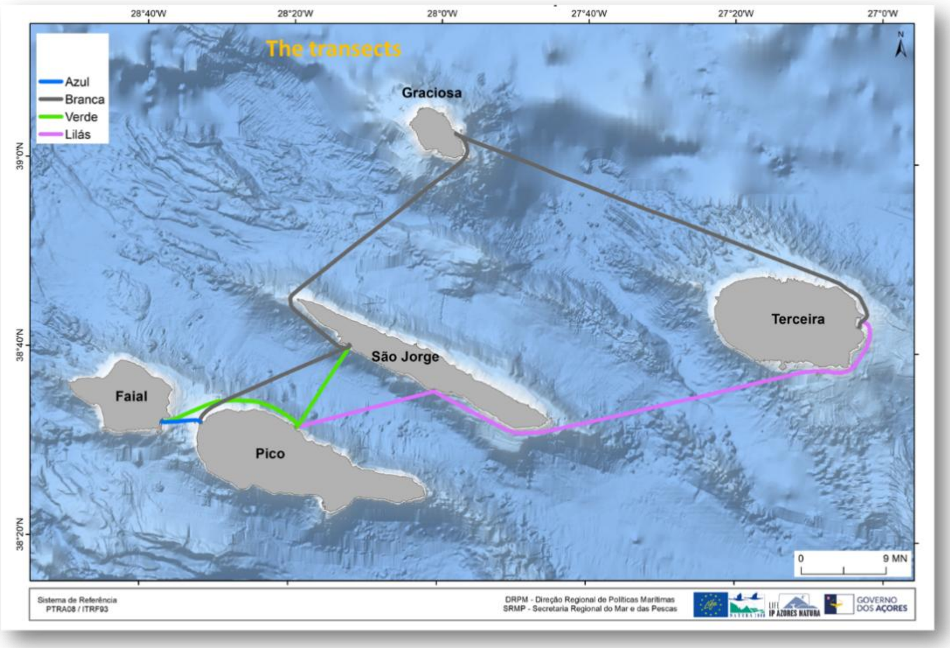


Figure 1. Data collection transects.

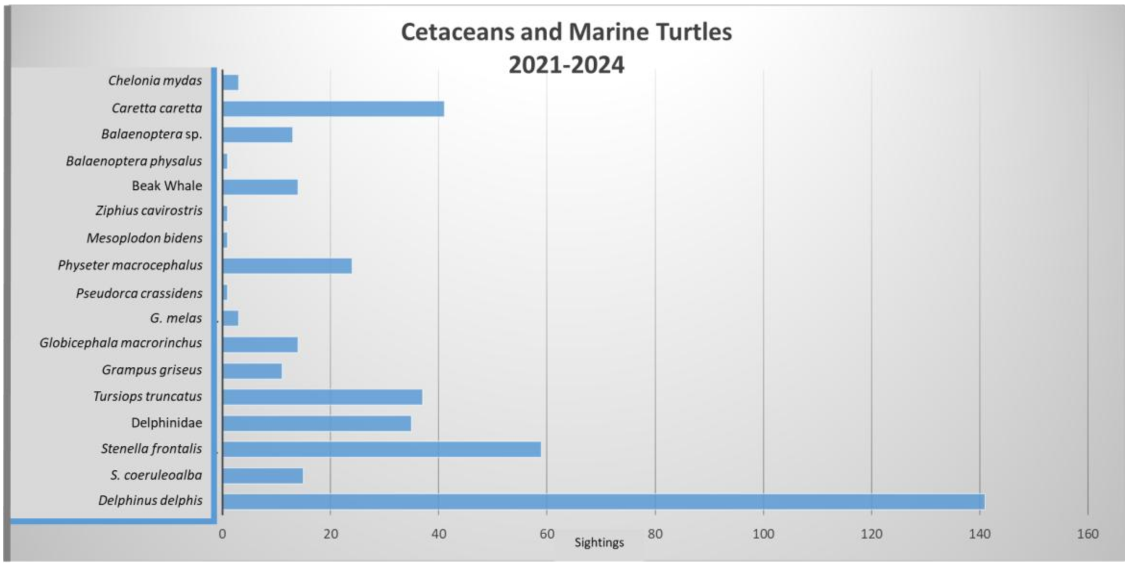


Figure 2. Marine mammals and marine turtle sightings by species between 2021 and 2024.

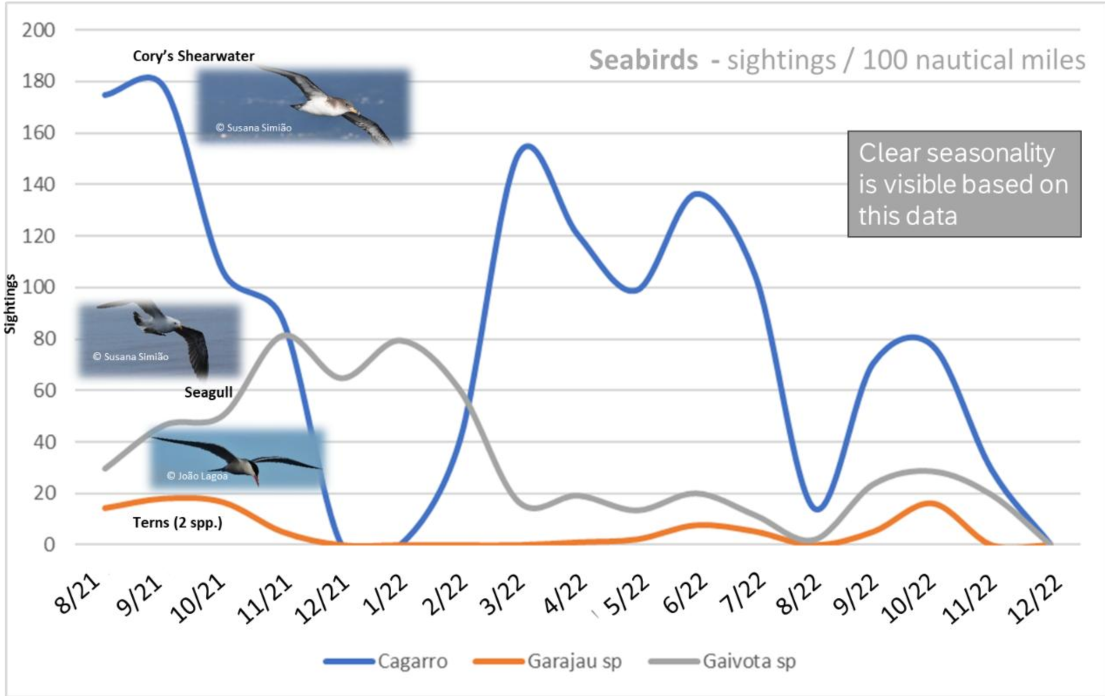

Figure 3. Seazonality observed in seabirds.


Acknowledgements

The authors acknowledge and express their gratitude to the commitment of Atlanticoline S.A on this POMET collaboration. We extend our sincere thanks to all the captains and crews of the vessels as well as to all POMET/POPA observers for their fruitful collaboration on this task. This work is funded through the LIFE program of the European Commission, under the LIFE-IP AZORES NATURA - Active protection and Integrated management of Natura 2000 network in Azores (AZORES NATURA/ LIFE17 IPE/IPE/000010).


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

### Navigating the winds of change: challenges for observers in novel data collection in offshore wind farms


**Wouter Suykerbuyk[1], Yoeri van Es[1], Sophie Neitzel[2]**

**[1] Wageningen Marine Research, Yerseke, Netherlands**

**[2] Wageningen Marine Research, IJmuiden, Netherlands**


In recent years, the Netherlands has led the way in utilizing wind energy from the North Sea, showcasing its commitment to sustainable practices. One key development in this effort is implementing "co-use," which allows for the dual use of offshore wind farms for both energy production and other activities like passive fishing and mariculture. Despite the progress made in understanding passive fishing in wind farms, practical experience remains limited. Questions about the legal framework, safety measures, and environmental impact continue to surface. Current research aims to address these gaps by exploring the practical aspects of passive fishing in wind farms, helping to shape policies that balance ecological, economic, and safety concerns. While these co-use initiatives hold great potential, they also present significant challenges for observers tasked with collecting data in these dynamic environments during these explorative, small-scale, novel experiments with often many stakeholders involved. Communication procedures for research in offshore wind farms are often difficult which can be challenging to observers at sea. Stakeholder involvement adds complexity to this process, as different groups—such as fishers, windfarm owners, coastguard and regulatory bodies—may have conflicting interests, procedures or priorities. Safety on board is another critical concern, especially in the challenging conditions of offshore environments, where weather conditions, limited space between turbines and fishery technical aspects can complicate operations. Unexpected events, such as equipment malfunctions or adverse weather conditions, further complicate data collection efforts. To manage these challenges, flexibility and proactive problem-solving by observers involved is essential. This presentation offers valuable insights into how these recent experiences from the field can inform others and improve future studies and monitoring programs in the field of co-use, offshore wind energy and fisheries research.

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**Observers, EM, and fishers: a collaborative approach to collecting species-specific manta and devil ray catch data**

**Jennifer Stahl[1], Melanie Hutchinson[2], Joshua Tucker[1,3], Forest O'Neill[4], Chelsey Young[1], Emily Crigler[1]**

**[1] NOAA fisheries, Honolulu, USA**

**[2] IATTC, San Diego, USA**

**[3] CIMAR, Honolulu, USA**

**[4] IBSS, Honolulu, USA**

Conservation efforts for mobulid rays (manta and devil rays) are hindered by a lack of species-specific interaction data in pelagic longline fisheries including catch rates and post-release survival. To address these data gaps, a multi-pronged approach was implemented within the U.S. Hawaiʻi-based longline fisheries.

Key components of this project include:

Genetic Sampling: Genetic samples were collected to determine which species are incidentally captured.

Species Identification Guide: A field guide was developed to enable accurate species identification of mobula rays in the Pacific Ocean by fishers, observers, and researchers.

Satellite Tagging: Mobulid rays were tagged to assess their post-release survival rates.

Electronic Monitoring (EM): EM video footage was analyzed to determine its utility for identifying mobulid species, documenting handling and release practices, and collecting data relevant to survival (e.g., at-vessel condition, hook location, amount of fishing gear at release).

Results

Genetic sampling and analyses, combined with observations from EM systems, fishers, and observers, have confirmed the presence of five mobulid ray species interacting with the Hawaiʻi-based longline fisheries.

To date, 11 individuals representing four of these species have been successfully tagged with satellite tags, demonstrating high post-release survival rates when best handling and release practices are used.

Insights gained from analyzing EM footage, particularly regarding species identification using the field guide, have been directly transferred to train observers on species-level identification and the collection of more comprehensive interaction data.

Conclusions

This collaborative project emphasizes the crucial role of partnerships in addressing complex conservation challenges. By effectively combining the expertise of fishers, scientists, and managers, we can significantly enhance our understanding of mobulid ray interactions with fisheries and develop robust conservation strategies for these vulnerable species.

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**Can REM replace observers on board fishing Vessels?**

**Njáll Ragnarsson**

**Directorate of Fisheries, Vestmannaeyjar, Iceland**

Introduction

Observer programs are not without their flaws. Observers are costly, their safety can be a concern and consistency, and objectivity can be questioned regardless of prior training and experience. At the same time, Remote Electronic Monitoring (REM) is evolving at a phenomenal pace. So, the question raised is whether REM can replace human observers and if so, to what extent.

Methods

My presentation will be divided into three categories.

Does the role of observers in fisheries and other monitoring programs vary significantly based on the program, country or continent they are working within? Although some RFMO's agree on the importance of observers, not all parties agree on what their role is.

Secondly, I will show real data on what can be called the observer effect. Namely, how behavior can change on board fishing vessels, both catch composition and sizes, when an observer is on board.

Thirdly, I will try to focus on new technologies when it comes to REM, and if those technologies are able to sufficiently do what an observer would otherwise do if he was on board the vessel.

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**Enhancing maritime surveillance: the role of drones in monitoring illegal discard at sea**

**Sævar Guðmundsson**

**Fiskistofa, Directorate of Fisheries, Akureyri, Iceland**

Illegal discard practices at sea pose a significant threat to marine ecosystems and sustainable fisheries management. Traditional surveillance methods often fall short of monitoring and mitigating these activities effectively due to their limited coverage and high operational costs. Drone technology can support maritime surveillance and address the challenges associated with illegal fisheries and discarding them.)

The Icelandic project highlights the key advantages of using drones, including their high-resolution imagery, extended flight durations, and the capability to integrate with existing surveillance systems.

Through case studies and empirical data, the Directorate of Fisheries can demonstrate how drones have successfully identified and documented illegal discard incidents, leading to increased enforcement actions and compliance with Icelandic regulations.

In conclusion, adopting drone technology for maritime surveillance is a significant advancement in combating illegal discard at sea. By providing a comprehensive overview of the use of drones and the data collected, the DOF could inform policymakers, maritime authorities, and stakeholders about the critical role of drones in ensuring the sustainability of marine resources.

## Open Discussion Session

Miguel Nuevo to Sævar Guðmundsson
Q: We are also using drone. For the small drone, those are operating from land or vessels?
A: From land.

Miguel Nuevo to Sævar Guðmundsson
Q: You showed discards dropped across all three fisheries but didn't change on bottom trawlers. Is this because the decline in measurements due to drone use acting as a deterrent?
A: Had very good cooperation with big fleet. Posters and educational materials on board for crew. Need to redo for new crew and refresh previous crew. Only 5-6 trawlers of 60.

Miguel Nuevo to Sævar Guðmundsson
Q: Have you used any of this footage for prosecution?
A: A few cases but mostly licenses revoked from offenders. Can be up to 6 years in prison but that is up to judge to decide.

Miguel Nuevo to Njáll Ragnarsson
Q: have you done follow up for prosecution to assess risk?
A: We did not follow up or prosecute that case. We cannot use footage as proof but it gives us an idea of it happening. Is pretty clear case of offenses.

Jason Vestre to Njáll Ragnarsson
Q: I believe that EM cannot per se detect the observer effect, and is a careless way to describe the data discrepancies in your presentation.
A: My background is not science but this footage gives idea.

Steven Todd to Njáll Ragnarsson
Q: Even same fishing grounds does not produce same catch from day to day. Do you have any data on "EMS effect" on fleet? (Vs. "the observer effect")
A: We had pilot project 2022-2024, and was written in legislation that this was pilot program. Not allowed to use against, it was just to test equipment on board of vessels. Get the ball running. I cannot say if there is EMS effect on those vessels for those reasons. I would argue having a camera (whether working or not) can have an effect on fisher behavior.

Steven Todd to Njáll Ragnarsson
Q: In your observations, how big of a data set? How many landings to make that table?
A: 3 separate landings. Focused on when inspector/observer is on board. We published catch composition and the effect having observer on board on catch composition.

Owen Kelley-Patterson to Madeline Green
Q: Interested in single species rapid test and the applications within our fishery. Can you elaborate if observers can use those on off-shore vessels? How laborious to collect samples and what degree of accuracy to species level.
A: I believe anyone can be geneticist. 2 ways to do: PCR machine (accurate as long as have species assay developed) but requires a bit of equipment set up onboard the vessel. The second option is rapid Isothermic Amplification Methods, similar to a COVID RAT test or

LAMP assay, these take a long time to develop but are easy to use, cost effective and cheap. Both options have come long way with technology and eDNA data collection.

Björg Þórðardóttir to Wouter Suykerbuyk
Q: In your presentation, you talked about collecting data to see if you can still fish near windmills. Any research on fishing stock when wind farm planted?
A: Places where windmills built were traditionally fishing grounds so we knew there were fish. We worked with fishers to be in places where fishes were.

Björg Þórðardóttir to Wouter Suykerbuyk
Q: Are the windmills destroying fishing grounds?
A: I cannot really answer because I am not I that topic. Some people believe so and our institute is researching to see if true.

Alvaro Teran to Madeline Green
Q: Used to output of observer monitoring program. If you looked 5 years in the future, how would it to integrate to those programs and what is the cost?
A: Data outputs, DNA gives presence only and not absence. Difficult to get relative abundance. In terms of integration, depends on fishery and compliance guides. We are focusing on certain species which shouldn't be found in the fish holds of these boats (S bluefin tuna and shark). I think there's a way to roll out data across fishery and determine any patterns to determine risk assessment. Different case dependent on fishery.
A: Cost: about $9 a sample and about $100 per vessel for our project.

Craig Heberer to Sævar Guðmundsson
Q: Cost and efficiency of program. Have you developed cost estimates and compared them to other observer programs to find out which is more effective?
A: New drone costs 150 euros and can go on many fishing vessels a day. Cost is dependent. We have hard workers working long trip on small boats. Monitoring legal bycatch and compare to catch logbook, if not applying to registering means serious infringement. Cost effective this way. Can focus on certain gear.

Craig Heberer to Sævar Guðmundsson
Q: How long on station is drone on individual vessel and how long does it take to review?
A: For trawlers and big industry boats, EM is good for those. Preventive for small boats but camera would not be as effective because of small catch amounts.

Lisa Borges to Gilberto Carreira
Q: You said using observers is good for biological data. I think it is a good opportunity for observers. So this could be a job opportunity for them.
A: Yes, I think this is good opportunity to have data where we wouldn't have before. Still have monitoring. In this case it is a good opportunity, observer will be there regardless of weather or conditions. This is pilot program and not something fully flushed out at the moment. We hope to have other opportunities to extend program. Results are promising and creates a base for monitoring for the future and comply with obligations.
Miguel Machete: Comment to follow previous - (general comment) the seasonal work opportunities for observers through EM have been very helpful in the Azores for us.

Lesley Hawn to Sævar Guðmundsson
Q: you talked about the training for staff in the drone program both big and small, could you please expand on that?
A: When started (2020), they were very enthused. After a few months of training, some guys already have drones for fun. State police also started using drones at this time. Must follow EU regulations. Very good training and everyone involved is excited to be flying drones.

Lesley Hawn to Sævar Guðmundsson
Q: How many drones have you lost?
A: Compare to cost overall and fishing industry. Have lost 4 drones but these are collateral and we expected to lose a few drones in the process.

Katherine Benedict to Joshua Tucker
Q: I'm interested in the background reasons to collect this data? Is there history of high mortality rates of mobula in the fishery?
A: Unknown info on mortality of mobula sp in the fishery. Data gap in telemetry data needed to be answered. Hopefully will have second deployment

Katherine Benedict to Joshua Tucker
Q: We monitor viability for Pacific halibut. Is there talk of added codes for tags to see if they recover from interactions?
A: Yes, main point of collecting data but too early in process to tell. From initial data, found the animals to be pretty hardy overall. Trailing gear had the most detrimental effect. Looking for correlation between satellite data.

## Poster Presentations - Extended Abstracts

### Enhancing maritime domain awareness: integrating pinpoint earth VMS & PierSight satellite technology for comprehensive IUU fishing detection

**Dave James**

**Pinpoint Earth Limited, New Zealand**

Abstract

Illegal, unreported, and unregulated (IUU) fishing poses a significant threat to the sustainability of global fisheries, maritime security, and the livelihoods of coastal communities. This paper introduces an innovative approach that combines advanced Vessel Monitoring System (VMS) technology from Pinpoint Earth with all-weather satellite surveillance from PierSight. This integrated system provides comprehensive, real-time monitoring and actionable intelligence for registered and unregistered vessels, thereby supporting effective fisheries management and regulatory compliance.

1. Introduction

Illegal, unreported, and unregulated (IUU) fishing accounts for up to 26 million tonnes of fish caught each year, leading to economic losses estimated between USD 10 billion and 23 billion. Traditional monitoring and enforcement methods, such as using patrol vessels and aircraft, can be expensive and are often limited by weather and daylight. There is an urgent need for persistent, scalable, and cost-effective solutions to improve maritime domain awareness and combat IUU fishing activities.

2. Pinpoint Earth VMS Technology

Pinpoint Earth was established in 2023 in Nelson, New Zealand, and specialises in designing, engineering, and manufacturing advanced VMS (Vessel Monitoring Systems) and tracking technologies. Its flagship products, the Pinpoint PICO VMS and PICO TITAN VMS, are backed by a robust cloud-based fleet management platform called Pinpoint NEXUS.

Key features:

- Real-time fleet tracking and behavioural analytics
- Geo Zone reporting, notifications, and remote diagnostics
- Customisable user and group access controls
- API integration for data sharing with regulatory bodies

This comprehensive solution allows fisheries managers to track fleet movements, ensure regulatory compliance, and obtain traceable insights into all vessel activities in the region.

3. PierSight Satellite Technology

PierSight, an Indian space tech startup founded in 2023, is developing the world's first dedicated constellation for maritime monitoring. Their compact CubeSATs are equipped with Synthetic Aperture Radar (SAR) and Automatic Identification System (AIS) sensors.

Technical highlights:

- High power efficiency and small-form-factor design
- India's first deployable flat panel reflect array antenna
- SAR + AIS demonstrator 'Varuna' launched in Q4 2024
- Targeted deployment of 32 microsatellites by 2029

The constellation will provide complete global ocean coverage, with revisit times of up to 30 minutes and near-real-time, all-weather surveillance—even during cloud cover, extreme weather, or at night.

4. Integrated Monitoring Approach

The integration of Pinpoint Earth's VMS technology with PierSight's satellite constellation enables:

- Continuous, real-time fleet tracking: For all registered vessels, with health diagnostics and compliance verification.
- Detection of IUU and "dark" vessels: SAR imaging reveals vessels not broadcasting AIS or VMS signals, identifying suspicious or illegal activity.
- Data fusion: Combining SAR and AIS data provides a comprehensive view of maritime activity, enabling rapid response and targeted enforcement.

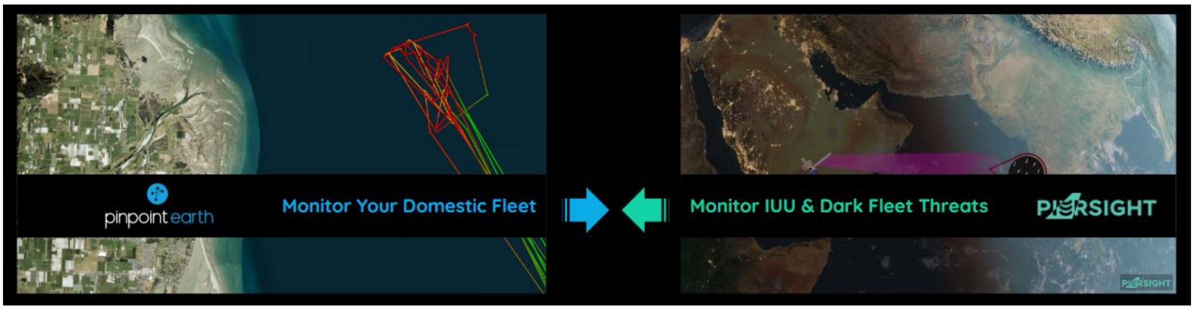


Figure 1: Data Fusion - combining Pinpoint VMS data with Piersight Satellite observations for comprehensive analysis.

5. Applications and Impact

- Fisheries management: Supports quota enforcement, bycatch monitoring, and area closures.
- Maritime security: Identifies IUU fishing, piracy, and other illicit activities.
- Environmental monitoring: Detects oil spills and monitors critical infrastructure such as undersea cables and pipelines.
- Cost efficiency: Reduces reliance on expensive patrols, enabling targeted, intelligence-driven interventions.

| Feature | Pinpoint Earth VMS | PierSight Satellite Constellation |
|---|---|---|
| Real-time tracking | Yes (Cell/Sat VMS) | Yes (SAR/AIS Satellite) |
| All-weather coverage | Yes (24/7) | Yes (24/7) |
| IUU detection | Limited (registered vessels) | Yes (detects non-cooperative vessels) |
| Data integration | Cloud-based, API-enabled | Direct to analytics platform |
| Global coverage | Yes, 100%  (with Sat airtime) | Yes, 100% (with subscription) |

Table 1: Pinpoint & Piersight - Complimentary technologies for IUU and Dark Threat detection

6. Future Directions

Pinpoint Earth and PierSight are committed to ongoing innovation and collaboration with fisheries management organisations worldwide. The goal is to establish a new global standard for maritime surveillance, supporting sustainable fisheries and resilient ocean ecosystems.

7. Conclusion

The combined capabilities of Pinpoint Earth VMS and PierSight's satellite constellation represent a significant advancement in cost-effective maritime domain awareness. This integrated approach provides fisheries managers and regulators with the necessary tools to detect, analyse, and respond to illegal, unreported, and unregulated (IUU) fishing and other maritime threats in real time. This ensures the long-term sustainability of global fisheries.

- Combining SAR and AIS data (Mdakane et al., 2023) enables persistent monitoring of both cooperative and non-cooperative vessels, while PierSight's compact CubeSATs (Seth, 2024) address coverage gaps in traditional systems.
- Pinpoint Earth's VMS infrastructure (Pinpoint Earth, 2024) complements SAR-derived insights, providing a holistic view of maritime activity for IUU detection.

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

### Optimizing fisheries observer deployment systems and increasing system transferability

**Mary Sheehan**

**TechGlobal in support of NOAA Northeast Fisheries Science Center, Woods Hole, USA**

Fisheries nationally and internationally utilize different systems to select vessels for observer and monitoring coverage. Although our fisheries behave and are managed differently, there is room to collaborate and utilize parts of current deployment systems to increase efficiencies across programs, safely track observer deployments, and streamline efforts to meet observer coverage requirements. At a regional scale, transitioning multiple observer programs to the same observer deployment system has had significant benefits. In May of 2010, the Northeast Fisheries Science Center implemented the web-based Pre-Trip Notification System (PTNS) to ensure equitable and sufficient coverage across the multispecies groundfish fleet. The PTNS was a replacement for the dockside intercept method used for the groundfish fishery in the past. Since 2010, the PTNS has expanded to include the herring fishery, and for fishing year 2024 we transitioned the scallop fishery from its current Interactive Voice Response System to the PTNS. The implementation of the PTNS has greatly benefited many aspects of our observer programs in the Northeast, namely, automating our trip selection process and reducing human error and bias, mitigating some of the logistical challenges our observer providers face, and increasing vessel equitability and coverage accomplishments.

In this poster, we will (1) discuss what the PTNS is and the logistical challenges associated with observer deployments in the Northeast US, (2) pinpoint the characteristics of fisheries that could

benefit from a web-based system utilized by fishermen, managers, and observer providers to effectively deploy observers to meet coverage requirements, and (3) identify how well these types of systems improve target coverage rate completion. Thorough review of existing notification systems can identify similarities and opportunities to build efficiencies in observer deployments both nationally and internationally, especially with larger-scale monitoring efforts on the horizon.

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**Enhancing at sea-monitoring using with AI**

**Kolbeinn Gunnarsson, Kolbeinn Guðmundsson**

**Trackwell, Reykjavík, Iceland**

The collection of fisheries data is continuously evolving, integrating various data sources, such as EM data, landing records, and inspections, that now have become crucial for accuracy and efficiency in the field of fisheries monitoring. Observers onboard fishing vessels ensure data accuracy and compliance while also collecting scientific research data. However, fisheries data comes from multiple independent sources, including landing records, sales records, and inspection reports, making it difficult for FMC officers to fully comprehend what is taking place at sea. So, what are the next steps for enhancing the utility of all this information?

This lecture will explore how AI and machine learning (AI/ML) can consolidate and analyse fisheries data in real-time allowing better decision-making for at-sea monitoring and port inspections. By automating analysis and detecting patterns, AI/ML can enhance compliance monitoring, calculate risk indexes and reduce the need for physical onboard observation, allowing human observers to focus on higher-value tasks.

The lecture will demonstrate how Trackwell foresees integrating multiple datasets, and by using AI/ML technology to provide deeper insights and aid in decision making regarding needs for at-sea observation and inspections.

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**Flipping the script on fisheries monitoring, a focus on benefit**

**Fraser Stobie, Jillian DiMaio, Amanda Barney**

**Teem Fish, Prince Rupert, Canada**

It is well understood that electronic monitoring (EM) technology is an effective tool for at-sea observation of fisheries, and is a viable option for meeting regulatory compliance. However, generating traction and excitement among industry participants for EM adoption for regulatory compliance purposes remains challenging. At Teem Fish, we are working to "*flip the script*" when it comes to how this technology is viewed by fishers; shifting perspectives away from EM as a requirement, towards EM as a *need*. To achieve this, we are focused on the thoughtful integration of modern technology that provides tangible real-world benefits to fleets and individual operators, beyond monitoring compliance.

By prioritising the needs of the fisher, we aim to deliver pragmatic advancements rather than speculative innovations, leading to faster uptake of EM and greater benefit to 'on the water' operators. Through collaborative approaches to program design and purpose-driven AI integration, we anticipate that intelligent-EM will drive harvest efficiency gains, connect generational and anecdotal knowledge to specific data insights, and bring data sovereignty back into individual owner-operator businesses.

Our approach to harnessing the benefits of EM technology emphasises "*progress over perfection*". To provide pragmatic and timely benefits (instead of additional burdens) to the fishing industry, we advocate for AI advancements in terms of step-change that introduce efficiencies gradually, allowing for more real-world testing and faster realisation of benefits. In our session we will cover lessons learned and highlight practical steps for integrating emerging technologies into EM and at-sea monitoring in the future, and how these will chart pathways toward better models for fisheries management.

## Session 7. Industry engagement with at-sea monitoring

**Leader: Kristófer Leó Ómarsson**

While fisheries at-sea monitoring programs can lead to tensions between regulators and industry, when fishers and at-sea monitoring programs work together there are often far greater benefits realized. There are several examples where industry has become actively engaged in monitoring, leading to results that are better than those obtained when either group operates in isolation. This session explored these collaborations to identify best practices and highlight opportunities to improve outcomes for industry and at-sea monitoring programs.

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

**The Norwegian Reference Fleet – an alternative to observer programs and EM for monitoring and biological sampling of commercial fisheries.**

**Tom Williams, Sofie Gundersen, Runar Smestad**

**Institute of Marine Research, Bergen, Norway**

The Norwegian Reference Fleet is a group of active fishing vessels, selected as an approximate stratified random sample of vessels from the Norwegian fishing fleet, and tasked with providing information about catches and general fishing activity to the Institute of Marine Research (IMR) (Clegg, Williams 2020). The fleet consists of both offshore and coastal vessels that cover most of Norwegian waters. The Offshore Reference Fleet began in 2000 and was expanded to include coastal vessels in 2005. The four main goals of the Norwegian Reference Fleet are to: 1. Support stock assessments with biological data; 2. Document the fishing effort and catch composition of total catches, including bycatch, discards and catches of non-commercial species, seabirds and sea mammals; 3. Provide a platform for the collection of additional samples from fisheries. 4. Increase collaboration and strengthen dialogue between researchers and the fishing industry. Fisheries data is collected by the crew members themselves, an approach commonly known as self-sampling of catches. Crew members are trained by IMR staff in scientific sampling procedures and the fishing vessels are equipped with instrumentation and software for data collection that was developed by IMR for using both by the Reference Fleet and on the IMRs own research vessels. In this presentation we give an overview of the structure of the Reference Fleet, the equipment used, and a summary of the experiences and lessons learned so far.

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**Fishing for science – science for fishing. How at-sea self sampling program helps the at sea sampling program in Ireland.**

**Macdara Ó Cuaig**

**Marine Institute, Galway, Ireland**

When Covid-19 struck many nations suspended their sampling at sea observer programs in the interest of health and safety. In Ireland to mitigate for this suspension the Irish fleet in co-operation with the Marine Institute developed the At-Sea Self Sampling Program. With the At-Sea Self Sampling Program fishers collect data and samples from a subset of fishing operations in accordance with robust sampling protocol. Skippers and crew are trained in advance and quality control is provided in real time via WhatsApp messaging. Data and samples are collected at fishing trip end for further investigation and analysis. Post Covid-19 the At-Sea Self Sampling Program complements the traditional sampling at sea observer program and increases participation in the at sea data collection from the Irish fleet. Data from the deck in Ireland is now collected via the dual stream approach of Self Sampling and Observer at sea sampling. Here we present the mechanics of the At-Sea Self Sampling Program and the lesson learned from the process.

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**The South African hake trawl fishery's engagement with at-sea monitoring**

**Willem Louw, Melanie Williamson**

**CapMarine, Cape Town, South Africa**

The South African Hake Trawl Fishery participates in at-sea monitoring through the following initiatives.

1) The self-monitoring program was initiated to monitor the interactions with Vulnerable Marine Ecosystem (VME) and Endangered, Threatened, or Protected (ETP) species as well as other bycatch Species of Concern. Through extensive collaboration with industry stakeholders, fishers, and regulators, CapMarine developed Move-On Rules for VMEs, trigger thresholds for ETP species, Standard Operating Procedures (SOPs) for data collection, reporting templates, and a comprehensive data management framework. The program is supported by regular on-site training, educational resources such as posters and stickers, awareness videos, and a detailed Safe Handling and Release guidebook.

2) The annual observer-vessel deployment plan was designed to increase the observer coverage across all the vessels in the hake trawl fleet. It also improved the logistical coordination among observers, service providers, and crew/vessel managers. This initiative improves the effectiveness of the observer sampling strategies for each vessel type or category while also supporting the proper implementation of self-monitoring SOPs and safe handling and release protocols. Spatial and temporal stratification further improves the representativity of catch and effort data. It also allows for ongoing communication and the interpretation and application of new measures or strategies at the vessel level by CapMarine observers, ensuring alignment with the requirements of Marine Stewardship Council (MSC).

In conclusion, the success of these initiatives highlights the value of collaboration between the regulators, fishing industry and monitoring programs.

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## Marching as one: engaging industry in the collection of robust data to inform assessment of South Australian fisheries

**Graham Hooper, Chris Presser**

**South Australian Research and Development Institute, Adelaide, Australia**

Establishing trust between fishery scientists and commercial fishing sectors is vital in achieving and maintaining sustainable fisheries over a long period of time. In South Australia, collection, and analysis of both fishery independent and dependent data underpin stock assessment of a diverse range of commercial fisheries, including finfish, crustaceans, and molluscs. The South Australian Research and Development Institute (SARDI) plays a key role in developing and undertaking these long-term monitoring programs for the purposes of establishing harvest strategies with predefined biological indicators that are linked to a nationally agreed framework for determining and enabling setting of Total allowable commercial Catches (TACC) at sustainable levels. In some cases, an additional outcome is providing evidence for Marine Stewardship Council certifications. Each season in collaboration with industry, SARDI observers collect robust and reliable data across South Australia's marine and gulf waters. As scientists and independent observers, marching as one involves communication, cooperation, connection, and preparation through engagement of our local seafood and fishing industry, in some cases spanning more than 30 years of collaboration. To achieve effective engagement, we implement a variety of approaches across diverse fishery types which are detailed in the following case studies : i) fishery co-management in the western king prawn fishery, ii) sub-program level planning in the southern rock lobster fishery, iii) individual sampling trips in the blue swimmer crab fishery, iv) working with traditional landowners in the goolwa pipi fishery, v) collaborative fish market/auction sampling in the marine scale fish fishery and vi) undertaking emergency responses in the abalone fishery. Continued industry engagement over long periods facilitates improved data collection techniques, integration of new technologies, management of conflict of interests, integration of women into historically male dominated fisheries, and importantly, maintains observer independence whilst liaising with industry to preserve close working relationships with key stakeholders.

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## Reducing green sturgeon bycatch in the California halibut trawl fishery: a collaborative project with observers and the trawl fishing industry

**Jason Vestre**

**Pacific States Marine Fisheries Commission, Morro Bay, USA**

Green sturgeon (*Acipsenser medirostris*) is a long-lived, slowly maturing species that is encountered as bycatch on the West Coast of North America in the California halibut trawl fishery. The Southern Distinct Population Segment of Green sturgeon was listed as threatened under the U.S. Endangered Species Act in 2006, prompting efforts to monitor more closely for, and to protect them from, the potentially negative impacts of commercial fishing encounters.

NOAA Scientists, CA Fish and Wildlife, CA halibut trawl fishermen, and the West Coast Groundfish Observer Program (WCGOP) have collaborated to better understand the impacts of green sturgeon bycatch. This was done through multi-year studies focused on genetic analysis, recapture rates, and post-release mortality estimates, as well as an underwater trawl net video study to characterize behavior of green sturgeon in response to trawl net encounters. Observers and fishermen worked side by side, in addition to their normal duties, to complete the onboard components of these studies including bio sample collection, placing pit tags, attaching satellite tags, and camera placement/retrieval on the trawl nets. Current efforts include a detailed trawl fleet gear characterization, gear modification, and further behavioral studies.

In this presentation, I will relay the results of the studies and discuss how the conclusions guide current and future efforts. Additionally, I will highlight the crucial role that observers have played, both as field biologists and as liaisons to industry. Additionally, I will detail how their training, expertise, and program support have effectively engaged the industry in this important work. Current and future collaboration will continue to build on these efforts and bring new insights to move the project closer to its goal.

## Open Discussion Session

Miguel Nuevo to Sofie Gundersen
Q: What are the advantages of using reference fleet over EM data, from a point of control/verification?
A: With the bycatch, it is used to estimate bycatch in the whole fleet. Offshore fleet will report all data along with sampling. They compare their data with whole data and scale up. Estimation of 1% discard. Trust is important. We trust they collect it properly and they trust we don't misuse it. If different fisheries/CG suspect discards they cannot use computers data? Norway is one of the societies with highest levels of trust. Voluntarily applied for, we know we are getting the 'right' ones.

Miguel Nuevo to Sofie Gundersen,
Q: Do you use this data for the whole fleet?
A: No, it is not used to extrapolate out to the whole fleet.

Miguel Nuevo to Sofie Gundersen,
Q: What are your thoughts on EM?
A: I think in some ways it may be implemented in the future. On Thursday someone will discuss CatchID

Amelia White to Willem Louw
Q: How do fishers receive the new protocols?
A: With the safe handling of the species mostly they are large bycatch. Some vessels bring up sharks or other large bycatch, and we work with the crews and vessels when this bycatch or birds come up to educate them how to release them with minimal injury. We gave them some posters to put in the factory, and gave them videos to show them how to safely release bycatch and birds.

Amelia White to Willem Louw
Q: Did you see any big changes in behavior in the fisheries?
A: Indeed, as I put down in my presentation we developed an observer vessel deployment plan. The captains especially were a bit grumpy, but after sitting down with them they completely understand the projects and plans

Lisa Borges to Macdara Ó Cuaig
Q: How do you compare observer data to the different sampling style of the industry data? How do you keep fishers engaged in the program?
A: You're correct it started as a mitigation measure for Covid, and continues because we still have resources. With subsampling is good. Why don't you get 2 or 3 samples? No, fishermen are overburdened with paperwork already. From an operational point of view it is difficult for QA/QC and would be useless due to fishermen forgetting key information. Another thing that is important from a logistical point of view, in the albacore fisheries we have extended our at sea self sampling to that fleet to increase sampled proportions.

Lisa Borges to Macdara Ó Cuaig
Q: How do you keep the fishers engaged and involved? How do you compare the data of different regions with the differences in the data?

A: we engage with them all the time and impress upon them the importance. We also give a nominal fee(payment) for the bycatch box, 55 euros. For the pelagic albacore there is no fee. With the QC is important is to ensure errors are addressed straight away instead of waiting for the whole trip. It's really good in the sense it introduces our vessels to the sampling program that may not have been introduced before, and shows them "these lads aren't that bad and we can work with them"

Sævar Guðmundsson to Willem Louw
Q: Do you use your data for real time closures of the fishery grounds?
A: Macdara Ó Cuaig: No, for my organization we do, but not all. Ireland does not have real time closures. But we do have some closures due to spawning throughout the time.
Willem Louw: The idea of the self-monitoring is for the VME species. We realized observers can't be on each and every vessel so we told the industry "look, you guys need to do your part." We developed an excel sheet and the Factory manager is responsible for ensuring the spreadsheet is properly completed. At the end of the trip they send it to CapMarine and we say "hey this is done correctly.
Remarked that the Icelanders are very thankful about moving beautiful ladies to Iceland from Ireland to Macdara!

Marie Storr-Paulsen to Macdara Ó Cuaig
Q: How do you use the data in scientific programs? How do you manage the data with the new programs and merge them together?
A: Raise it from the trip level up. The resolution is higher in the observer program than in the self-sampling system. We only have 2% coverage. In the Irish system there is no compulsion to carry observers, so we are taking all the information we can, and it is more useful for trends.

Ella Williamson to Willem Louw
Comment: coordinating the observer program, Observers were getting stuck on the same boats because only some would take them. We came up with a brilliant plan with an Excel that would assign a minimum number of covered trips by the fleet and they may choose which month, and it has helped a bunch with industry engagement. If any providers are having issues getting observers out this method has increased our coverage from 6-10%

Kristófer Ómarsson to Graham Hooper and Jason Vestre
Q: Has the industry been resistant to the project?
A: Jason Vestre: Quite a lot of resistance. At the initial response they sent a fisherman that voiced every single grievance with NOAA at this collaborative meeting, which prompted others to vent theirs. What it took was one of the other fisherman to speak in support to change the minds. One other pushback is that fisherman believe their gear is perfect unless they personally discover the cause.
Kristoff: shared his own experience of fisherman sharing grievances in response, which led to the development of a workshop to encourage industry engagement. We used lollipops to have fishermen show their ideas for sorting
Jason Vestre: We offered fisherman travel reimbursement, and free lunch to get them to the workshops. As well as certain rewards for participating in the project
Kristoff: "We try to have a social gathering with crew to facilitate better working relationships"

Megan Miller to Jason Vestre
Q: Thoughts about expanding the sturgeon project for the Columbia River? Do you think there will be any pushback from the industry?
A: California halibut is only SoCal (Southern California). The trawl fisherman in northern states don't encounter as many, and the southern population is the only population that's listed. We don't take data nobody uses.

Teresa Athayde to Sofie Gundersen
Q: How do the vessels or the project get paid? Is it the crew volunteering or mate?
A: With the offshore fleet its usually a company and the company applies, which could be a problem because it's the higher ups deciding. The boats apply. For the coastal fleet individuals apply.

Teresa Athayde to Sofie Gundersen
Q: Who gets the responsibility?
A: Usually they will have a talk with the crew before and say "listen we want to contribute to science, will you do it?" On some vessels the money will be put in a pool, in others the sampler will get 60% of the reference fleet income but have to complete duties on their own time.

Teresa Athayde to Sofie Gundersen
Q: Are they voluntary?
A: I'm not sure how they choose them. On one of my vessels I was training some that found the technology too much to handle so we did not use them for sampling.

Unidentified to Sofie Gundersen
Q: How do you see the future of the reference fleet?
A: I think it will continue for many years but not as it does today. We are looking into different sampling methods to get more data from the fleet about their whole fishery. Maybe get them to take otoliths, but we still need catch data and maturation. It is hard to train maturation

Elanor Bratt to Sofie Gundersen and panel
Q: Any thoughts on communication with the fleet and the best way to do it?
A: Macdara Ó Cuaig: "you have to be very careful when communicating that because people can misinterpret what you are saying. In my experience meeting fishermen in their environment is the best thing to do to show respect for their time. You cannot say if we do this there will be an increase in stocks, because there may not be one, so honesty is important. (anecdotal story) Fishermen always complain about the delays in the science. Don't make false promises, because these people have made immense investments. This of course makes things a harder sell
Jason Vestre: Anecdotal accounts from other fishermen are more effective when explaining science. Whatever I've said has been taken back to the fleet and would be verified by them anyway.
Willem Louw: From my point of view if you go for the head of the snake the body will follow. We involve the department of fishery, we educate them, we tell them the plan, and if they bite, the captain and crew will follow. So go for the snake's head.

Lina De Nijs to the panel
Comment about industry engagement: Works for industry, can translate the knowledge of the fishermen to the surveys, to assist with the science. We have been asked to help with collecting samples due to staffing shortages. For example they needed mackerel samples, and the fishermen encounter it every week. So collaboration is very important. We have quite a program in the Netherlands that works really well.

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

**Industry survey: preserving and supporting fisheries culture.**

**Lauren Trainor**

**AIS Inc. in support of NOAA Fisheries, Northeast Fisheries Science Center, Fishery Monitoring & Research Division, Woods Hole, USA**

This project will explore preserving and supporting fisheries culture in the Northeast U.S. by enhancing industry engagement in our observer programs. Interviews will be conducted with fishermen and fisheries management personnel with questions regarding the future of the fisheries and how managers and fishermen communicate about impacts to the industry. Interviews will be done in person or over the phone, focusing on topics such as proposed changes to fisheries management, areas to improve communication between the fishing industry and management; particularly how policies and regulations are shared with fishermen, and research studies fishermen would like to participate in. Identities will remain anonymous, with nine fishermen from different ports along the Northeast and nine individuals working in fisheries management. Responses and trends will be identified, synthesized, and reported on. Results will summarize the current status of communication between industry and managers, and reveal where participants feel improvements can be made. These interviews aim to capture fishermen's perspectives in an industry where fishing effort may have shifted in certain fisheries over time. Observers face a unique opportunity to act as an "in-between" industry and management while improving communication and identifying avenues for further collaboration. This project has the potential for greater preservation of fisheries culture in the Northeast via recurring fisheries-based surveys to further improve relationships between NOAA and fishermen.

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**Bycatch of northern fulmar (*Fulmarus glacialis*) in Norwegian longline fisheries: assessing spatiotemporal variations in scale and risk to improve management**

**Tom Clegg[1], Signe Christensen-Dalsgaard[2], Vegard Sandøy Bråthen[2], Arnaud Tarroux[3], Johannis Danielsen[4], Sébastien Descamps[5], Hálfdán H. Helgason[6], Arne Follestad[2], Gunnar Thor Hallgrimsson[7], Morten Helberg[8], Jón Einar Jónsson[9], Yann Kolbeinsson[10], Hallvard Strøm[5], Paul Thompson[11], Thorkell Lindberg Thorarinsson[10], Tom Williams[1], Kim Magnus Bærum[2]**

**[1]Institute of Marine Research, Bergen, Norway.**

**[2]Norwegian Institute for Nature Research, Trondheim, Norway.**

**[3]Norwegian Institute for Nature Research, Tromsø, Norway.**

**[4]Faroe Marine Research Institute, Thorshavn, Faroe Islands.**

**[5]Norwegian Polar Institute, Tromsø, Norway.**

**[6]East Iceland Nature Research Center, Egilsstaðir, Iceland.**

**[7]Faculty of Life and Environmental Sciences, University of Iceland, Reykjavík, Iceland.**

[8]BirdLife Norway, Trondheim, Norway.

[9]University of Iceland, Snæfellsnes Research Centre, Stykkishólmur, Iceland.

[10]Northeast Iceland Nature Research Centre,, Húsavík, Iceland.

[11]University of Aberdeen, School of Biological Sciences, Cromartyt, United Kingdom

Seabirds are vulnerable to bycatch in longline fisheries but for most species the impacts are largely unknown. To address this knowledge gap, studies can estimate bycatch directly using observations or calculate the theoretical risk of bycatch using overlap indexes. In a recent study, Clegg et al. 2024 have quantified the scale and risk of bycatch of northern fulmar (Fulmarus glacialis) in the Norwegian offshore longline fishery using a ten-year time series of bycatch observations from a reference fleet programme, and large-scale datasets of fishing activity and northern fulmar distribution. This poster presents the results and conclusions of their work. They estimated an average of 0.01 (95 % CI: 0.008–0.03) northern fulmars bycaught per 1000 hooks, which results in a highly varying estimated annual bycatch of between 51 and 16242 (95 % CI) northern fulmars per year, with the largest hotspot in the Norwegian Sea during June-August. They compared these estimates with overlap indexes calculated for northern fulmars and the same fishing activity. This pinpointed the highest risk of bycatch within the breeding season, where fishing activity increased in the waters around the largest cluster of breeding colonies in the northeast Atlantic. Strong correlations between estimated bycatch and calculated overlap indexes validate overlap indexes as an indirect evaluation of risk and strengthen evidence for management decisions based on the spatial and temporal trends identified in our analyses.

## Session 8. Mental health of observers and observer safety and readiness

**Leader: Bubba Cook**

The physical challenges of observing at sea are well known and addressed in training programs. However, psychological and emotional challenges are issues that can adversely affect an observer's mental health and wellbeing when deployed. During debriefing processes, observers have displayed frequent signs of depression; fatigue, insomnia, feeling helpless and eating disorders. This session focused on case studies of mechanisms to deal with mental health issues of observers, as well as strategies and support and training options adopted by observer programs.

The second component of this session focused on observer safety and readiness. Observers face many challenges and risks while deployed on a huge variety of vessels worldwide. Besides navigating the harsh environment at-sea, they must deal with infectious diseases, cultural differences, stress, fatigue, isolation, unsafe vessels and sometimes even violence. Programs have the task of helping observers to cope with these factors through support, training, technology, and equipment. This session also explored some of the issues faced by observers and how protocols, training, and technology can help reduce the risks associated with observing.

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## Oral Presentations - Extended Abstracts

### Taking control of the situation: incorporating sexual assault/sexual harassment strategic resistance training into fisheries observer training programs

**Catherine Benedict**

**West Coast Groundfish Observer Program, Pacific States Marine Fisheries Commission, in support of NOAA Fisheries Observer Contract #1305M322CNFFP0086**

Introduction

Life at sea has a reputation for danger, be it foul weather, gear malfunctions, or otherwise. As a result, observer safety and preparedness is often considered one of the most important components of any observer training program. While typically focused on drills, maydays, and sea survival training, preparation for sexual assault/sexual harassment (SASH) incidents is often under-emphasized in its importance pertaining to observer safety and preparedness. However, fisheries observers are classified as a group at high-risk for experiencing SASH incidents while onboard fishing vessels.

According to a study conducted with the North Pacific Observer Program, between 10 and 17% of observers experience and report harassment or assault events, including SASH incidents, in a given year. Additionally, researchers established that observers who experienced sexual harassment were less likely to report the incident than observers who experienced other types of victimization, including intimidation, coercion, hostile work environments, and assault. Ultimately, the study found that while researchers have access to reports for analysis, the 10 to 17% average number of impacted observers is an under-representation of the total number of observers who experience harassment events annually. Their estimates indicate that the number is likely closer to 33% (Jeroue et al., 2025).

Background

To combat sexual assault/sexual harassment in the workplace, the National Oceanic and Atmospheric Administration created the Workplace Violence Prevention and Response (WVPR) Program in 2018. WVPR supports all NOAA employees, including contractors and affiliates like fisheries observers, by providing Victim Advocate Liaisons to those who reach out in need of assistance. Additionally, WVPR can assist impacted persons in filing reports regarding SASH incidents. Throughout the year, WVPR staff are available to provide informational lessons to the NOAA Workforce about what SASH is, how reporting works, and ways to overcome the established barriers to reporting SASH incidents.

In 2023, WVPR partnered with Soteria Solutions to create a training module for NOAA employees who were identified as at "high risk" for experiencing sexual assault or sexual harassment. Soteria Solutions is a 501(c)(3) organization that develops "innovative, research-based solutions…[for clients to] attain and maintain safe and respectful environments." More specifically, WVPR identified fisheries observers to be the target audience for this new training module. Fisheries observers are classified as high-risk groups due to the isolation of their working environments at sea, as well as their limited access to support resources during their work duties.

Initial Workshop

In July 2023, WVPR invited representatives from several observer programs across the United States to participate in the first Train-the-Trainer Workshop hosted by Soteria Solutions staff. This 8-hour event was designed to introduce the new material in Soteria's Strategic Resistance™ Training to observer program trainers, in an effort to encourage staff members to take leadership of the training and presentation materials and incorporate them into regional observer training courses.

Trainers stepped into the shoes of observer trainees during the workshop to experience the training module first-hand, as well as practiced facilitation of the material with partners throughout the seminar. This facilitation practice with the guidance of both WVPR and Soteria Solutions representatives offered participants the opportunity to ask questions about best practices when facilitating the material in the classroom. At the conclusion of the workshop, attendees received copies of the Soteria Solutions presentation, a Facilitator Guide, and the Soteria Solutions Strategic Resistance Toolkit. These items are trademarked by Soteria Solutions, and are not permitted to be copied, forwarded, or reproduced.

Module Content and Facilitation

Before diving into the material, facilitators first set the expectations and guidelines for observer trainees to abide by throughout the module. This includes discussing any required national standards covered during the presentation, addresses the "parking lot" system for questions (in which facilitators may write a question down to answer later), and reiterates that a participant's value in the conversation is not determined by their participation level. Facilitators express that the material covered in the presentation is sensitive, and if participants need to leave to practice self-care, WVPR support staff are available to assist them.

Soteria Solutions' main presentation for observers is backed by several key ideas, including social norms theory, bystander intervention, and power differentials. While these concepts are not explicitly discussed in the module, it is the duty of the facilitator/instructor to have a baseline understanding of these core concepts in order to better relate these complex topics to observer trainees in an approachable way. Since facilitators are not expected to be experts in these areas, it is recommended to have a representative present who can answer more detailed questions about these concepts, or to refer trainees to a qualified individual who may provide more insight as needed.

The remainder of the presentation can be broken down into seven core concepts: defining sexual assault/sexual harassment, strategic resistance skills, bystander intervention skills, considerations for responding to an event, support networks, self-care, and reporting options. A brief overview of these concepts is found below:

1. **Defining Sexual Assault/Sexual Harassment:** NOAA's definitions of sexual assault and sexual harassment are clearly outlined for trainees. If observer trainees have additional definitions or expectations outlined by their employer, these are noted. Trainees are also introduced to the Continuum of Harmful Behaviors, which illustrates that a behavior that may be considered harmful to some people may seem harmless to others. Behaviors that are in this "gray area" may happen more frequently to observers than behaviors that everyone agrees/acknowledges is harmful.

2. **Strategic Resistance Skills:** This grouping of skills to reduce the harmful effects of sexual assault/sexual harassment are utilized by impacted persons. These include skills such as: setting boundaries, verbal responses, and leveraging a support network. Trainees are also introduced to the Zones of Opportunity, in which they may use a skill before, during, or after an incident based on their comfort level.

3. **Bystander Intervention Skills:** These skills can be employed by active or pro-social bystanders who look to effect positive change in a SASH incident. These include but are not limited to: speaking with the impacted person, involving others, and distracting the offender using positivity.

4. **Considerations for Responding:** Trainees use their understanding of power differentials and social norms theory to establish why each individual may or may not feel comfortable responding to an incident as a bystander or an impacted person. Facilitators highlight how not responding (or "doing nothing") is employing a skill, and should be recognized as a valuable way to utilize their skills and knowledge.

5. **Support Networks:** As observers often feel isolated in their work environments, facilitators help trainees brainstorm who could provide support before, during, and after experiencing a SASH incident. By creating this list ahead of time, trainee observers may be more able to recall and select an appropriate support person in any situation, and understand the best way to get in contact with them if out at sea.

6. **Self-Care:** Trainees review the importance of maintaining a self-care routine, as well as identify different kinds of self-care including meditation, prayer, journaling, and more. Facilitators review how self-care can help reduce the harmful effects that impacted persons and bystanders can experience following incidents of SASH.

7. **Reporting Options:** Increasing awareness of reporting options for trainees at this stage can help to reduce the under-reporting of SASH incidents. Facilitators introduce the differences between restricted (confidential) reports and un-restricted (non-confidential) reports. Providing this information offers trainee observers the agency to choose which report they would like to file, and covers how those reports are handled.

Throughout the module, observer trainees are encouraged to provide ideas, brainstorm individually and in a group setting, and participate in group and individual scenario activities. These activities can be modified to reflect the specific sampling difficulties each program faces, as well as highlight where SASH incidents may occur more frequently for certain programs (i.e. bunkhouses, shared bunkrooms, processing plants, etc.). While participation and volunteering of information is not mandatory throughout the presentation, facilitators encourage cooperation by providing their own examples to prompt discussion when trainees are hesitant to get involved in the conversation.

<u>Implementation</u>

After attending the initial Train-The-Trainer Workshop in July 2023, West Coast Groundfish Observer Program (WCGOP) training staff began the task of taking on leadership of the material presented by Soteria Solutions in order to incorporate the Strategic Resistance Training Module into their observer training courses. Previously, WCGOP had set aside one hour of time in their 3-week training schedule for representative from WVPR to give a short presentation about sexual assault, sexual harassment, WVPR, and available reporting options. However, the Soteria Solutions presentation was designed to take 2 hours of time, and upon rehearsing the material often took longer than the designated 2-hour time window.

Between July and November 2023, WCGOP staff members spent time reorganizing the presentation order to fit program needs, replaced some pre-recorded videos in the presentation with brainstorming sessions to increase engagement, and modified scenario activities to fit realistic situations WCGOP observers may face during their employment with the program. Additionally, facilitators spent time reworking the Resource Toolkit to incorporate activity worksheets in order to encourage trainees to flip through the toolkit throughout the presentation.

The first iteration of the NOAA Fisheries Observers Sexual Assault and Sexual Harassment (SASH) Prevention: Strategic Resistance™ Training was implemented during annual briefing events for returning WCGOP observers from December 2023 to January 2024. Following these briefings, the module was also facilitated for new observer trainings from 2024 onwards. Additionally, WCGOP staff developed a separate 1-hour module for 2025 annual briefing events for returning observers to reiterate core materials as well as clarify information that had been updated in the previous year. Beyond observer trainings and briefings, WVPR has also requested for WCGOP staff members to facilitate further Train-The-Trainer workshops for NOAA observer training staff, which were conducted for the

Southeast Fisheries Observer Program in June 2024, and in January 2025 for WCGOP staff members who were unable to attend the original Train-The-Trainer hosted by Soteria Solutions.

Conclusion

The West Coast Groundfish Observer Program has seen great benefits from implementing the Soteria Solutions Strategic Resistance™ Training Module. Most notably, taking on the material and diving deeper than the original 1-hour WVPR presentation in years prior to the new module has provided staff the opportunity to better connect with trainee observers. The sensitivity of sexual assault/sexual harassment training materials lends itself to deeper conversations, as well as the ability to build trust early with staff members, which will ideally break down some of the barriers observers face when reporting SASH incidents. WCGOP staff have indicated anecdotal evidence of increased requests for WVPR contact information, as well as more reports directly to obligated reporters, such as debriefers and coordinators. While there are some limitations to presentation modifications and the usage of materials (as the materials are copyrighted by Soteria Solutions), the overall implementation of the new training module has been positive.

For parties interested in receiving more information on the Strategic Resistance™ Training or partnering with Soteria Solutions to create a training module for their observer program training courses, please contact Soteria Solutions at https://soteriasolutions.org/.

Citations

Jeroue L, Faunce C, Kingham A and Smith J (2025) Estimates of disclosure and victimization rates for fishery observers in the maritime workplace. *Front. Mar. Sci.* 11:1461655. doi: 10.3389/fmars.2024.1461655



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**LGBT+ observers; Navigating a difficult industry**

**Martin Beach**

**West Coast Region Observer Program, Frank Orth and Associates, California, USA**

Introduction

It is well-established that observing is a stressful and dangerous occupation. Observers are in the vulnerable position of often being an unwanted guest in remote locations. In addition, the inability to communicate with friends and family often leads to loneliness, depression, and anxiety (Dorobek, 2018). The lack of a support system also leaves observers vulnerable to harassment from boat crews (Wang & DiCosimo, 2019). Crews and captains, resentful of having to pay for, feed, and potentially alter their fishing practices due to observer requirements, can treat observers with disdain, coldness, and even anger. This, in turn, creates a culture that amplifies the loneliness and anxiety observers face.

This threat of harassment and general feelings of ‘otherness’ among the captain and crew disproportionately affect observers who are members of protected identities (Garcia, 2024). Research has been conducted on the additional struggles faced by female observers, who are more likely to be subjected to sexual harassment. Most harassment goes unreported. In a 2016 NOAA study of 553 participants, 46% reported having experienced harassment and only a third of those harassed reported incidents every time they occurred (Wang & DiCosimo, 2019). Victims are often hesitant to report due to feelings of shame, fear of being blamed, and the tendency to minimize what happened to them (Smith, 2018). While research has been conducted on the prevalence of violence and sexual harassment, reporting hesitance, and the mental impact upon observers, there is little data on how observers of marginalized sexual and gender identity are impacted by discrimination, bias, and harassment.

Observers have never been immune to the politics and cultures of fishing vessels. As political polarization worsens worldwide, discussions of political affiliations and world events are becoming increasingly contentious. Observers are generally advised to avoid political conversations while at sea for their own safety. However, this recommendation falls short when an observer's very identity is politicized.

Fishing industries tend toward traditionally masculine and conservative cultures. For LGBT+ observers, being placed onto boats can leave them particularly vulnerable to harassment. While observer programs have policies to respond to violent, aggressive, or otherwise threatening incidents, the rate of disclosure to program officials is undeniably low. In addition, LGBT observers experience more subtle forms of workplace bias that, while not reaching the threshold of harassment, can leave them feeling unsafe. Comments, jokes, invasive questions, and a general disdain for LGBT crew members or observers can impact the mental health of observers while at sea. Moreover, many observers hide their identities. The act of concealing their gender identities, LGBT status, or the existence of romantic partners can create an atmosphere of anxiety surrounding day-to-day tasks and conversations.

To provide support to LGBT observers, programs must first understand the prevalence of these incidents, the reasons that observers might chose to report or not, and the impact that homophobia and transphobia have on the mental health of observers.

Methodology

I designed and distributed an anonymous survey to current and past observers asking a series of questions about homophobic or transphobic incidents, reporting, and mental health. All questions were entirely optional to protect observers’ privacy. I sent the survey to program managers and online observer social groups. The survey consisted of three sections.

The first section requested optional biographical information, including whether or not they identified as LGBT. In addition, observers were asked if they ever hide that identity while on fishing vessels.

The second section concerned the prevalence of homophobic and transphobic harassment at sea. Observers were asked whether they had experienced of witnessed any incident, language, or boat culture that they felt was homophobic, transphobic, or made them uncomfortable. If they had, they were asked about the nature of these incidents, whether or not they had reported the behavior to their programs, and, if applicable, why they had chosen not to. If they had, the survey asked how they had felt about their program's response.

In the third section, observers were asked about actions they take to protect themselves from homophobia and transphobia on boats, such as hiding their identity, refraining from joining in personal conversation, and altering their behavior. In addition, observers were given the option to submit comments about their experiences, how they keep themselves safe, and the impact to their mental health.

They survey was open to responses from April of 2025 to late June 2025. After the submission period closed, responses that did not complete questions past the identification section were removed.

Results & Findings

The survey received 55 responses that met completion criteria. As a result of the survey's topic and distribution, the demographics of the respondents are skewed towards LGBT observers in the United States and Europe. 47% of respondents identified themselves as LGBT, 49% as straight, and 4% preferred not to identify either way. They ranged from first year observers to 4+ year and retired observers. The majority of responses came from programs within the United States, as well as from the following countries, in order of descending number of responses: Canada (3), England (3), Ireland (3), Croatia (2), Portugal (2), Colombia(1), France(1), Italy(1), Kiribati (1), and Spain (1). These numbers are approximate as identifying one's program and nationality was not required to submit a response. In addition to fishery observer programs in the United States, respondents identified themselves as working in the BFT, IATTC, PNOT, POPA, NAFO, MII, and Falkland Islands programs.

The survey confirmed that observers are experiencing homophobia and transphobia on fishing vessels. 67% of respondents reported witnessing or experiencing homophobic or transphobic language or incidents. When asked to characterize these incidents, 33% reported experiencing an uncomfortable culture on a boat, 31% have been asked inappropriate questions or received unwelcome comments, 19% witness homophobic or transphobic language directed at another, and 8% have had unwelcome behavior directed at them.

Respondents then went on to identify ways that LGBT observers protect themselves from these persistent attitudes. Of the responding observers that identified themselves as LGBT, 38% avoid sharing personal details and avoid personal discussions with captains and crew. 17% present themselves differently or alter the way they speak. When asked about measures they take to keep themselves safe from homophobic or transphobic harassment, observers mentioned keeping silent during personal and political conversations, distancing themselves from the crew, altering their wardrobe, and even carrying a weapon for personal defense. Importantly, survey responses indicated that the majority of LGBT observers remain 'in the closet' while aboard vessels. 52% of LGBT identifying respondents 'always' hide their identities on boats, and 26% 'usually' do.

The vast majority of surveyed observers, 84%, did not report incidents of homophobia or transphobia to their programs. The prevailing reasons observers did not report were similar to those given by victims of sexual harassment. They minimized the importance and impact of the incidents, and were put off by the sensitive nature of these issues. In addition, many of the incidents were aimed at other crew members, creating an oppressive atmosphere that harmed observers indirectly without providing basis for a report. Jokes and impersonal remarks may not rise to the level of harassment but can lead observers to alter the way they present themselves to avoid escalation. Other respondents did not want to draw attention to themselves. In some cases, they did not trust their programs to be able to safely handle the situation. One observer responded that it was such a pervasive issue that it was simply "easier to be quiet." Others reported worrying that their programs would out them to captains and crew.

The stress caused by anti-LGBT rhetoric and the mental strain of constant self-policing of their identities has had consequences for many LGBT observers. Respondents reported feeling anxious or jumpy, and it affected some to such a degree that they questioned their place in their programs. Of the 19 LGBT-identifying observers who responded to questions about mental health impacts, 10 replied having experienced moderate or severe anxiety or depression. Several added that this anxiety impacted their ability to complete their assignments, and several others commented that they 'compartmentalized' or remained in the closet so as to enable them to do their jobs. Two respondents cited homophobia and transphobia as key reasons they left their programs.

Conclusion

It is clear that LGBT observers experience and are impacted by homophobia and transphobia on fishing vessels. This comes in the form of direct harassment as well as a prevailing cultural atmosphere which leads many observers to hide their identities. Many LGBT observers are forced to monitor and alter their speech, body language, and expression to avoid outings. This has an undeniable impact on many observers' mental health.

Collecting observer accounts is the first step in addressing homophobia and transphobia experienced by observers aboard vessels. By understanding the nature and prevalence of such incidents, programs can work to ensure observers' physical and mental health. In addition, knowing how observers react to anti-LGBT comments, cultures, and harassment can improve the ability of programs to create safe and effective reporting spaces.

Programs are placed in a difficult position when it comes to designing standardized response procedures for reporting homophobia and transphobia on boats. These are systemic issues rooted in the cultures of fishing boats, rather than the actions of individuals. Observers fear that reporting incidents will force their programs to out their identities to crew, or else position themselves in opposition to crews and captains. Individualized, observer-led responses to harassment may be more effective. Observers also mentioned observer communities as being vital to building resilience. Programs might consider fostering peer-to-peer support groups. Speaking openly about these issues during training, and ensuring privacy, may encourage LGBT observers to be open with their colleagues and with their programs.

## Observer Comments

Through this survey, I offered observers of all identities the option to express their opinions on the topic. I would like to share comments from those observers who wrote. Many of these are from LGBT observers explaining how they have experienced and been impacted by homophobia and transphobia at sea. Some of these responses are incredibly insightful and may be useful to those trying to improve their program's support systems, and some are particularly poignant reminders of what happens when we fail to provide that support. Respondents were given the option to chose whether their comments were shared.

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|---|---|---|---|
| "It was very stressful and one of the primary reasons that I left observing" | "it can be pretty stressful, worrying about being 'outed'" | "It's made it very hard to think about coming back as an observer" | "I keep a taser in my personal belongings" |
| "[My mental health] has undeniably suffered, but I believe my mental health would suffer more if I attempted to present myself with the gender expression I am more comfortable with, as it would inevitably cause invasive questions and behaviors." | "Usually at meal times crew and captains will randomly talk about gay and trans people in derogatory ways. I have been asked if I was 'one of them' meaning a liberal/queer/trans person. A lot of hate speech regarding the LGBTQ+ community and jokes made." | "Me and some observers was talking to few of the crew members about having kids/raising kids and one of them talked about how if he had a son and he wanted to be a girl, that he would "beat" or knock sense into him." | "locker room talk." Lots of uses of the term "tranny" going around, calling each other gay is somewhat light but almost universal - one of the more egregious things I've seen was definitely a mate and the engineers talking about an openly gay deckhand with some strong derision. Have been asked if I'm gay with a not-so-great tone a couple times." |
| "Fisherman disparagingly use homophobic phrases and words at one another. Seemed to also be very opinionated on trans issues as they gained popularity in 2022-2023" | "It sucks to not be able to be authentically myself, and it doesn't feel great to be called the wrong pronouns, but I would rather hide my identity so I feel safe so that my work isn't impacted." | "I was questioned about my identity, made to feel insecure about it, my identity was challenged, I heard crew members using very hatefully homophobic language about someone they didn't like very loudly in the galley " | "This survey helped me voice issues I had away on contract that I otherwise would not have been able to share" |
| "[I] avoid discussing politics or personal things, avoid talking to crew outside of crew duties" | "Having a community to process issues with helps build resilience" | "I do not speak up. I do not agree nor do I disagree. I keep my mouth shut as to not alienate myself nor put myself in danger. | "Negative impact, makes for uncomfortable working environment." |
| "Feels even more isolated which degrades mental health. Once crew start to make comments, I feel on edge and jumpy the rest of the trip" | "There is no place for gayness on a working commercial fishing vessel. Those guys work hard and are usually tougher characters than most. My best advice is to find another profession to be in if you want to do your thing." | "I feel generally many captains and crew on vessels are from a rougher crowd. They generally make comments to get a rise out of each other. Sometimes I feel they do not whole heartedly mean what they say. But they say things for shock value." | "I once boarded a long line vessel, typically a month long trip and the first question out of the captains mouth was "how many genders are there". Sensing a trap I answered based on what he wanted me to say to avoid a hostile trip" |
| "In cases it leads to harassment it is obviously critical to immediately correct and can lead directly to trauma, but I think in most situations it is an added stress that can be absorbed by a healthy individual with solid support." | "I think that any truly helpful solution will need to address the way we prepare observers for an intrinsically challenging and difficult situation and support them through it rather than dividing people into groups and assigning them moral values to explain what's going wrong. " | "When talking about my friends or colleagues, I avoid discussions on their gender or sexual identity. I also avoid discussing certain media I digest if it may come off as "gay" to the crew, such as certain tv shows or books discussing LGBT+ issues or characters." | "It's been detrimental. To be less myself at sea means to be less focused on the job at hand. There are certain topics I try to avoid and thus I'm walking on eggshells in certain cases." |

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**How to advocate for observer interests as an observer? Understanding mental health and other hardships from an observer's perspective**

**Nicole Santoyo**

**North Pacific Fisheries Observer (Alaskan Observers, Inc., North Pacific Observer Program)**

The observers of the North Pacific Observer Program (NPOP) encounter physically and mentally stressful conditions at sea such as cold, injury risk, social isolation, and exhaustion. After a 90-day deployment, when the program surveys observers about health and safety concerns as well as for suggestions, ideas may be forgotten and momentum lost. Observers readily provide information about their experiences, but often asynchronously from recognizing a solution they would like implemented, or before realizing the significance of an earlier event.

When opportunities for observer input often arise while we are at sea or off-contract in other locations (and thus, away from administrative offices), how do we best advocate for ourselves? Community building allows observers to network and build solidarity that enhances their impact in scenarios where advocacy is important. Social media and group chats, for example, help keep observers connected and require little energy to maintain, facilitating organization and sharing of ideas.

In October 2024, two events relevant to North Pacific observer interests occurred: A paper on observer availability was presented at the North Pacific Fisheries Management Council (NPFMC), and observers with my company, Alaskan Observers, Inc. (AOI), received an email from our representative with Seafarers International Union ahead of our 2025 collective bargaining agreement negotiations, soliciting suggestions for the new agreement. In the NPFMC Observer Availability paper, possible factors influencing retention and availability to take on contracts were discussed: for instance, a harsh physical environment, a social environment that can, at times, be "hostile and intimidating", inconsistent work due to changing vessel needs, and the overall stresses of being away from home and loved ones for long periods of time (2024). Sarah Williamson, former Observer Representative for the NPFMC's Fishery Monitoring Advisory Committee, responded to this paper in a public comment, stating that more observer feedback should be sought in exploring observer availability and retention issues, as there were several observer provider staff interviewed but observers as a group were not surveyed directly for this paper (2024). I was able to give my own public testimony before the council (Santoyo 2024), arguing that more material benefits would increase observer availability. Conversations about adequate compensation leading up to my public testimony, along with the desire to clearly document observer needs in the wake of the renegotiation of our collective bargaining agreement, led me to reach out to fellow AOI observers to collect relevant accounts of our struggles and suggestions.

To gain more understanding of observer hardships and advocate for my peers, I conducted a short survey and sought out personal correspondence from my peers regarding compensation, benefits, and the effects of work conditions on mental health, from both current observers and those who have observed in the recent past. The questions I posed were as follows:

- Are you currently working with AOI?
- How long have/had you been observing?
- What benefits would you like to see in our new contract?
- How has observing impacted your mental health? Do you have any suggestions for how to mitigate the negative effects of long deployments on mental health?
- Have you ever needed time to recover from a contract (either physically or mentally), and felt pressured to return to work before you are fully recovered? Do you have any suggestions on how to support observers in completing their recovery before redeploying?

I received 7 survey responses from 6 current observers and 1 who observed in the recent past, but in addition to this, a wealth of information through more informal in-person and electronic correspondence via WhatsApp group chats. The time spent observing within individuals surveyed varied from 5 years to 6 months. When asked about desired benefits, the most common response was dental insurance (4) followed by an increase in pay that accounts for increases in cost of living (3), and the ability to receive paychecks through direct deposit (2).  4 of the 7 respondents indicated mental health stressors such as feelings of isolation, depression, increased stress, and even an account of serious harassment by crew. I received several similar responses in my personal communications with other observers, who described experiences with harassment, hostile environments, and the distress of missing life events and emergencies at home. Converssationally gathered information about desired benefits were similar to those gathered by the survey – increased healthcare coverage and pay were frequently discussed, especially reimbursement for mental healthcare such as therapy appointments. Survey responses regarding pressure to return to work were mixed, with some observers feeling little pressure or acknowledging that it exists, but has not been personally felt by them, but some being pressured after illness or when needing significant downtime to mentally recover from a particularly stressful contract. My conversations outside of the survey provided several anecdotes of times where recoveries were rushed, or observers were contacted about returning to work at times when they had previously indicated they were unavailable to take contracts.

Conducting this work compelled me to think critically about how to conduct research in service of my coworkers, in ways that facilitated responses from those with limited time and at-sea internet for responding to queries, and who might be most easily reached for short periods of time in-person, on land, in the lead-up to deployment, briefing, or debriefing. While surveying is useful and allows responses to easily be categorized and quantified, formatting questions for ease of response can be challenging, and requiring short answers may result in forgotten surveys or a hesitation to respond. Gathering information via conversation may not result in easily comparable responses, but building community through interacting and sharing stories, complaints, and memes has a positive effect on camaraderie and group cohesion that surveying cannot achieve. Meeting observers where they can be found and reliably documenting ideas and concerns about the state of observing will require me (and perhaps the next observers interested in advocacy) to be ready to take notes at unconventional occasions, such as an impromptu dinner outing when several observers are in town while their vessels are offloading. Outreach and building rapport with peers is important – when colleagues become aware that you are non-judgmentally seeking out their feedback and concerns, you are more likely to receive thoughtful responses about challenging topics. Discretion in recording, storing, and presenting answers is particularly important, especially in knowing when to anonymize particularly sensitive information to protect respondents. While the task of observing requires skills with data entry, marine species identification, and time management to successfully gather fisheries data, "soft skills" such as empathy, patience, humor, and kindness are important for gathering accounts from our peers to support our interests.

The work presented here represents my preliminary data collections and initial forays into advocating for observer interests. Going forward, I will combine regular surveying efforts with outreach to aggregate data for future use in correspondence with stakeholders and at professional meetings. My next survey will further explore quality-of-life and professional issues that are routinely encountered, such as those within working relationships between pairs (or sometimes groups) of observers deployed to a vessel or shoreside processing plant where one observer is the more experienced lead, interactions with providers, and areas where differences in expectations between these groups create conflict. As time goes on, I hope to gain more experience and documentation of the process of inter-observer outreach and advocacy and pass it on to future observers. To secure and preserve adequate compensation and benefits for our difficult, invaluable work, it is important that we observers continue to build solidarity in support of our shared goals and continuing prosperity.

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

### The vulnerability of observers - an evaluation of observer programs welfare and working conditions

**Marcelo Hidalgo[1], Bianca Haas[2], Peter Trott[3]**

**[1]Seafoodmatter, Utrecht, Netherlands**

**[2]Australian National Centre for Ocean Resources and Security, University of Wollongong Innovation Campus, North Wollongong, Australia**

**[3]Fishlistic, Hobart, Australia**

Human rights issues on fishing vessels are increasingly receiving much-needed global attention. However, most focus is directed towards the fishing crew, often ignoring other important workers on board fishing vessels, namely, observers. Due to their specific role as the “eyes and ears” on the water, observers are not covered by any current binding international regulations concerning working standards on board fishing vessels. This leaves them relatively unprotected, besides flag state control. One way flag states address observer welfare and working conditions is through observer programmes. This presentation aims to share assessment results of whether observer programmes fulfil their responsibilities to protect the health, safety, and welfare of observers and their living conditions while onboard fishing vessels. This analysis was done by developing a specific observer benchmark tool for reviewing observer programmes. The results of this research found that, on average, assessed observer programmes demonstrate good performance. Based on the results, four recommendations are provided, including the need to conduct independent reviews of observer programmes. Generally, more research is needed to get a better understanding of geographical hot-spots and observer experiences. Fisheries observers are key to ensuring sustainable fisheries management, and it is imperative that their right to a safe work

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### Coping mechanisms for observers to utilize and reduce the adverse effects isolation has on fisheries observers

**Meghan Miller**

**Southeast Fisheries Observer Program, Galveston, USA**

Working as a fisheries observer presents many challenges while being offshore. Feelings of isolation and loneliness due to language barriers, a sense of being a burden on deck, lack of common interests with fishing crews, and limited connections to the outside world can have both temporary and lasting mental health impacts on observers. Offshore life can be stressful due to many factors including harsh weather, crew dynamics, operational challenges, and personal pressure to succeed as a fisheries observer. Research on relocation studies have shown that reducing or cutting off social ties significantly increases mental

health concerns. For fisheries observers, working offshore often limits social interaction, both physical and technological due to the isolating nature of this career. Coordinators and fisheries programs play a crucial role in addressing these challenges by identifying and implementing strategies to mitigate their impact. Creating self-care strategies prior to deploying observers can help mediate these feelings of seclusion. Engaging and challenging oneself in activities such as mind stimulations, physical activity, utilizing equipment, such as InReach Garmin Devices, can help stay connected to family and friends, and following and maintaining a routine are all self-care strategies that can help reduce mental health concerns while offshore. Methods include distributing a survey throughout each fisheries observer program to previous and present observers. Results indicate which methods are most effective at combating these challenges. In this research, we aim to guide fisheries coordinators different teaching and mentoring strategies for present and future observers to help manage mental health challenges during offshore deployments. Providing guidance, communication, and positive reinforcement can help lessen mental health, alleviate obstacles and foster a more supportive environment for fisheries observers.

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**The lone ranger – life as an observer in the wild Westfjords**

**Hakon Dagur Gudjonsson**

**Fiskistofa, Isafjordur, Iceland**

It has long been the consensus among observers in the Directorate of Fisheries (DoF) that fisheries surveillance in Iceland is lacking means to serve its purpose properly. One example of that is that in the Westfjords of Iceland there is only one inspector who serves the area on a regular basis. With some of the richest fishing grounds in the world in its backyard, the stakes are high. The Westfjords has 13 ports, hundreds of vessels, thousands of tons and millions of dollars landed yearly.

Armed with a Volkswagen, a drone and good intentions, I do my best to do my job properly, but it isn't always easy. In 2 years of working for Fiskistofa (DoF) I have already encountered numerous challenges in my daily job. From huge accidental releases of salmon to gun wielding fishermen, the job produces new challenges every day. In a small community where everyone knows everyone, it's not always black and white.

In this presentation I hope to give you some insight into my life as an observer in the Westfjords both out at sea and on land. The Westfjords is a region known for two things, fishing and fjords.

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**Supporting open communication and observer safety**

**Braven Ledgerwood**

**AIS, Seattle, USA**

Knowledge of vessel and crew history is crucial for observers to make informed decisions and to be advocates for themselves, especially in the North Pacific Observer Program (NPOP) Partial Coverage Category where observers are assigned numerous vessels over a single deployment. Thankfully, protocols are in place to support a working knowledge of vessels of concern (VOCs), which affords observers the right to know previous observer's experiences. These protocols rely heavily on open communication between observers, providers, and NOAA Fisheries. Since it is only known what observers report, it is crucial that observers are supported and understand all resources available to them.

Currently, NPOP Partial Coverage Category observers are informed by their providers of VOCs prior to boarding. These concerns range from observer reported issues of ill-compliance to hostile work environments including harassment. With this prior knowledge, observers can prepare accordingly knowing they may need to be more observant to particular fishing practices or crew behavior. Observers are encouraged to document and report any situations to NOAA Enforcement and their providers, whoever they are most comfortable reporting to. With this information potential consequences for violations can be determined and more importantly steps can be taken to mitigate any current risk to observer safety. These situations may include simple double checking of wheel watch or arrangements being made so that an observer may not have to stay onboard a vessel overnight when only one crew member is present.

With observation of vessels under investigation still being required and crews being ever changing, observer reporting is imperative to provide the most current information possible. Knowledge is power, and when observers know reports do not go unheard and that resources are always available for them, an environment of open communication is bolstered.

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**Observer accommodation standards – PNA Observer Agency**

**Mae Polani[1], David Byrom[2]**

**[1]PNA Observer Agency, Majuro, Marshall Islands**

**[2]MRAG Asia Pacific, Toowong, Australia**

A common cause of frustration for observers operating in the Western and Central Pacific Ocean has historically been the accommodation and working conditions onboard vessels. Shared accommodation with multiple crew, bed bug infestations, lack of privacy or quiet areas to work with no secure locker, smoking in the rooms, lack of potable drinking water and a poor, oily diet were all commonly reported issues. In addition, very few vessels were able to provide accommodation suitable for female observers, limiting opportunities for trips. These problems were all despite obligations on vessel operators under WCPFC CMM 18-05 to provide "… the ROP observer, while onboard the vessel, at no expense to the observer or the ROP observer's provider or government, with food, accommodation, adequate sanitary amenities, and medical facilities of a reasonable standard equivalent to those normally available to an officer onboard the vessel".

In order to address longstanding problems with accommodation, Parties to the Nauru Agreement (PNA) observer programs worked closely together to develop a series of practical minimum standards to better define expectations for observer accommodation and living/working conditions on vessels. In February 2023, following approval by the Parties, the CEO of the PNA Office issued a Circular to all vessels operating in PNA waters advising of the new requirements. This presentation will explore the substantial improvements seen since the Circular as well as outlining a vessel audit system that aims to promote continuous improvement in observer working conditions.

## Open Discussion Session

Sarah Williamson to panel

Q: I'm not sure if you know there is a PCFMAC Committee for the council. Partial coverage came forward. What are the barriers to getting partial coverage involved and what could the community do to better inform them of this role? Do you think having someone fill that position would be beneficial to partial coverage observers?

A: When it comes to that open position, I'd recommend increasing publicity, I think I saw an email about it, but I think it's important to bring it up in weekly meetings given we are out often. Absolutely beneficial to have our voices heard on the council. Most people assume Alaska is all full coverage, but Partial coverage is just as important and very different with smaller vessels and different regulations in terms of standardized sampling spaces and accommodation.

Shane White to Martin Beach

Q: Do you have any advice for preventing observers from feeling intimidated by the offshore environment and keep them from taking the job? My question is more for pre-hire. We recently lost a LGBTQ+ candidate change their mind and I asked them what they felt they would have needed to know to feel more comfortable in the position.

A: I think what I was hearing is the most important observer to observer communication. We try to communicate on one shared document to pass information about issues faced with a boat. Unfortunately, this document had to be taken down due to privacy. Being able to communicate about conditions on the boat does help prepare observer for the boat and the possible issues they might face. Being able to be prepared for the anxiety that could be faced on this vessel allows for better mental health outcomes. This allows for a readiness that can be important for the LGBTQ community.

I think if you have an LGBTQ member you should be honest about the boat culture with possible homo/transphobia behaviors. Honesty is the most important to help protect your candidates. Observers are the best provider of this information and having anonymous comments from other observers could give content to those upcoming observers especially in the LGBTQ. Better preparation for out in the field and to either be ready or move onto the other job with having observers communicate to one another.

Miguel Machete to panel

Q: My priority as a fisheries coordinator is my team. I choose them, I contract them. I receive hundreds of applications every year for the tuna fishery and only select 30 for interview. One of the first questions I ask is "can you handle 6 months in hell" I scare them in a way. I've been an observer and done this for 20 years. Some people are not fit for the position. They are in a phase when they are not psychologically stable enough for the job. The fleet cannot be changed, it is a place of intolerance, especially if they are not catching fish, you know? I think my question for the panel is How do you see this regarding recruitment? How is this possible? I know companies with observers on the vessel that have never had experience. They don't talk to them. I'd like to know your opinion on that.

A: Nicole Santoyo: I think that providing documents that have comments/ thoughts about fishing communities and how the vessel life works from other observers is important. I spoke to many observers, and many feel underprepared for the field. Life out in the field is very different from what is said during in training. Setting up a document with real expectations and experience would be critical in helping observers.

Meghan Miller: Open communication is key. We do hit hard on some of the challenges that you will face out in the field by covering protocols, sampling, and mental preparation part hits hard while out in the field. Connecting prior observers with newer observers is helpful Struggles with LGBTQ community have been reported, we would love to have them be open to current observers so they can assist. Understand what they face and how to help based on their past experiences.
Marcelo Hidalgo: Observer labor rights is something to talk about. Communication is important to address the problems at hand since harassment is high level issue. Proper communication is key to address the problems at hand.

Amelia White to David Byrom
Q: Thank you for bringing these issues to light. Do you ever find conflict arises when an observer brings it to your attention that they are experiencing issues with accommodation.
A: Simple answer is yes, we do. However, the aim is to sort the conflict out before the boat leaves. Have a check list for every trip to make sure that everything is in order. If there are problems found after the checklist, the vessel is held up to address/fix the issue. If a problem is formed between observers and captains, we will remove around our observers. We always have conflict within the program, and we are trying to sort it out the best we can.

Sunny Tellwright to Martin Beach
Q: Thank you to Martin for sharing your personal story, it is incredibly important. What are your plans moving forward? Do you plan to expand your scale? How would you recommend assisting LGBTQ+ observers moving forward?
A: I plan to keep the survey open through the summer and with recent events with NOAA only 35 responses. I would like to have more responses. The responses varied between region to region. Each region has different proprieties and crew views on the LGBTQ community. Observers commented on why they report and why they do not, some were the same and others were different. My hopes are to have a larger paper to report the challenges in reporting harassment in the LGBTQ community in all observer programs throughout the world. Collecting these reasons for not reporting is to help the program out in helping them address the issues.

Mac Hardy to David Byrom
Q: Our boats are similar, with bedbugs and squat toilets. We think there is an ideal set of conditions we would like to have on boats, but there is also the reality that things are going to happen. How much of your training in your region is directed toward self-empowerment in these situations.
A: Pacific Islanders and the program are different, meaning they are good at crisis management and adapting to hard situations. The training is intense with a 6-week training. The observers are used to harsh environment which helps them adapt to the vessel's environment.

Monique Arsenault to David Byrom
Q: In the northeast our groundfish fishery is also under 100% coverage, but we have a safety waiver for those vessels that are known to have issues. It seems like your program is more cut and dry and if these vessels do not address these issues they cannot sail. Is this correct?

A: We operate with 8 different nations and all the vessels are flagged with that nation. The flagged state involved will take control if there is an issue with the vessel. If there is any reporting of observer harassment, the vessel is held up. The observers are well looked after, and we care for their safety.

Teresa Athayde to Marcelo Hidalgo
Q: I was surprised to see 65% positive considering my experience. What kind of observer programs was this survey addressed to? It seemed like it was more regional or trans-shipment observer programs which is highly regulated. From my knowledge National programs would not do as well, particularly in the Indian ocean region.
A: This study was mainly focused within our network. This focused-on tuna in Western, Eastern Pacific and Indian ocean with a couple problems in the Atlantic (not tuna). I have a table that states these results, but in the Atlantic had a lower performance in mental support. Some of the findings: 38% do not know how to swim, 88% recover mentally after a trip, 80% some say they are not fine. Some of the numbers are surprising.

Jason Vestre to Catherine Benedict
Q: What a horrible job observing is. I'm curious how hard it would be to adapt those materials to other programs? How did those materials work out in other places?
A: Observer programs as we know are different. Differences on what they experience within the program leads to adapting the presentation material is essential to assist the observers. The trainers should put themselves in the shoes of others. Reviewing the dynamics of two observers, being a new observer, as well as a prior observer to adapt the presentations to that community. Communication should be open to share experience and have the place to say it. Give the observers the opportunity to ask questions in the open or in private. It takes many hours making it our own with these presentations. You need specialize it for your program.

Siosifa Fukofuka
Comment: adding to what David said, we have 2 training programs training observers from the Pacific region that is 6 weeks long. We have a good group of trainers, all very experienced trainers.

## Poster Presentations - Extended Abstracts

**Advancing observer safety and data integrity with self-powered, tamper-resistant VMS technology**

**Dave James**

**Pinpoint Earth Limited, New Zealand**

Abstract

Fisheries observers play a vital role in sustainable resource management and regulatory compliance; however, they frequently encounter threats to their safety and the accuracy of the data they gather. This paper introduces a new technological solution: a self-powered, tamper-resistant Vessel Monitoring System (VMS) designed to track observer safety and independently ensure data integrity at sea. The system allows for real-time monitoring from shoreside and secure digital record-keeping, providing a transformative approach to observer protection and transparency in fisheries management.

1. Introduction

Fisheries observers are crucial for gathering unbiased data, monitoring compliance with regulations, and promoting sustainable practices in fishing. However, this profession comes with significant risks, such as harassment, violence, suspicious deaths, isolation, mental health challenges, and hazardous working conditions. Additionally, opportunities for tampering, bribery, and a lack of accountability can further undermine the integrity of the data collected. It is essential to address these issues to enhance the credibility and effectiveness of observer programs.

2. Human Observer Challenges

Key risks faced by observers include:

- Personal Safety: Harassment, violence, suspicious deaths, and accidents.
- Mental Health: Isolation and psychological stress from dangerous, remote work environments.
- Data Integrity: Bribery, corruption, and manipulation or deletion of observer reports.
- Systemic Issues: Inadequate safety measures, lack of accountability, and insufficient incident response mechanisms.

3. Pinpoint Earth's Technological Solution

Pinpoint Earth's VMS technology offers a robust, independent solution to these challenges:

A. Self-Powered, Tamper-Resistant VMS Units

- Operate independently of vessel power, communications, and computer systems.
- Simple bolt/clamp-on installation enables rapid deployment on any vessel.

- Anti-tamper features and health diagnostics ensure continuous operation and immediate detection of interference.

B. Real-Time Global Observer Reporting

- Tracks the observer's location and well-being anywhere at sea.
- Incident data (e.g., threats, accidents) is transmitted in real time to shore-based authorities.
- Digital records are stored securely in the cloud, preventing deletion or manipulation by the vessel crew.
- System is not reliant on captain or crew cooperation, ensuring unbiased reporting2.

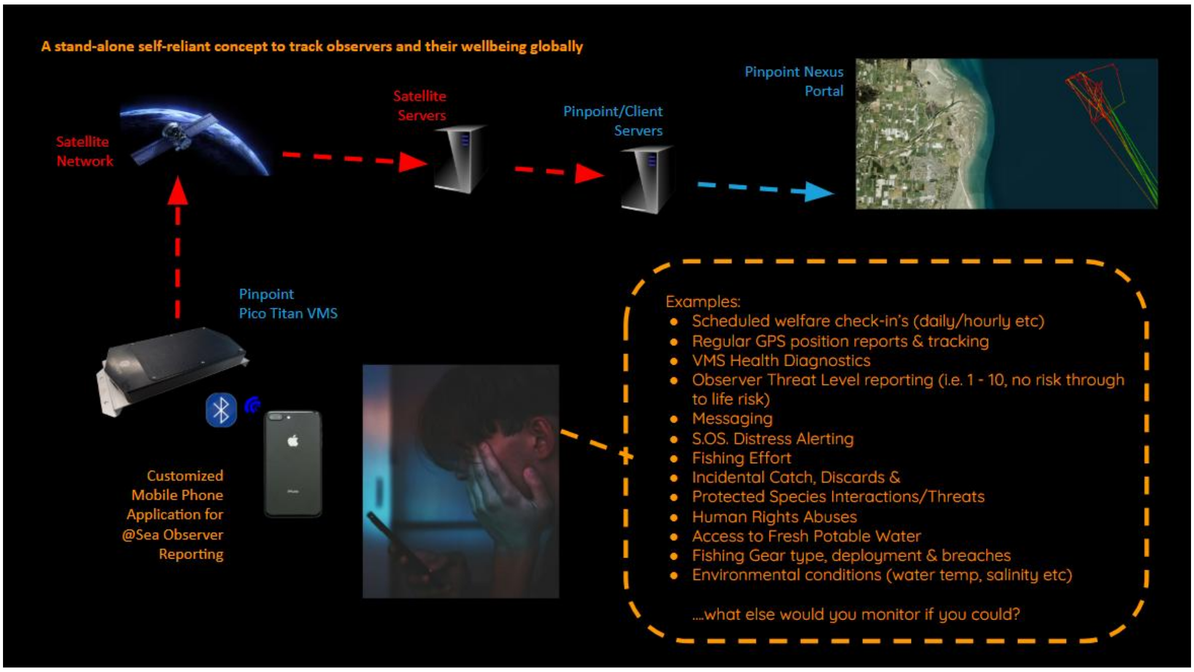


Figure 1: Diagram of VMS unit, showing independent power, tamper detection, and secure data transmission to the cloud.

4. Observer-Friendly Certification and Market Impact

- Vessels that permit the installation and operation of the system can be branded as "Observer Friendly."
- This branding builds consumer trust in ethically sourced seafood and can provide market advantages for compliant operators.
- Enhanced transparency and accountability support regulatory oversight and industry reputation.

5. Data Integrity and Security

- All incident and observer data is encrypted and stored in secure cloud servers.

- Anti-tamper health reporting ensures any interference is immediately flagged and reported.
- Digital records create an immutable audit trail, supporting investigations and regulatory actions.

| Feature | Traditional VMS/ Observer Reporting | Pinpoint Earth Observer VMS |
|---|---|---|
| Power Source | Vessel-dependent | Self-powered (independent) |
| Tamper Detection | Limited | Real-time anti-tamper reporting |
| Data Transmission | Via vessel comms/captain | Direct, secure to shore/cloud |
| Data Integrity | Vulnerable to manipulation | Immutable, cloud-based records |
| Observer Safety Monitoring | Indirect, delayed | Real-time, global |

Table 1: Pinpoint Earth Observer VMS vs Traditional VMS/Observer Reporting

6. Implementation Considerations

- Mobile App: Currently in concept phase; requires further co-development for full observer reporting integration.
- Data Costs: Iridium SBD transmission can be costly, but data compression and encryption can optimise usage.
- Adoption Barriers: Some vessel operators may resist installation; solutions include legal mandates or commercial incentives.
- Cost Factors: Hardware and airtime costs must be addressed for broad adoption, but the benefits to safety and compliance are substantial.

7. Conclusion

Fisheries observers face systemic risks, including harassment (22–38% annual prevalence) and data tampering, exacerbated by reliance on vessel systems.

Pinpoint Earth's self-powered, tamper-resistant VMS technology aligns with industry standards for secure, independent monitoring and significantly advances observer safety and data integrity. Co-development of a real-time Observer reporting mobile application addresses long-standing vulnerabilities in observer programs by providing independent, real-time tracking and secure digital record-keeping. Adopting this technology can transform safety standards, enhance regulatory compliance, and build trust in global seafood supply chains.

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**An exploration of barriers to reporting victim violations for American fisheries observers**


**Alyssa Lambert[1], Sarah Williamson[2]**

**[1]NAVFAC Marianas as a Marine Biologist**

**[2]North Pacific Observer, Saltwater Inc.**


Introduction

Fisheries observing is an integral part of fisheries management but comes with many risks to the wellbeing of those who perform the job. Within the Magnuson-Stevens Fishery Conservation and Management Act, the legal framework that justifies the deployment of fisheries observers in the U.S., there are stipulations regarding how observers are treated. It is unlawful "to forcibly assault, resist, oppose, impede, intimidate, sexually harass, bribe, or interfere with any observer on a vessel" (MSA, 16 U.S.C. 1857 §307 1L). Reported violations of this subsection are investigated by the Office of Law Enforcement and can come with hefty fines if there is enough evidence to support the claim. Still, a recent study by Jerou et al. *(*2025) has found that many of these victim violations go unreported by observers for numerous reasons. This would seemingly be against their best interest, given that support from the program is their primary avenue for achieving justice. Our survey sought to illuminate the complex motivations victims may have for making this choice and offer them a means to openly express what they believed could help those experiencing harassment in the field.

<u>Methods and Results</u>

This voluntary, anonymous survey was sent out by participating provider companies to their at-sea observers. The questions fall into three categories: demographic data, harassment circumstances, and free response questions. Once the survey period ended, statistical analysis was performed to identify potential relationships between variables that may identify barriers to reporting harassment. Observers had the option to omit answers depending on their comfort levels. This study experienced limitations due to the voluntary option for observer providers to inform their observers about this survey. Social media platforms were also utilized to provide this survey directly to observers.

Our survey results yielded a total of 87 respondents across all the major US fisheries observer programs. Demographic questions covered age range, gender identity, ethnicity, experience, average sea days per year, and whether the observer was still active. 60.9% of responses came from individuals in the North Pacific Observer Program, with individuals observing in multiple programs (17.1%), and the West Coast Program (14.9%) making up the next two largest cohorts. Women made up 51.7% of respondents, while 40.2% identified as men, 3.4% identified as nonbinary, 3.4% identified as transgender, and 1.1% identified as genderqueer. About half of the respondents (56.3%) had 3 or fewer years of experience observing. A significant relationship between gender identity and identity of the antagonist in uncomfortable situations ($p<0.001$), as well as gender identity and the identity of the perpetrator of harassment ($p<0.001$). For both questions those who self-identified as women largely reported problems with crewmembers. Observers were also asked what they believed were the biggest barriers to reporting harassment (open-ended question), and what they believed were the best options for offering observers support (supplied answers and open-ended). The tables below summarize their responses.

| **Most Influential Barriers to Reporting Harassment** | | |
|---|---|---|
| **Type of Barrier Mentioned** | **Count** | **Percent** |
| Embarrassment | 6 | 8.33% |
| Retaliation | 29 | 40.28% |
| Failure to Take Action (by Provider, NMFS, OLE) | 22 | 30.56% |
| Minimization of Experiences | 8 | 11.11% |
| Length of Process | 9 | 12.50% |
| Confusion About Reporting Process | 2 | 2.78% |

| | | |
|---|---|---|
| Isolation | 4 | 5.56% |
| Psychological Distress | 2 | 2.78% |
| Desensitization | 3 | 4.17% |
| Unsure if Situation was Harassment | 3 | 4.17% |
| Lack of Unbiased Support | 2 | 2.78% |
| Social Ramifications | 6 | 8.33% |
| Unprofessional Response from Superiors | 2 | 2.78% |
| No Barriers to Harassment | 2 | 2.78% |

*Table 1: Most Influential Barriers to Harassment. Participants were able to list more than one barrier.*

| Participant's Opinions of Best Options for Support | | | |
|---|---|---|---|
| | Avenues for Support | Count | Percent |
| Supplied Options | Peer-Based Mentorship | 12 | 13.79% |
| | Better Access to Therapy in the Field | 31 | 35.63% |
| | Support Groups After Contract | 12 | 13.79% |
| | All of the Above | 4 | 4.60% |
| | No Opinion | 12 | 13.79% |
| Write in Responses | All of the above, And Immediate Reassignment | 1 | 1.15% |
| | Access to Anonymous Reporting | 2 | 2.30% |
| | Actionable Consequences for Perpetrators of Harassment | 1 | 1.15% |
| | Additional Oversight for Providers/Staff | 1 | 1.15% |
| | Better Accountability from Agency | 5 | 5.75% |
| | Crisis/Sensitivity Training for Providers/Staff | 2 | 2.30% |
| | Immediate Assignment Change | 1 | 1.15% |
| | More Communication and Support Between and Among Observers | 1 | 1.15% |
| | Speak with Captain | 1 | 1.15% |
| | Decertification for Fraternization | 1 | 1.15% |

*Table 2: Options for Increased Support Preferred by Survey Participants*

## Discussion

Observers who experienced uncomfortable interactions or harassment while on contract engaged in several different behaviors to try to minimize risk of reoccurrence or escalation. These included but weren't limited to avoiding common spaces, eating in their office instead of the galley, wearing headphones to be less accessible, and avoiding certain topics or people. There was notable, but not significant differences between strategies used by observers based on gender and program. Many respondents who experienced harassment or uncomfortable interactions reported utilizing at least one of these strategies which is indicative of the larger mental load observers must carry following these incidents.

Responses to the survey highlighted the need for better support in the field. Many individuals shared personal anecdotes of instances where they felt harassed but did not feel they had the resources to immediately address the issue without experiencing additional hardship. These additional stressors came in many forms, but fear of retaliation was the most frequently cited reason, with 26 respondents mentioning it. Other reasons included but were not limited to disillusionment with the framework for justice, embarrassment, and fear of being disbelieved. Through this survey, observers have demonstrated that choosing not to report is a complex issue. Many fear retaliation if they report their experiences, and almost all individuals who have experienced problematic behavior in this job have engaged in some sort of avoidance behavior. These responses, when viewed together, highlight the fact that ultimately any response from the Agency or the Provider will be retroactive, sometimes by several months. During this time, the observer must cope with the reality of the experience they are living, and as a result expend considerable energy to try to minimize their discomfort. Additionally, regulations regarding observer harassment are interpreted narrowly which leaves many loopholes for harassers to exploit. Observers must carefully weigh if risking their relationship with crew, their provider, or their partner is worthwhile when doing so has no guarantee of a favorable outcome.

One of the final survey questions addressed what observers thought would be most helpful to them when they experience harassment while on assignment or in company housing. Multiple choices were provided along with the option to write in responses. Responses varied greatly by program and as such solutions should be tailored to address issues specific to each program. The most frequently cited improvement observers believe could be made is better access to therapy in the field. In regions such as the North Pacific, new internet providers can provide highspeed internet at sea and have gained popularity amongst fishing companies; this may offer an avenue for accessing telehealth services in locations where therapists are few and far between. However, some respondents voiced concerns that a standard therapist may not have enough familiarity with this extremely niche vocation to adequately support their clients. Instead, they believed better sensitivity and crisis training to NMFS and provider staff may be a more direct means of aiding observers in need of assistance. Alternatively, many others also expressed interest in a peer-based mentorship program, which has also been previously proposed by Sarah Williamson during the IFOMC in 2023 (Williamson, S. 2023). This would allow observers to help each other in a more streamlined consistent fashion beyond simple social venting sessions. With many respondents also citing a mistrust in the regulatory bodies that oversee the programs, this solution offers a more organic means of support.

There were some challenges in the analysis of this survey because many respondents reported serving in multiple observer programs. As such, it was difficult to determine which program the respondents with multiple affiliations were attributing their negative experiences to. However, observers that worked in single programs demonstrated that each program contends with different forms of harassment because of regional differences. Other demographic data that tended to be more "fixed" was far simpler to compare responses with. This survey also was the subject of self-selection bias, and as such those who have had negative experiences may have been more inclined to participate. The authors also both were affiliated with the North Pacific program, which likely contributed to the high turnout of responses from the region. In conclusion, barriers with reporting harassment are complex and difficult to quantify. Each year new barriers emerge and communication with observers is crucial to help address this evolving issue. To expand upon this work and continue the conversation surrounding observer welfare, the authors have launched a new survey targeted at international fisheries observer programs. Interested parties may visit the link below to access the survey. The website also contains additional information about the authors and the original survey.

New Survey Link: https://sites.google.com/view/lambertandwilliamsonifomc25/surveys

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

### Beacon management for observer programs: reducing risk and improving emergency readiness

**Eric Brasseur**

**Pacific States Marine Fisheries Commission, Newport, USA. NOAA/NMFS/NWFSC, Seattle, USA**

This community of professionals has been dedicated to the advancement of collecting information to benefit the management of fisheries around the world. The advancement of technology has expanded the flexibility and availability of EPIRB's as Personal Locator Beacons. Providing observers with a personal emergency rescue beacon is something that every program should make a standard practice to help mitigate the risk inherent to working at sea. When an observer program issues a personal rescue beacon, it takes on a critical responsibility for that individual's safety. Effective beacon registration, management, and assignment significantly influence emergency response efficiency. A well-structured system ensures that accurate information reaches the Coast Guard promptly, reducing response time and minimizing the risk of unnecessary or delayed actions.

It is imperative for Observer Programs to establish clear, easy to follow protocols for identifying the individual behind an activated beacon, their vessel, and available points of contact. Strategies range from a universal registration system with shared emergency contacts to individual beacon assignments with customized contact details. Each approach carries trade-offs in terms of efficiency, reliability, and accessibility.

This presentation will explore best practices and lessons learned based on the United States 406 MHz Beacon Registration system for managing emergency beacons, establishing and using emergency action plans, addressing false activations, threats to observer safety, and vessel emergencies. Attendees will gain insights into building a beacon management system tailored to their program's needs, ensuring a swift and appropriate response to emergencies.

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**Innovative readiness: managing risks and ensuring safety in observing**

**Rulon Hardy**

**Fisheries Immersed Sciences Hawaii, Inc., Honolulu, USA. Pacific Islands Regional Observer Program, Honolulu, USA**

To ensure situational readiness and safety in the dynamic and challenging environments where observers work, it is imperative that they are deployed with the right training, tools, and support to accomplish the goals of their programs while safeguarding mental and physical health in unpredictable conditions.

In this session, we explore the issues that observers encounter by examining the relationship between observers and their program in the Pacific Islands Region. Drawing from the direct experiences of observers, program providers, and fishery service professionals, we highlight the incumbent task of programs in providing innovative solutions to these issues to better understand how programs evolve and adapt to support observers, reduce risks, ensure safety, and instill readiness in the field.

We examine the importance of training and manual protocols, discussing how syllabi are informed, revised, and updated by feedback loops via observer experiences. These data inform program-wide adaptations that lead to updated protocols, implementation of policies, and the adoption of new equipment which serve to mitigate the novel and inherent risks that observers face in their profession.

We discuss the important role that new and existing technologies like satellite texting and Wi-Fi play in maintaining safety by providing in-situ response to emergent situations, extending connectivity to in-season advisors, friends and family, thereby minimizing burnout and other isolation related fatigues.

Inspecting specific cases where new technologies and protocols were implemented in response to challenges and risks that observers reported, we discuss the successes and lessons learned by innovating components of observer programs

to adapt to the unique and fluid landscapes where they operate.

With robust and regionally tailored training, protocols, and technology, observer programs can provide specific support and tools to reduce risks, protect health and wellbeing, and enhance the safety of their observers in and out of deployment.

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**Supporting open communication and observer safety**

**Braven Ledgerwood**

**AIS, Seattle, USA**

Knowledge of vessel and crew history is crucial for observers to make informed decisions and to be advocates for themselves, especially in the North Pacific Observer Program (NPOP) Partial Coverage Category where observers are assigned numerous vessels over a single deployment. Thankfully, protocols are in place to support a working knowledge of vessels of concern (VOCs), which affords observers the right to know previous observer's experiences. These protocols rely heavily on open communication between observers, providers, and NOAA Fisheries. Since it is only known what observers report, it is crucial that observers are supported and understand all resources available to them.

Currently, NPOP Partial Coverage Category observers are informed by their providers of VOCs prior to boarding. These concerns range from observer reported issues of ill-compliance to hostile work environments including harassment. With this prior knowledge, observers can prepare accordingly knowing they may need to be more observant to particular fishing practices or crew behavior. Observers are encouraged to document and report any situations to NOAA Enforcement and their providers, whoever they are most comfortable reporting to. With this information potential consequences for violations can be

determined and more importantly steps can be taken to mitigate any current risk to observer safety. These situations may include simple double checking of wheel watch or arrangements being made so that an observer may not have to stay onboard a vessel overnight when only one crew member is present.

With observation of vessels under investigation still being required and crews being ever changing, observer reporting is imperative to provide the most current information possible. Knowledge is power, and when observers know reports do not go unheard and that resources are always available for them, an environment of open communication is bolstered.

## Session 9. Implementing and managing EM programs

**Leader: Luis Cocas**

EM technology has been around for over two decades and there is now a width of experience in many agencies and companies responsible for fishery monitoring. Issues such as interoperability and applicability to other fisheries, data confidentiality, and funding models were examined in this session to identify “best-practices” in established EM programs.

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## Oral Presentations - Extended Abstracts

### Implementing and managing Electronic Monitoring programs: a case study from the Indian Ocean

**Carolina Cavero[1]; Manuel Menchaca[2]; Gonzalo Legorburu[3]**

**[1]EM Consultant, Satlink EM Department**

**[2]Head of EM, Satlink**

**[3]Head of Digital Observer Services (DOS)**

Introduction

Electronic Monitoring (EM) is increasingly recognized as a key tool for strengthening fisheries management, compliance, and data transparency. Its successful adoption requires careful design of technical frameworks, regulatory integration, and robust stakeholder engagement at national and regional levels. In the Indian Ocean region, the Indian Ocean Tuna Commission (IOTC) has recently adopted minimum standards for EM systems under Resolution 23/08, marking a major step forward for regional harmonization (IOTC, 2023).

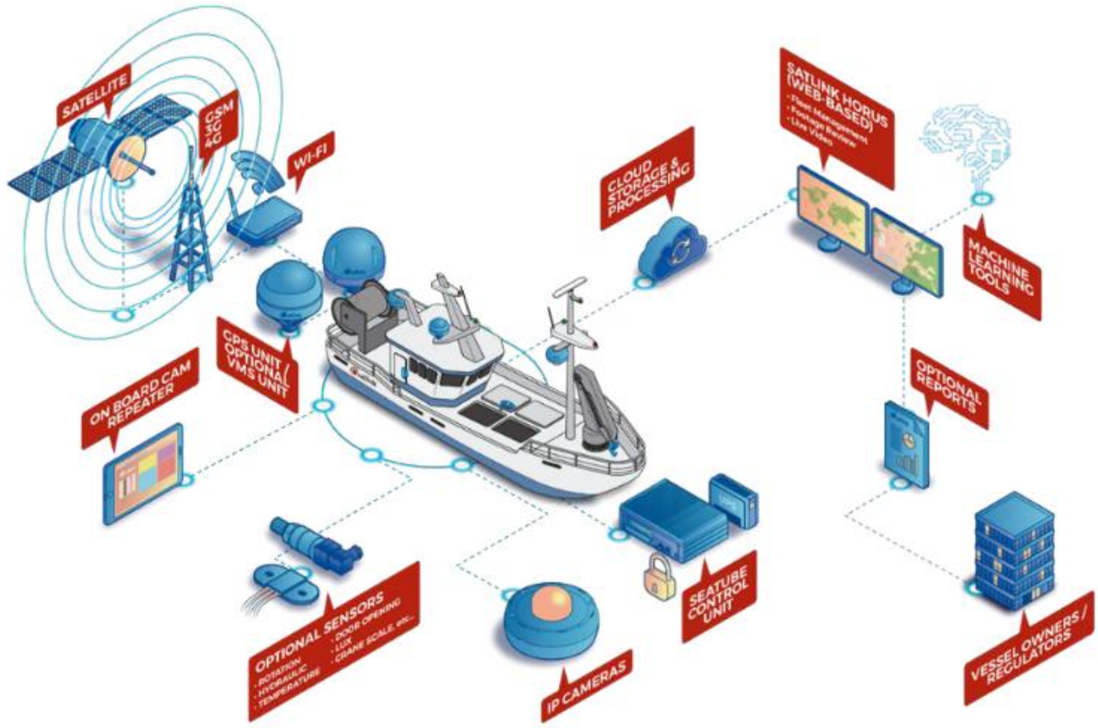
This extended abstract describes a case study of the implementation of a government-led EM program in the Indian Ocean. The program began as a pilot in 2018 with NGO support and has evolved into a fully integrated component of the national fisheries’ regulatory framework, supported by Satlink as the technology provider.

Methodology

The initial pilot focused on purse seine vessels, co-designed with government authorities and NGOs to test EM feasibility and inform regulatory development. The process included:

- Defining monitoring objectives and fleet coverage
- Installing EM systems tailored to gear-specific needs
- Training government officials, vessel operators, and local technicians
- Developing local manufacturing, logistics, and technical support capacities
- Establishing a national data review center operated by trained government staff

Data management protocols addressed security, confidentiality, and access rights. The regulation is progressively to be expanded to additional fleets (e.g., longliners, gillnetters) as technical, regulatory, and institutional capacities grew.




*Copyright Satlink – Electronic monitoring architecture*

<u>Results and Discussion</u>

By 2022, the program had successfully transitioned from a pilot to a fully operational government-led initiative, with EM requirements formally embedded in national fisheries regulations. The project demonstrated the ability to integrate EM technology across purse seiner fleet.

Key achievements include:

- **Nationwide EM coverage of purse seine vessels**. The fleet is now systematically monitored, with recorded data enabling verification of fishing effort, bycatch handling, and compliance with area/time closures and FAD management measures.
- **Operational data review capacity**. A national data review center was established and staffed with trained personnel, enabling independent review of EM footage and sensor data. Quality assurance was reinforced through periodic audits and technical assistance from the technology partner.
- **Evidence-based compliance and fisheries management**. The program generated verifiable data that contributed to improved reporting to regional fisheries management organizations (RFMOs) and national compliance frameworks, enhancing the country's reputation in international forums.
- Support to scientific data collection on catch composition and non-target species interactions.

The EM program also supported scientific data collection by providing high-resolution information on fishing operations, catch composition, and interactions with non-target species (i.e., sharks, turtles, and seabirds).

Challenges and lessons learned:

- Data volume management. One of the most significant challenges was handling and storing large video and sensor datasets. The adoption of stratified review protocols and targeted sampling strategies helped improve efficiency.
- Stakeholder engagement. Continued dialogue with vessel owners, captains, and crew was essential to securing buy-in, especially as the program expanded to new fleet segments.
- Technological upgrades. The integration of improved data transmission systems (including satellite-based options) enabling near-real-time reporting of key events, such as FAD deployments and by-catch handling.

Conclusions and Recommendations for a Next-Generation EM Approach

The case study underlines the viability of scaling EM from pilot to full implementation aligned with IOTC standards. To shift EM to a new approach, future programs should adopt next generation features that address operational challenges and enhance efficiency:

First Generation of EM Systems

- Manual extraction of storage devices required
- 100% human review of all video footage
- Data stored only on physical devices onboard vessels
- High workload for analysts and slow turnaround times for data processing and reporting

Next Generation of EM Systems

- Remote data transfer via 4G or satellite connections
- AI-assisted analysis and event-based review to reduce manual effort
- Cloud-based, centralized data management for scalable and secure storage
- Scalable workflows and near-real-time analysis using AI/ML

A phased, adaptive deployment strategy, combined with strong institutional partnerships, local capacity building, and technological upgrades, is essential to realizing the benefits of this next-generation EM model. These innovations are key to aligning national programs with regional EM standards and ensuring long-term sustainability in fisheries management.

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**Stakeholder perspectives on Electronic Monitoring in Norwegian fisheries**

**Maël Manuel Bueno**

**Norwegian College of Fisheries Science, UiT The Arctic University of Norway, Tromsø, Norway**

Introduction

One of the key recommendations from the 2019 Official Norwegian Report *The Fisheries Control of the Future* is the integration of technological solutions in monitoring, control, and surveillance (MCS) programs. The overarching ambition is to move away from unverifiable, self-reported catch data and toward proactive, automated monitoring starting as close as possible to the point of harvest so as to better detect and act on unreported fishing. CatchID, developed by the Norwegian Directorate of Fisheries, represents a central step in operationalizing this compliance-by-design vision. This program aims to use machine vision and artificial intelligence (AI) to automatically register all harvested marine resources in real time, forming the foundation for a "fully integrated documentation system". While the term Electronic Monitoring (EM) is not commonly used in the Norwegian context, these developments align closely with global trends toward the digitalization of MCS systems. EM-type technologies are seen as having the potential to improve decision-making, regulatory enforcement, scientific assessments, and market access (Orofino et al., 2023; Probst, 2020; Bartholomew et al., 2018).

Yet, the scaling-up of EM approaches in Norway has already been met with skepticism and resistance, particularly from the small-scale fleet (Ahlquist et al., 2025). Fisheries management is a relational and dynamic process. Its effectiveness depends not only on regulatory design or technological capacity, but also on trust among stakeholders and the perceived legitimacy of institutions (Tirrell, 2017; Johnsen & Eliasen, 2011). This study posits that the integration of EM technologies reconfigures the socio-technical system that is fisheries. The outcomes of implementation will likely depend on how the dynamics of fisheries governance are renegotiated in response to this. The objective of this research is to examine this process by systematically assessing the social and ethical dimensions surrounding EM uptake in Norwegian fisheries.

Methodology

The research builds on David Wright's (2011) Ethical Impact Assessment (EIA) framework, originally developed to identify and mitigate ethical risks in the deployment of information technologies. This study contributes to the field by adapting this framework to the contemporary technological landscape and structures of resource governance. The framework is further refined by integrating perspectives from conflict analysis and governmentality theory.

Key stakeholders in Norwegian fisheries were identified and grouped into ten categories. Data collection includes document analysis and semi-structured interviews. At the time of the IFOMC, a review was conducted of 72 official documents and 132 news articles related to EM in the Norwegian context, and ten interviews were completed and transcribed: four with fishers (aged 50+, vessels 11–15 meters, mixed fisheries), three with representatives from the Norwegian Fishermen's Association and the Norwegian Coastal Fishermen's Association, and three with officials from the Directorate of Fisheries and the Ministry of Trade, Industry and Fisheries. Interview questions address a range of ethical and governance themes such as autonomy, beneficence, non-maleficence, privacy, justice, and collaboration. Transcripts are analyzed in NVivo 15 using a combination of inductive and deductive coding strategies.

The findings presented below are preliminary and simplified to fit the scope and format of this abstract. The four stakeholder categories are notably consolidated into two broader groups: small-scale fishers and fisheries authorities. The following section highlights recurring themes supported by illustrative quotes, with interpretations informed by document analysis.

Findings and Discussion

*Table 1: Diverging stakeholder perspectives on EM implementation*

| **Aspect** | **Regulatory authorities** | **Fishers and fisher organizations** |
|---|---|---|
| What and where to monitor | Prioritize at-sea monitoring (e.g., via CatchID) to collect data early in the value chain. | Emphasize dockside monitoring (e.g., automatic scales), where risk of misreporting is seen as greatest. |
| Purpose of EM | Tool for compliance, scientific assessment, and market incentives. | Skeptical about effectiveness and EM seen as punitive surveillance. |
| Costs | Responsibility of fishers as they receive a license to harvest a public resource. | Seen as disproportionately impacting small-scale fishers; should be publicly funded if EM serves management goals. |
| Trust in technology | A means to reduce human error, level the playing field, and ease bureaucratic burden. | Penalization due to glitches or estimation errors: *"It's like punishing you for not getting seven numbers right in the lottery"*. |

| | | |
|---|---|---|
| Trust in each other | Feel misunderstood: *"We don't want a surveillance society. We just want data on the catch"*. | Feel criminalized: *"You feel accused. It's demotivating."* |
| Timeline | Acknowledgement of communication issues. | Frustration over unclear rollout: *"It comes as a surprise every time, like Christmas Eve for the unprepared"*. |
| Internal diversity | *"[T]he younger generation is the answer"* but *"they're afraid of the choir of complaints"*. | No unified fisher perspective. Tech-savvy or younger fishers may support EM but feel silenced by peer pressure. |

These points of tension confirm the hypothesis that the integration, or even its prospect, of EM approaches is reconfiguring the dynamics of fisheries governance. For these technologies to actually realize their intended benefits, such renegotiation must build on areas of consensus, where trust, acceptance, and institutional legitimacy can be strengthened.

One such area is the confusion surrounding EM and REM terminology. Both the function and purposes of these technologies are interpreted and communicated differently across stakeholder groups. This conceptual ambiguity might weaken the conditions for dialogue, and ultimately erodes trust. It also creates operational challenges for fishers operating across multiple regulatory regimes. As one authority put it: *"When you have different objectives, different approaches, perspectives, it's just everything put into everything. It's very confusing and not always helpful to actually move the discussion ahead"*. A fisher echoed this concern: *"We need to look at the map from the same direction before we can find the way forward"*.

Another point of agreement relates to conditions for EM use and recognition of its benefits. Unlike in the US or EU, where EM often aims for full operational footage – including of crew –, Norwegian stakeholders currently reject CCTV-style video surveillance of individuals onboard, citing privacy concerns and limited added value of the data collected. Instead, support centers on catch-focused camera monitoring (e.g., CatchID). There is also shared backing for dockside monitoring, with automatic scales and fixed cameras, as well as for enhancing the monitoring of recreational fisheries. Beyond compliance, both fishers and authorities acknowledge that EM can contribute to broader governance objectives, such as spatial planning (e.g., mitigating conflicts with offshore wind farms), maritime safety, and market or environmental certification.

Finally, there is strong agreement on the shortcomings of the current implementation process. Both groups recognize misaligned timelines and expectations between science, policy, enforcement, and the daily fishing operations. Still, there is shared support for a phased and flexible rollout, starting with high-risk vessels and potentially including proportionate financial support based on fleet earning capacity. Crucially, all parties emphasize the need for better communication and dialogue. Fishers describe feeling unusually excluded and confused by regulation design. Authorities recognize difficulties in clearly conveying both their ambitions and policy changes. In the absence of clear communication, rumors and misinformation have taken hold, which further erode trust. These are textbook conditions for conflict escalation.

## Conclusion

The integration of EM approaches into MCS reconfigures how the structures of fisheries governance are understood and enacted by stakeholders. What constitutes a "successful" EM implementation varies by context, and so do the conditions required to achieve it. The ethical impact assessment (EIA) proposed by this study offers a framework to understand stakeholder perspectives on EM integration, both in relation to one another and within a broader governance system shaped by interdependent relationships. This approach aims to clarify the conditions under which EM can be implemented in ways that realize its intended benefits while maintaining, or even improving, relationships between stakeholders. In the Norwegian context, this will likely require co-designed rollout strategies, targeted support for small-scale fishers, clear and consistent standards, and transparent communication about EM's purpose and limitations. These early findings represent the initial phase of a PhD project. Interviews with a broader range of stakeholders are ongoing. A comparative case study in Iceland is also planned to refine the EIA framework and explore how relational dynamics shape EM uptake in other governance settings.

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

**Supporting global EM uptake via the Global Electronic Monitoring Accelerator**

**Alvaro Teran**

**The Nature Conservancy, San Jose, Costa Rica**

Over the past decade, The Nature Conservancy (TNC) has supported electronic monitoring (EM) pilot projects in over 18 geographies, advanced innovative technological solutions, contributed to the adoption of the first Regional Fisheries Management Organization (RFMO) EM standards, as well as secured 100% monitoring commitments from seven countries, two global retailers, and the world's largest tuna supplier.

During this time, TNC has developed the expertise, tools, and strategic approaches necessary for creating durable EM programs. However, we recognize that enabling conditions and local situations are different for each country and/or project. That's why we are focused harnessing our lessons learned to support broader knowledge sharing that can improve and streamline global EM uptake EM.

To do this, TNC is launching the Global Electronic Monitoring Accelerator (GEMA), aiming to support fishery managers, industry players and governments with EM program design processes that can best meet science, compliance, and commercial needs. GEMA will equip stakeholders with advisory services, implementation products, and innovative technological solutions. Our goal is to scale EM globally by providing stakeholders with the technical assistance that they need to enable 100% EM coverage across industrial fishing vessels.

During our presentation, we will discuss the main EM implementation challenges that government and industry partners face and we will discuss how the tools and approaches housed under GEMA can best support these stakeholders. Specifically, we will focus on GEMA's four main tools/approaches for advancing EM programs: a) Technical/Operational; b) Financial; c) Scientific; and d) Markets. To help share our vision and story, we will review past case studies, including our work with Chile, to highlight how these tools and approaches can lead to feasible and effective country and industry-wide EM implementation.

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**Electronic Monitoring in the Chilean industrial purse seine fleet: advances and challenges**

**Javiera Fuentevilla[1], Raúl Saa[1], Luis Cocas[2]**

**[1]Servicio Nacional de Pesca y Acuicultura, Valparaíso, Chile**

**[2]Subsecretaría de Pesca y Acuicultura, Valparaíso, Chile**

Electronic monitoring through Image Recording Devices (DRI) has been a key tool for enforcing fisheries regulations in Chile's industrial fleet. This study analyzes 92 fishing sets conducted in 2023 by purse seine vessels operating in regions XV, I, and II, with the objective of assessing marine mammal and sea turtle bycatch, as well as compliance with fisheries regulations.

The results indicate that the implementation of DRI has led to improvements in the reporting of bycatch in the Electronic Fishing Logbook (BEP). Specifically, an increase in recorded interactions with South American sea lions (*Otaria flavescens*) and loggerhead turtles (*Caretta caretta*) was observed, along with greater adherence to the bycatch mitigation protocols implemented in 2022. However, the comparison between BEP and DRI records suggests that event reporting remains lower than the actual bycatch observed in the video footage.

Despite these advances, technical challenges were identified, such as camera placement on board, the presence of blind spots, and variable image quality, which may limit the

detection of bycatch as well as the proper documentation of other non-target species. Additionally, the need to strengthen human and technological resources was highlighted to expedite video analysis and improve the effectiveness of the current monitoring system.

This study underscores the importance of electronic monitoring in fisheries management and highlights opportunities to optimize its implementation, promoting more efficient enforcement and compliance with environmental regulations in the northern Chilean purse seine fishery.

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**Using EM data in stock assessment**

**Kirsten Håkansson, Marie Storr-Paulsen**

**DTU Aqua, Lyngby, Denmark**

The Danish bottom trawl fishery in Kattegat is one of the most important fisheries in the inner Danish waters. These days the fishery mainly targets Norway lobster with by-catches of fish.

Since 2021 the Danish Agricultural and Fisheries Agency has monitored the fishery with EM, including camera. All trips are monitored, a fraction of the trips per vessel are randomly selected for review and others are selected based on a risk assessment. During the review all specimens of Atlantic cod, Haddock, Hake, Saithe and Sole have been annotated with length measurements. Further, it has been noted if the specimens are landed or discarded. The number of reviewed vessels has increased from 11 to 71 since 2021.

In parallel, Denmark has maintained scientific sampling programs covering the same fishery. A) An at-sea observer program collecting data for estimating the amount of discard and below minimum size landings (BMS), and associated biology, and B) an on-shore program collecting biological samples for the landings.

The Danish commercial figures used for input to ICES stock assessment are based on the amounts reported in sale slips and landing declaration or estimated by the means of the scientific sampling programs. Here we explore the feasibility of using the data from the EM program in the stock assessment of Atlantic cod in Kattegat, where the majority of the Danish landings in 2023 and 2024 were taken by the EM fleet. The analysis includes 1) compare and evaluate the data source for discard and below minimum landing size (BMS), 2) compare and evaluate the source for length and age distributions from the two different sources, and 3) We will touch upon the minimum data requirements for utilizing EM data from a control agency in stock assessments

## Open Discussion Session

Miguel Nuevo to Carolina Cavero
Q: Can you elaborate on cost of transition from older to newer generations of EM on vessels?
A: When new projects implement this new technology, the transition to that technology and its initial phases are the most expensive to implement. Satellite transmission and hardware are expensive in these initial phases, as well as sensors and their maintenance. Developing machine learning and training the AI models is also a large startup cost but is essential, and an effective long-term investment for EM programs, saving money as the program grows past the initial implementations.

Miguel Nuevo to Alvaro Teran and Maël Manuel Bueno
Q: How do you get buy-in and acceptance from industry for the GEMA (Global Electronic Monitoring Accelerator), and which part of the process do you put the most effort?
A: Alvaro Teran: A clear win from an industry perspective is needed for their acceptance. The GEMA's four main approaches (technical/operational, financial, scientific, and markets) are strong focal points. Communicating the feasibility of EM is essential. Pushing EM on industrial fleets is likely easier than small vessels due to their higher capital and their higher pressure from RFMOs (Regional Fisheries Management Organizations). Smaller vessel owners need more of an incentive, clear incentives, or they simply will not be likely to accept. Communicating EM as being easier than observers may work, as well as informing the industry of how EM can still contribute to MSC certification audits can be a big selling point.
Maël Manuel Bueno: Agrees with Alvaro. The communication of transparent, realistic implementation timelines helps build trust and confidence in EM, the industry does not like uncertainty. They need tangible benefits and clear communication of incentives and goals. Communication of definitions in EM can help fishers, as they may sometimes be difficult to understand.

Lauren Clayton to Kirsten Håkansson
Q: Were the measurements within the stock assessment EM annotated by humans or AI, or a combination of the two? When it comes to the trips, how was the EM footage they selected and reviewed? Did you review all the trips or just a sample?
A: Yes, it was annotated by humans. Around 5% of randomly selected trips per vessel were reviewed, and others were selected based on a risk assessment in the Danish bottom trawl fishery in Kattegat.

Lauren Trainor to Javiera Fuentevilla
Q: Do you think logbooks showed less recorded interactions due to the industry knowing it would be picked up by EM on that trip? What's the value of logging those interactions when the footage of that trip exists in the EM recording?
A: The crew likely didn't care about the EM presence, and there likely wasn't a significant difference between the EM data and logbook data on the same trip. Logbook recording is continually improved to report fish and bycatch, but EM helps fill gaps of species abundance. There is a bit of fear with EM presence of getting punished for certain fisheries practices or mistakes. AI implementation will help mitigate these, but until then, the logbook system helps validate some EM footage and lowers cases of omitted or missed trip data. Logbook data is still the primary source of the fishing data but can be cross-referenced with a sample

of EM footage for compliance or quality assurance, but likely won't be compared one-to-one for sake of time and cost of review.

Sævar Guðmundsson to Javiera Fuentevilla
Q: "How did you get permission from the ship operators and fishers to have recording EM cameras on their vessels? Was it difficult and what were their reactions to the presence of EM cameras?
A: Permission isn't needed to have this equipment onboard, it has been a lawful requirement since 2012. The reaction is mixed, some don't like the system, some are indifferent. There is generally some good acceptance due to certification benefits with EM implementation. Robust EM datasets in Chile over the last four years have helped incorporate risk assessment in EM, standardization decreases cost over time as risk assessments can be adjusted on a vessel-by-vessel basis.

Njáll Ragnarsson to Alvaro Teran
Q: How do you get other countries to participate in EM pilot studies? What incentives have you found to be helpful?
A: Maël Manuel Bueno: Main view of EM is opposed to for older generations and in favour of in younger. However, younger generations may be less likely to voice this view in future meetings with older generations present, since the older generations have more fisheries knowledge and impose the social structure. Interviewing fishers individually is more costly, but more effective at getting real EM opinions. Comparing fishers among each other for market benefits may help push. A clear goal is a primary incentive. In small-scale fisheries, EM glitches are a fear. There's less of a margin for error in these fisheries, but they do not like this and they typically have a negative response to changing technology in general. Clear communication on the failures of the system and trouble-shooting measures would be beneficial.
Alvaro Teran: Certifications in MSC help audits easier in later EM implementations, and thus the process is less intrusive and timely on fishers in the long-run. Efficiency and cost of human observers can be very expensive, and a fleet manager's perspective may want to opt for EM with this in consideration. Certifying good behaviour, EM has helped reduce accidents and help provide evidence for claims in insurance contexts, and has been shown to prove or disprove certain safety malpractices. For example, a deckhand arguing with a captain that he was wearing helmet during accident when the EM footage revealed he was not. This can be communicated as an incentive for fishers.

Madeline Green to Alvaro Teran
Q: How do you have discussion with fishers, managing bodies, or governments on EM implementation when they aren't financially viable yet for those demographics?
A: Alvaro Teran: When you don't understand the finances and scaling of EM being introduced to a fishery. Financial modelling tools have really helped fisheries have a tangible amount of money to understand the cost vs. benefit on a fishery-to-fishery and fisher-to-fisher basis. Robust historical data of other fishery success with EM has also been helpful. Managing expectations of stakeholders in the fishery, clarity, and trust are all essential for scaling up EM implementation.

Joshua Wiersma to Maël Manuel Bueno
Q: What is the role of governments and regulators in EM exceptions?

A: Maël Manuel Bueno: It is very important to discuss incentives and governmentally imposed EM exceptions. There have been lots of postponements with supplementary EM tools due to limitations and integration issues, such as an automatic fish scale. This has been a setback for the exemption rollout. The EM exemptions are contextually based and is difficult to standardize. Balance between implementation and industry comfort is crucial; being too flexible would negatively affect EM integration, the fishers may take advantage of lax implementation needs at the cost of data quality and proper fisheries management.

Luis Cocas to Alvaro Teran
Q: How can someone apply for the GEMA program?
A: Alvaro Teran: There are plenty of pamphlets at the booth, email lists, and online reading material. These can provide a better pathway to start a dialogue among stakeholders, and help many understand the state of the project cycle in one's country or company and then move forward from there into GEMA implementation.

Luis Cocas to Carolina Cavero
Q: What is the most important aspect for helping coordinate a successful EM?
A: Carolina Cavero: Clear communication among all stakeholders, particularly towards the industry, is arguably the most important aspect of a successful EM culture. Proper accommodation for implementing EM based on fishers and their project demands should take priority based on these communications.

# Poster Presentations - Extended Abstracts

## Can partial counting of EM video help reducing workload in EM review?

**C. Chen, K. Molla Gazi, T. Smith, T. Zawadowski, E. Schram[1], E. van Helmond**

**Wageningen Marine Research, The Netherlands**

### Introduction

Electronic Monitoring (EM) is increasingly used to monitor by-catch and discarded species, particularly under the EU Landing Obligation, which mandates compliance with regulations on below minimum landing size (BMS) species (Helmond et al. 2017). In the Netherlands, a trial has been conducted since 2019 involving EM monitoring on eight demersal beam trawl ships operating in the North Sea. BMS plaice discarded during fish processing are identified and counted by experts in Wageningen Marine Research (WMR) using EM footage of catch sorting belts. However, with belt processing times ranging from 5 to 60 minutes per haul, the EM review workload is substantial (Figure 1). This study investigates the feasibility of reducing the EM workload by reviewing subsets of footage.

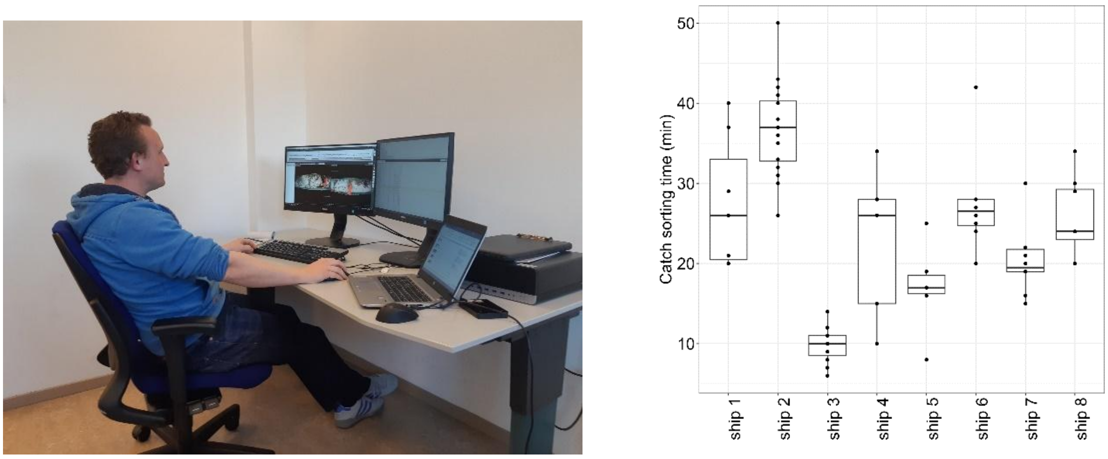



Figure 1. left: An observer is reviewing the EM footages, which is very time consuming. Right: boxplot of catch sorting time per haul for each ship.

### Methodology

A total of 75 hauls were randomly selected from 8 trips across the 8 different ships. For each haul, five randomly chosen 1-minute video segments were reviewed by experts from WMR.

Data reveal that while significant variations exist among ships and hauls, the BMS plaice counts per minute are relatively uniform within each haul. This uniformity allows the total BMS count for a haul to be reliably estimated using linear regression or a ratio estimator based on reviewed sorting time. Simulation studies were further conducted to test the review time and the corresponding precision in counted BMS.

### Results and Discussion

The number of BMS plaice counted showed a strong linear correlation with the duration of the reviewed footage time (Figure 2). While the slopes were consistent within each ship, they varied largely between ships. A statistical linear regression model was then built for each ship to estimate the total number of BMS plaice based on the duration of footage reviewed.

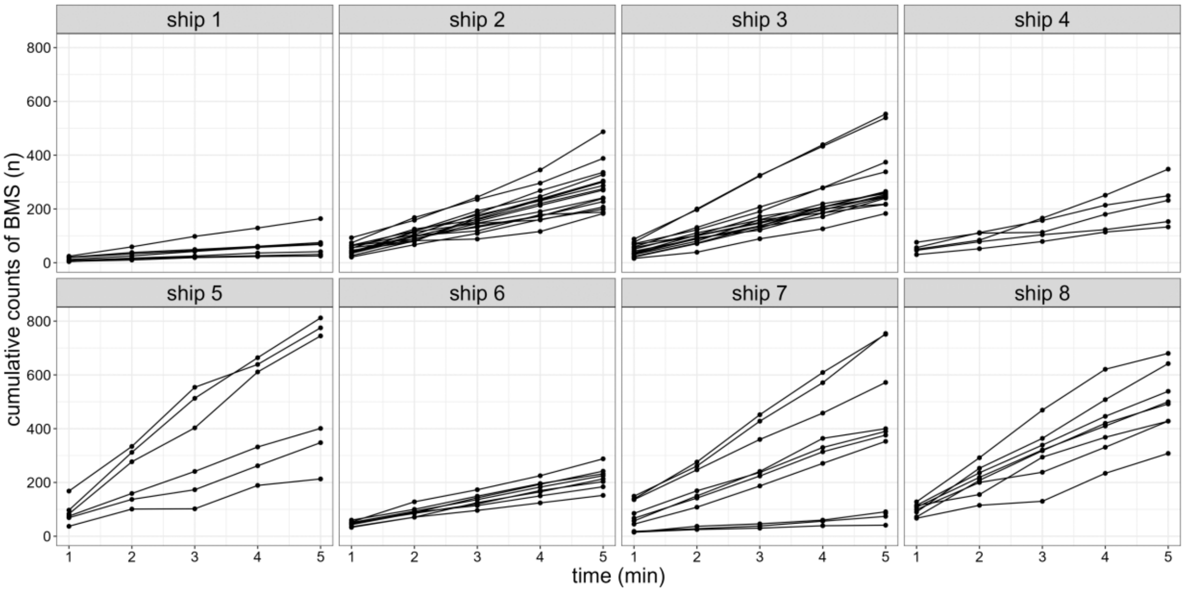
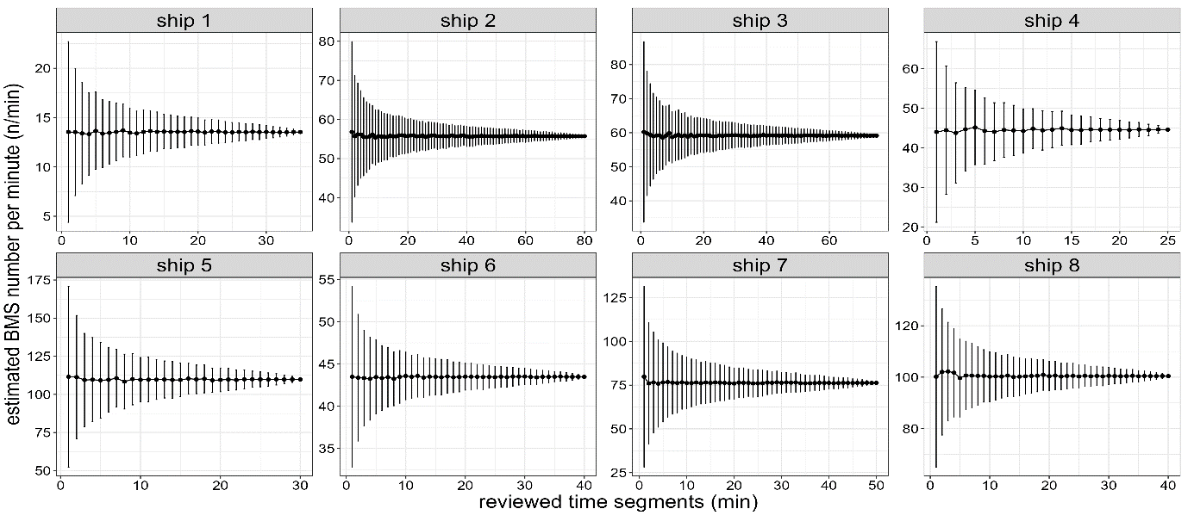



Figure 2. Number of counted BMS plaice vs. the duration of EM footage reviewed by experts.

Simulations show that reviewing less than 10 minutes of footage per haul was sufficient to achieve a high level of precision, corresponding to a coefficient of variation (CV) of 0.1(Figure 3).



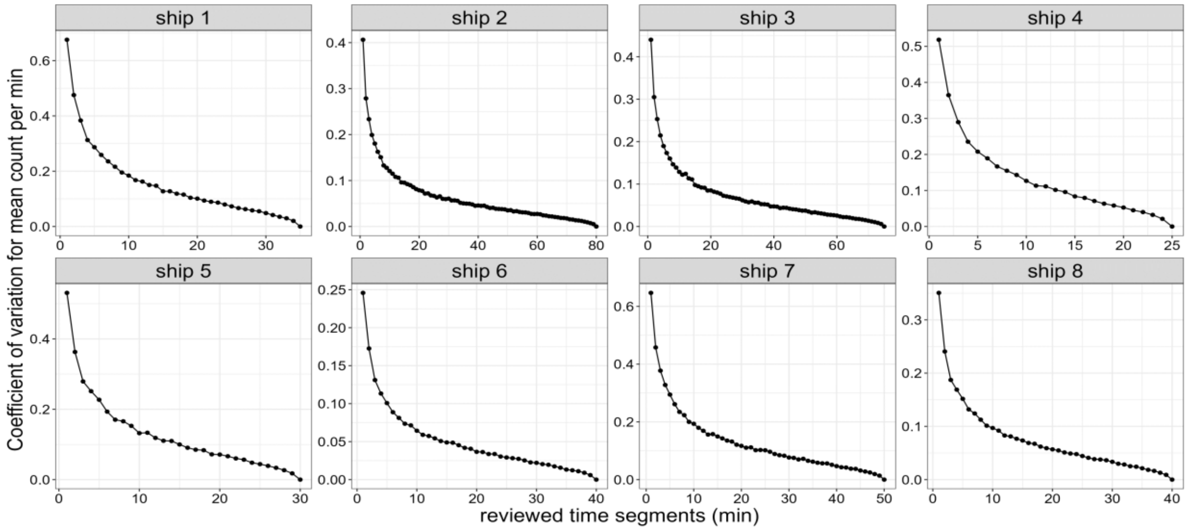



Figure 3. Results of the simulation. Top: estimated average count of BMS plaice and its standard deviation given duration of reviewed EM footage. Down: CV of the estimated average count.

These findings provide a strategic framework for optimizing EM review efforts by allocating less review time to ships with lower variations and more time to those with higher variations. This approach significantly reduces workload while maintaining precision and compliance monitoring effectiveness.

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

### Assessing the role of Electronic Monitoring in shark bycatch data collection in Hawai'i longline fisheries

**Chloe Moore[1,2], Andrew Lanza[1,2], Jennifer Stahl[2], Joshua Tucker[1,2], Keith Bigelow[2]**

**[1]CIMAR, Honolulu, USA**

**[2]NOAA Fisheries, Honolulu, USA**

Through collaborative research with fishers in the Hawai'i longline fisheries, NOAA's Pacific Island Region (PIR) is conducting electronic monitoring (EM) and machine learning (ML) research to modernize data collection of bycatch species. Research has demonstrated that from EM systems some bycatch can be identified and data on fisher handling, animal condition and attached fishing gear can be collected for cetaceans and sea turtles with high accuracy when animals are brought beside the vessel, with data accuracy diminishing with distance from the vessel. Research is ongoing to determine if similar information can be gathered on sharks, specifically the protected oceanic whitetip shark, after several fisheries management regulations were changed in the PIR. These regulatory changes prohibit wire leaders, require oceanic whitetip and silky sharks to be brought alongside the vessel and recommend all other sharks to be brought into EM camera views for identification, all of which may alter fisher handling techniques and allow for shark bycatch detection using EM. To assess shark interactions, recorded fishing hauls from Hawai'i's 20 EM longline vessels with known oceanic whitetip shark catch events, as determined from at-sea observer data, were selected and reviewed to locate any potential shark interactions and to determine fisher handling across all shark species. Secondary reviewers then compared the EM and at-sea observer detections to evaluate the effectiveness of EM in shark bycatch data collection and species-specific shark identification. Further, shark imagery was collected from the reviewed hauls to add to an image library for ML model training to detect shark and other bycatch to enhance EM video review efficiency. This research demonstrates the potential for EM to improve shark bycatch data quality in Hawai'i and other pelagic longline fisheries, a crucial step in conservation and management of shark populations which is a central priority for regional fisheries

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**Electronic ETP bycatch monitoring in the small-scale Swedish gillnet fisheries**

**Anna Persson[1], Sofia Nyberg[1], Filip Bohlin[1], Aron Hejdström[2], Andreas Lind[1], Marcus Eriksson[3], Per Johannesson[1], Sara Königson[1], Lachlan Fetterplace[4], Lisa Sörman[1], Kristin Öhman[1], Katja Ringdahl[1]**

**[1]Swedish University of Agricultural Science, Lysekil, Sweden.**

**[2]Aron Hejdström Produktion, Klintehamn, Sweden.**

**[3]Swedish University of Agricultural Science, Simpevarp, Sweden.**

**[4]Swedish University of Agricultural Science, Öregrund, Sweden**

Large sampling effort is needed to collect data on bycatches of ETP (endangered, threatened and protected) species as events are rare and the occurrence often patchy. Gillnet fisheries are usually associated with high risk of bycatch. Systematic monitoring of the Swedish gillnet fishery was first implemented in 2017, but sampling effort was limited and only covered a small area of Swedish waters.

On-board camera systems where initially developed as part of a pilot study (2020-2021) to allow for increased sampling coverage in a cost efficient way. Since 2022 monitoring covers all Swedish waters populated by the Baltic and Belt Sea populations of harbour porpoise (*Phocoena phocoena*). The aim is to monitor minimum 5% of the gillnet fishing effort in Kattegat, Öresund and the Baltic proper. This corresponds to ~400 commercial fishing trips yearly.

Monitoring of the Swedish gillnet fishery is challenging. Vessels are small (5-12m), often with limited power supply, geographically dispersed with heterogeneous fishing patterns and activity levels.

We are presently developing an in-house camera system solution to better meet the challenges of the small scale fishing vessels.

The camera systems consists of a main box with two cameras – one outside of the vessel and one inside with a view of the sorting table. The outside camera increases the chance of spotting dropouts and the inside camera aids in identification of e.g bird species.

The systems are small and lightweight and can easily be moved between vessels by personnel from SLU Aqua.

Depending on vessel size, adjustable arms are custom built to improve the view and minimise people being captured on film. The power source is also adaptable: some systems utilise the vessels own power supply and others are built to use external batteries. Systems are adapted for accessing the data remotely to avoid manual download of film.

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**Innovating pelagic fisheries monitoring: wireless AI-driven solutions by DPPO and Integrated Monitoring**

**Joshua Wiersma[1], Mathias Søgaard[2], Lise Laustsen[2]**

**[1]Integrated Monitoring, Boston, USA.**

**[2]Danish Pelagic Producers Organisation, Copenhagen, Denmark**

The Danish Pelagic Producers Organisation (DPPO), in collaboration with Integrated Monitoring, has set a new standard for electronic monitoring (EM) in pelagic fisheries by developing a fully wireless, AI-driven program. This innovative system eliminates the need for traditional winch sensors by employing advanced artificial intelligence (AI) models to identify fishing events such as net setting, hauling, and pumping. DPPO staff meticulously reviewed and marked fishing activities, creating a robust dataset. Integrated Monitoring then fine-tuned the AI models using YOLOv8 as the machine vision backbone.

The collaboration extends to the Danish Fisheries Authority (DFA), with whom protocols for data sharing and video review have been developed. These protocols address privacy and confidentiality concerns by adapting Integrated Monitoring's Monitor platform to offer tiered access permissions. Vessel owners can view all video footage, while regulators are restricted to fishing activity events, ensuring transparency while protecting sensitive operational data.

Optimized video transfer using Starlink and 4G networks, coupled with variable frame-rate recording, reduces costs and enhances data efficiency. By automatically prioritizing significant events for high-resolution uploads, the program ensures effective use of limited bandwidth while maintaining high-quality data for analysis.

This groundbreaking wireless EM program not only strengthens compliance with EU landing obligations but also provides an operationally efficient, cost-effective solution for fisheries monitoring. The system's adaptability and scalability offer a viable model for other countries implementing EM in pelagic fisheries. By integrating cutting-edge AI with industry engagement and regulatory collaboration, DPPO and Integrated Monitoring have demonstrated the transformative potential of wireless, AI-enhanced monitoring to meet sustainability, compliance, and operational goals, paving the way for broader adoption of EM globally.

## Session 10. AI applications in electronic monitoring

**Leader: Mark Michelin**

As EM programs evolve, there is increasing emphasis on program costs, data quality and timeliness of data delivery. To balance these priorities, many programs are integrating cutting-edge technology like AI and machine learning (ML). This session provided examples of AI and ML applications already implemented in EM programs.

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## Oral Presentations - Extended Abstracts

**Advancing automated fish detection in EM Systems: segmentation-based AI and open image libraries for scalable fisheries monitoring**

**Joshua Wiersma[1] and Jeff Douglas[2], University of Massachusetts[3], AIS Inc.[4]**

**[1] VP Business Development and Science, Integrated Monitoring, Boston, USA**

**[2] CEO, Integrated Monitoring, Boston, USA**

**[3] UMass SMAST, Collaborator**

**[4] AIS Inc., Collaborator**

Introduction

Electronic Monitoring (EM) systems can help meet the dual demands of sustainable fisheries management and regulatory oversight. Yet in practice, these systems still face major limitations: labor-intensive video review, inconsistent data quality, and low scalability. Traditional EM often fails to deliver the precision and automation required to shift monitoring from a burdensome compliance tool to a real-time management asset.

Integrated Monitoring, in partnership with UMass Dartmouth, AIS Inc., and with the cooperation of the NOAA, Northeast Fisheries Science Center has developed a transformative solution to this challenge: an AI-powered, conveyor-based image capture system that achieves near-perfect fish detection accuracy and enables automated weight estimation, discard tracking, and species-level accounting. The core advancement lies in combining high-quality, standardized imagery with a flexible open-access AI image library, laying the groundwork for transparent, scalable EM solutions across regions and gear types.

Methodology

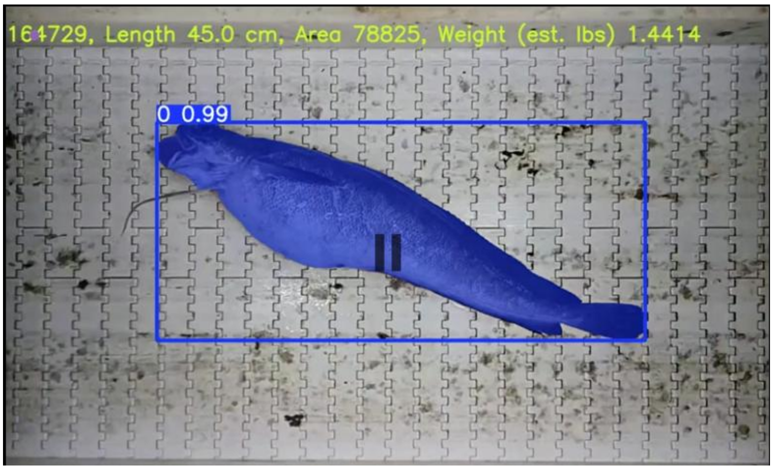
At the heart of this approach is the intelligent conveyor system—a top-mounted discard chute equipped with calibrated cameras, controlled lighting, and real-time edge processing. The onboard system uses a "Segment Anything" model to isolate fish instances from the video feed and tag them with species-level classifications using lightweight YOLO and CNN models.

Each fish is measured using two complementary methods:

- Keypoint detection (eyes, tail fork, dorsal base) for species where posture allows reliable length estimation;
- Segmentation mask area as a proxy for biomass, especially valuable for bent, overlapping, or irregularly positioned fish—common challenges in trawl operations.

This innovation enables a breakthrough: biomass estimation at scale, even when fish posture precludes length-based metrics. All processing is done via edge computing (NUVO-7150 + Hailo-8 AI accelerator), with priority frames uploaded for cloud refinement and annotation. Onboard event detection reduces upload burdens, streamlines review, and allows reviewers to focus on meaningful segments.

Through deployments on three commercial vessels, the system has now:
- Detected over 60,000 individual fish;
- Produced over 10,000 manually annotated training examples;
- Accumulated over 100 GB of structured image data, hosted in an open AI image library on GitHub.




<u>Open AI Image Library and Annotation Standard</u>

A cornerstone of this initiative is the open AI image library—a standardized, shareable repository designed to train and validate AI models for fisheries monitoring. Images are stored in a COCO-style JSON format with extensions for:

- NOAA species codes and FAO 3-alpha codes;
- Discard/retain status;
- Confidence scores and behavior tags;
- Anatomical keypoints and pixel mask areas for morphometric and weight calculations.

The value of this open architecture is profound: it allows researchers, regulators, and technologists across jurisdictions to train, share, and compare models using consistent, high-quality inputs. It accelerates innovation, avoids duplication, and supports model generalization across fisheries. By providing standardized, high-resolution images from commercial vessels, this library fills a critical gap left by older, inconsistent EM footage and closed proprietary datasets.

NOAA Bigelow Integration and Proposed Research Standardization

Initially, the project sought to integrate annotated imagery from NOAA's *F/V Bigelow* research vessel. However, imagery from these trawl surveys often included identifiable human features and suffered from varying lighting and camera angles. Despite their scientific value, legal and logistical barriers around redaction, as well as lower annotation consistency, limited their practical utility for AI training.

As a result, Integrated Monitoring is now in discussions with NOAA to install the same intelligent conveyor system onboard the Bigelow. Doing so would:

- Standardize imagery format and framing across both commercial and research datasets;
- Allow automated comparisons between research and commercial catch;
- Feed high-quality, directly compatible data into the same open AI library, enhancing model accuracy and regulatory confidence;
- Expand the dataset from thousands to potentially hundreds of thousands of labeled instances, further strengthening AI learning curves.

This proposed integration would represent the first time that a U.S. government research vessel and commercial EM fleet feed real-time, format-aligned imagery into a shared AI ecosystem.

Results and Discussion

The intelligent conveyor system has fundamentally shifted what is possible in EM. Real-time species ID, discard detection, and now area-based weight estimation introduce automation in areas once reserved for trained human reviewers. Early deployments show:

- Near-100% detection accuracy for fish crossing the conveyor;
- Robust species classification performance, including for morphologically similar species (e.g., red vs. silver hake);
- Enhanced utility for regulatory audits, catch accounting, and discard monitoring;
- A scalable system architecture that supports both trawl and hook-and-line vessels.

The open library design has also gained attention from international collaborators. Projects like EveryFish and OptiFish in the EU have expressed interest in harmonizing formats, sharing image libraries, and co-training models to improve trans-Atlantic monitoring systems. The potential for a global, modular EM standard rooted in open image data is now within reach.

Conclusion

This project demonstrates the power of combining purpose-built hardware, advanced AI models, and open data principles. With over 60,000 fish detected, 10,000 annotated, and 100 GB of imagery hosted, the groundwork is laid for a scalable, automated, and internationally compatible EM system.

The proposed deployment of the conveyor system on NOAA's *F/V Bigelow* promises to unify research and commercial datasets into one seamless pipeline—feeding the same AI image library and enabling the next generation of fisheries monitoring tools.

This work represents more than a technical solution—it is a shift toward transparency, automation, and shared stewardship in ocean resource management.

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**The CatchID program**

**Ole Høstmark; Pia Jonsson; Bjarne Schultz**

**The Directorate of Fisheries, Bergen, Norway.**

Introduction

In 2024, the Norwegian fishing fleet landed catches with a first-hand valued at over 4.4 billion USD. Alongside the aquaculture industry, this makes seafood Norway's second-largest export commodity. Norway's natural conditions allow fisheries at this level year after year. The situation could, however, have been very different without proper management of our common resources.

Over the past decades, Norway have faced significant challenges, including fleet overcapacity, the near collapse of our most important stocks, and illegal, unreported and unregulated fishing (IUU-fishing) in our waters. To avoid overfishing, we have introduced a range of management measures followed by monitoring, control and surveillance (MCS), where the success can be measured in stocks being recorded at stable and high levels for years.

However, as management systems evolve, so do illegal fishing practices. This ongoing challenge requires continuous improvement and innovation in our approach. One of the most important lessons learned is that a comprehensive management regime is essential for ensuring compliance. Moreover, the most effective strategy is to prevent illegal or undesirable activities before they occur—because reacting to violations is always less efficient than preventing them from happening in the first place.

Compliance by design and CatchID

Norwegian authorities have identified that the main reason we have not managed to end IUU fishing is that reporting by the fisheries industry is either based on self-reporting or, in some cases, lack of reporting requirements altogether. At the same time, expectations from consumers, markets, and regulatory bodies are rising, with increasing demands for documentation that proves the legality and sustainability of fisheries operations.

Therefore, we have decided that we need to develop and introduce new technological solutions to be used on board fishing vessels, where these solutions represent an independent third party. This approach aligns with the concept of compliance by design, as described by Bharosa et al. (2013):

«*Compliance by design architectures represents an end-to-end approach in which information is collected from the source system and distributed to the relevant public agencies*».

An automated and transparent documentation system will be able to contribute to various documentation requirements. It will also reduce the potential for unlawful gain through deliberate misreporting and increase the quality of registered data. It can also incentivise more selective fisheries and increase efficiency through the value chain. Ultimately, this fosters greater trust in stock management, ensures accurate quota deductions, and strengthens confidence among industry stakeholders, regulators, scientists and the public.

To realize this vision, the Directorate of Fisheries launched the CatchID Program in 2021. The program supports the development and deployment of new technologies to address these challenges. Its primary goal is to use third-party systems to automatically register all harvested marine resources in real time, with minimal or no human input, and to provide this data to monitoring, control, and surveillance (MCS) authorities.

The program's main focus has been and remains the development and testing of technologies that can collect verifiable data as early as possible in the value chain. Over time, integrating these technologies into MCS systems will enable quota deductions before landing, significantly reducing the risk of both intentional and unintentional regulatory violations. These data will also serve as the foundation for enhanced traceability and transparency throughout the seafood supply chain.

CatchID functions as an umbrella of several projects involving Directorate of Fisheries, including several projects funded under the Horizon Europe Framework. One such project is OptiFish, where the Directorate collaborates with the Norwegian Metrology Service to develop test criteria and standards for AI-based optical measurement systems—standards that likely will be very important for future integration into MCS frameworks.

Since 2022, the Directorate has also been involved in developing several prototypes for automated documentation of species, fish count, and weight across three segments of the demersal fishing fleet. These prototypes use artificial intelligence (AI) and machine vision to identify fish species. For larger vessels—such as demersal trawlers and large coastal vessels (over 20 meters)—the systems include conveyor belt scales. For smaller vessels, the prototype relies solely on machine vision and fish shape to estimate individual fish mass, due to the limited space available at the vessels.

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**Automatic target tuna catch estimation in tropical purse seiners**

**Xabier Lekunberri[1,2], Ahmad Kamal[1], Jaime Valls Miro[1,3], Jon Ruiz[1], Iñaki Quincoces[1]**

**[1] AZTI Foundation, Sustainable Fisheries Management**

**[2] University of the Basque Country (UPV/EHU), Department of Computer Science and Artificial Intelligence**

**[3] IKERBASQUE, Basque Foundation for Science**

Introduction

Purse seiners play an essential role in global tuna fishing, as approximately 66% of the world's tropical tuna is fished using this gear (Justel-Rubio, 2024). In addition to traditional observers, all tuna Regional Fisheries Management Organizations (RFMOs) have established minimum standards for using Electronic Monitoring (EM) in fisheries monitoring. EM was developed as a potential complement to onboard observers, as it improves data collection efficiency and traceability. However, EM still poses challenges, such as the time required to review all the data. In this context, we are developing a pipeline that significantly reduces the workload of EM analysts. This pipeline utilizes video captured by the EM system in two locations, the brailer and the fishing deck, and several computer vision models. This configuration permits the estimation of the catches' total weight and species composition with minimal human interaction.

Methodology

The total weight will be estimated using the depth information from the brailer captured by a 3D camera. A standard RGB image will be used to segment the brailer, while the depth information will be used to calculate its volume and fullness during each fishing operation. The target tuna species composition is estimated with the 2D footage from the wells deck. Here, the fishes are recorded on a conveyor belt before being stored in wells. Instead of segmenting and classifying using the same model, we do those separately. First, we segment all the fishes on the conveyor belt. For that purpose, we finetuned a Mask R-CNN (He et al., 2018) model with tuna images. After that, the ByteTrack (Zhang et al., 2022) algorithm is used to track the fishes across the conveyor belt. This allows us not to count the same fish on several occasions and make the species classification based on different frames. Finally, we finetuned three RegnetX400MF (Radosavovic et al., 2020) models for the species classification to create a hierarchical classification. The first model discriminates between target tuna species and bycatch. Then, tunas are classified as skipjack (SKJ) or other tunas (a mix of bigeye and yellowfin). This is because SKJ individuals are visually very different from BET and YFT. The third finetuned model is used to discriminate between those two species. To validate all our results, expert observers sampled multiple fishing operations and recreated smaller fishing operations where the species composition was perfectly known. In the example we show here, the observers manually identified 308 fishes.

Results and discussion

*Figure 6: Image where most of the caught tunas are segmented and classified by our models. Each segmented fish is represented with a different color.*

The pipeline tuning tasks are ongoing, so the results presented should be considered preliminary. The training image set continues to grow, as do the tests with different models in various phases (segmentation and classification). All our models were validated using a robust repeated 5-fold stratified cross-validation. The results for the fishing operation that we show here can be seen in Table I. Overall, we were able to sample 64% of the fishes, maintaining an error rate of 2.6% for the species classification. That's below the 10% that the EU Fisheries Control Regulation currently enforces. It is important to consider that it is impossible to sample 100% of the catches with computer vision, as some of the fishes are constantly occluded.

*Table 3: Comparison between the ground truth and the sampling done with our pipeline. It is important to notice that reaching a sample size of 100% is impossible as some of the fish are occluded.*

| **SPECIES** | **GROUND TRUTH** | **OUR SAMPLING** |
|---|---|---|
| BET | 22 (7.1%) | 9 (4.6%) |
| SKJ | 266 (86.4%) | 170 (86.3%) |
| YFT | 20 (6.5%) | 18 (9.1%) |
| BYCATCH | 0 (0%) | 0 (0%) |
| **TOTAL** | **308** | **197** |

While the pipeline's initial development focused on tropical purse seiners, some minor modifications have been successfully tested for use in other fisheries. It is too early to get results for those fisheries, but development and testing time should be significantly reduced.

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**Advancing edge AI technology application in electronic monitoring footage review**

**Vienna Saccomanno[1], Meghan Fletcher[1], Alvaro Teran[1], Ben Gilmer[1], Guzmán López[2], Alicia Schandy[2], Graciana Castro[2], Joaquín Tomé[2], Lucía Osorio[2], Javier Berneche[2], Matt Merrifield[1]**

**[1]The Nature Conservancy, Large Scale Fisheries Program**

**[2]Tryolabs**

Background

Large-scale fishing provides essential protein globally, but over one-third of the world's fish stocks are fished at unsustainable levels.[1] Illegal, unreported, and unregulated (IUU) fishing can lead to fish stock decline, altered food web dynamics,[2] and decreased resilience of marine species and ecosystems to climate change impacts.[3,4] Effective fisheries management requires verified monitoring data.

Electronic monitoring (EM)—the use of onboard video cameras, GPS and sensors to monitor and verify fishing activities at sea—has significant potential to improve fisheries sustainability and management when installed on industrial fishing vessels. However, the broad adoption of EM is hindered due to the immense volume of footage generated by a single vessel and the lengthy and often costly review requirements. Currently, many EM programs involve manually shipping hard drives to human review centers after vessels return to port where the footage is analyzed long after the seafood products enter the supply chain. This prevents the delivery of timely, actionable data to stakeholders.

Additionally, human review of one longline set can range anywhere from USD $200 - $500 per set and is largely dependent on the review rate (i.e., 20% vs. 100% review).[5,6] In light of these challenges, it's clearer than ever that better technology is needed to more quickly sort through EM footage and flag possible risky IUU fishing activity before vessels return to port. That's why the Nature Conservancy's Large-Scale Fisheries (LSF) Program has been working to dismantle these barriers to scaling EM by integrating edge AI, a form of computer vision that makes processing footage faster by analyzing the video aboard fishing vessels and predicting catch count and species composition in near real-time. Edge computing reduces EM footage review time down from months to hours and quickly points to instances where secondary human review of the footage could be necessary.

<u>TNC's Edge AI Vision</u>

TNC and our partners have been conducting research and development on the feasibility of using edge AI technology to assist in the EM footage review process and flag potentially risky activity on semi-industrial tuna longline vessels in the Eastern Tropical Pacific. TNC's core goal is to develop a repeatable, edge-based EM footage review system that provides near real-time, verified information on the sustainability of a vessel's catch before products enter global supply chains, enabling continuous on-the-water improvements.

During the first phase of work, TNC and our partners found that edge processing of fishing activity is possible in at-sea conditions, but that further AI/ML development was needed to make automated catch count and classification between target- and by-catch species more reliable to facilitate near real-time verification. TNC is now building on Phase 1 with a plan to make all products open source to promote shared learning across EM and fisheries stakeholders.

<u>Phase 2 Focus</u>

TNC and Tryolabs, a technology firm that specializes in data engineering and machine learning operations, are working to drive Phase 2 forward under an approach that emphasizes three primary goals: 1) improve the AI models for both catch count and species classification to provide more reliable  AI predications that are within 10% of EM expert analyst estimates, 2) utilize broadband satellite internet data transmission to enhance near real-time data availability, and 3) develop a daily risk profile of fishing activity that compares EM and eLogbook data to rapidly verify captain reporting and provides other risk-based insights to prioritize secondary human review.

The current AI modeling approach is based on the YOLO11m architecture and is pretrained on Fishnet.ai data, with vessel-specific EM imagery used for additional training data. The model is comprised of three components (Figure 1):

1. Catch Detector: Detects the presence of an animal in the video frame and generates a species classification.

2. Fish Tracker: Tracks an animal across frames to support counting for retained and discarded animals.

3. Fish Counter: Determines whether an animal is formally retained or discarded.

Currently, the model is generally reporting low error rates (i.e., within 10% of expert human review) for retained catch and is consistently making accurate predictions about species classification. However, there are still some areas of the model that need improvement, especially when it comes to accurately detecting discard events. As this project unfolds the team will continue to mitigate this issues by emphasizing more data collection to provide a more robust pool of training data to drive continuous model improvement.

Additionally, our team has developed an automated daily report summarizing AI predicted catch activity and an associated risk profile that gets sent off the vessel's edge device via Starlink to deliver actionable data to stakeholders. The daily report assesses risk across four areas: where fishing took place (e.g., proximity to marine area closures), alignment between the captains' catch count and composition reports and what the model predicted (i.e., to screen for unreported catch), AI predications of retained illegal species, and the health of the EM and edge system (e.g., to ensure all fishing activity is recorded). The risk variables are weighted according to fishery-specific priorities – culminating in a final aggregated risk score. This risk-based framework allows managers to focus on the vessels with the highest risk, while driving confidence that self-reporting logbooks can be used for science and market access purposes.

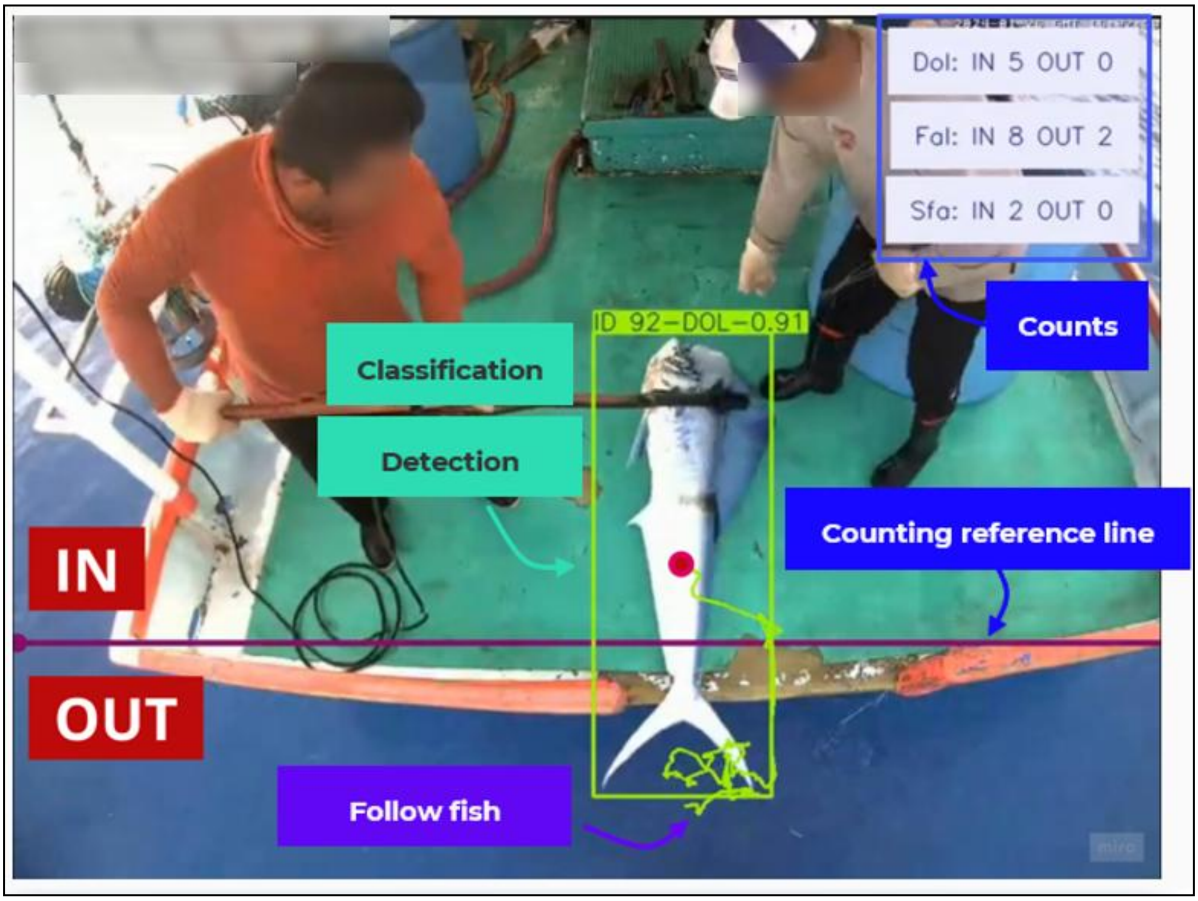


Figure 1. A screen shot of the current edge AI model in action with labels of each of the three model components (Catch Detector = green boxes, Fish Tracker = purple box, Fish Counter = blue boxes).

<u>Next Steps</u>:

TNC is nearing the completion of this second phase of work and is working with Tryolabs to make final adjustments based on new EM video footage that is currently being collected and annotated. The project team will refine the daily report and risk scoring features based on stakeholder feedback. Upon project completion, TNC will release the entire system architecture as open source to support equitable advancements in the use of AI for state-of-the-art EM programs. Finally, to further support the global uptake of EM, TNC will build a business case for implementing edge AI technologies into EM programs to improve review speeds and provide stakeholders with the real-time data they need to make timely, informed decisions.

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

### Applying machine learning to automate the analysis of EM video footage to quantify catches in a highly mixed European demersal trawl fishery


**Tom Catchpole[1], Becca Lamb[1], Michal Mackiewicz[2], Brian Cowan[3], Hang Zhou[2], Mark Fisher[2], Mads Dueholm[3]**

**[1]Cefas, Lowestoft, United Kingdom.**

**[2]University of East Anglia, Norwich, United Kingdom.**

**[3]Anchor Lab, Copenhagen, Denmark**


Remote Electronic Monitoring (REM/EM) refers to a suite of technologies installed on fishing vessels to collect data on fishing activities. These systems typically record vessel position, speed, gear usage, and video footage. Once processed, this data provides insights into location, fish species and quantities caught, and fishing methods used. Traditionally, human analysts interpret this information, but as EM adoption grows, the available human analytical resource will constrain our ability to maximise the use of EM data.

Artificial Intelligence (AI), particularly machine learning, offers a cost-effective solution to automate EM data processing, unlocking its full potential. AI can enhance scientific monitoring of environmental impacts (e.g., on sensitive species), improve compliance and enforcement, and strengthen seafood traceability.

Presented here are the advancements in automating EM video analysis for fish catch and discard quantification in UK mixed demersal trawl fisheries, achieved through two EU-funded projects: SMARTFISH (H2020) and EveryFish (HEU). We detail progress in creating training datasets, applying segmentation tools, tracking fish movement, and improving fish detection and classification algorithms.

Key challenges remain, including image quality, high fish densities, occlusion, visually similar species, rare species detection, and ensuring model accuracy and data reliability. Addressing these issues is essential to maximizing AI's role in EM systems.

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**Optimization of electronic monitoring data analysis through machine learning and artificial intelligence tools**

**Gonzalo Legorburu, Asier Ruiz**

**Digital Observer Services, Bilbao, Spain**

Electronic Monitoring (EM) technology has been widely adopted by industrial fisheries as a practical solution for monitoring fishing activities, with the aim of estimating fishing effort, target catches, and incidental species captures. However, the high recurring costs associated with EM data analysis have often limited its broader implementation. Accurately quantifying sets, catches, and bycatch has long posed a challenge for EM, requiring labor-intensive analysis per unit effort, which significantly increases operational costs.

This study assesses the effectiveness of various Machine Learning (ML) and Artificial Intelligence (AI) tools in reducing EM data analysis time. Utilizing an extensive dataset from 1,464 purse seine tuna fishing trips and 1,215 pelagic longline fishing trips conducted between 2014 and 2023 across multiple EM projects in the Atlantic, Indian, and Pacific Oceans, it's demonstrated a 78% time reduction in tuna purse seine fisheries, from 210 minutes per fishing day in 2015 to 47 minutes in 2023, and a 77% in longline fisheries, going from 243 minutes per fishing day in 2015 to 56 minutes in 2023.

Performance improvements per unit effort are analyzed in relation to the detection of key fishing events, including set deployments, catches, and discards. These advancements greatly enhance the ability of EM systems to identify and classify fishing activities, enabling broader coverage at a lower cost. As a result, cutting-edge EM technologies support the expansion of fisheries observer programs, leading to statistically more robust datasets that contribute to improved fisheries management. Additionally, the recent integration of edge and cloud computing facilitates real-time monitoring solutions, effectively bridging the time gap between at-sea events and final reporting.

Our findings highlight the growing potential of EM for both compliance and scientific applications, providing more representative data and fostering the adoption of management measures that are better aligned with real-world fishing dynamics.

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**Essential requirements for adopting AI technological solutions in the western and central Pacific.**

**Vivian Fernandes[1], Malo Hosken[2], Leontine Baje[2], Timothy Park[2]**

**[1]Independent Consultant, Sydney, Australia**

**[2]Pacific Comunity, Noumea, New-Caledonia**

Trials of electronic monitoring (EM) in Pacific Island countries and territories (PICTs) have progressed at varying levels. Some of these trials have included the development of AI applications driven independently by external service providers. Given the expertise within national fisheries observer programs, the Pacific Island Forum Fisheries Agency (FFA) and the Pacific Community (SPC) were tasked to explore the establishment of a regional library of annotated images to support Pacific-led EM development.

A broad stakeholder consultation identified ten key recommendations, structured into strategic, operational, and tactical priorities. Strategic actions focus on defining objectives, securing funding, and establishing governance frameworks. Operational steps include building partnerships, integrating with existing EM programs, and defining data-sharing protocols. Tactical priorities involve reviewing annotation processes, training observers, piloting initiatives, and establishing regional coordination.

Developing a Pacific-owned image library is feasible and offers significant benefits, member states can now decide on a pathway forward to address these essential requirements.

## Open Discussion Session

Miguel Nuevo to Ole Høstmark
Q: How do you see CatchID progressing? Regarding a timeline, is it going to be operational for industrial or commercial fisheries anytime soon?
A: We are in the phase of the project where three prototypes are in testing on commercial vessels. In regard to the prototype I demonstrated here, they are looking to put this in the market within a year, so they are actively trying to commercialize it. The project runs until August this year, and we have to see how accurate the system is by then; while we don't have those resources at the moment, the results are promising.

Miguel Nuevo to Meghan Fletcher
Q: In your presentation, you mentioned real-time monitoring and being able to detect infringements in real-time, and stop them; however, you also mentioned that we are not there yet. What do we need to do to be able to do this?
A: When we say, "near real-time", in the context of this project, what we're saying is not immediately, but within a couple of hours, which is much better than the current status quo, of course. Where we're at is that we're actually able to do this; we currently have systems sending us daily reports of risk activity, which go to a secure TNC box folder. To your point, how do we integrate this into the market? We really want to build the business case around this. How much money and time is this going to save? That's the work we're digging into now, we've proven we can do it, now we need to move on to this second piece. We're also looking at how to integrate this process into traceability systems, so what would it look like if you could tag a fish at the vessel level with a QR code, scan that, and then pull in information from your AI system to track that fish all the way through and provide stakeholders with the date they need.

Maël Manuel Bueno to Ole Høstmark
Q: How is the CatchID program received by the fishers and fisheries industry department, what kind of feedback have you received? Do you have any pilot programs in the smaller segment of the fleet? What kind of incentives are required for the fleet to take on the program. What is the interoperability between this project and EU projects?
A: Industry is sceptical of new technologies, so there are definitely conversations we have with the industry. There is a generation gap, some of them see it as a potentially good solution to move away from estimation of catches, and less work on their end. Obviously, cost is an issue that is addressed a lot by fishers, they fear that this will be costly if it became mandatory in the future, and some would rather have these systems on shore than on vessels. The prototype shown in the presentation is shown on 9m vessels, which is our smaller fleets. For incentives, we are trying find common grounds with fishers, and an objective is to find incentives so it is beneficial to both parties; if you're able to document fishes caught legally and sustainably, and trace it through the value chain, then you can have an increased revenue, so that's one incentive. Also, moving away from the need for manual reporting could be another incentive. Interoperability between programs would be something we need to look further into.

Drew Forward to panel
Q: Will AI replace observers completely?

A: Gonzalo Legorburu: There is no need to replace observers completely. We trust the job of observers and humans, we want human research. AI, at present, looks like a good solution to many things, but we need to learn how to use it and what for.
Josh Wiersma: The question is not necessarily AI, but it's rather EM replacing observers, as you can't have AI without EM. What we've seen is not necessarily EM replacing observers globally, but expanding monitoring opportunities to fishers that might not necessarily have been able to afford it. Whether or not AI will eventually be able to replace all video review, I would probably say no, I don't think you want it to. I think you're always going to need evidentiary video on some level, but I certainly think it will make the review process easier, as it can flag important events better and it can help better integrate into the supply chain key data elements.

Unidentified to Ole Høstmark and Meghan Fletcher
Q: Is it costly to train AI?
A: Ole Høstmark: I think that would come down to electricity cost. I don't think I have a good answer to that, we haven't really done any analysis on that side of things yet.
Meghan Fletcher: I don't really have much to say on that either, as I'm not an AI analyst myself or machine learning expert. What I can say is that, generally, there are studies out there to evaluate the environmental impacts of AI and ML on a large scale, but any of those are just in the beginning phases, so I think it's going to take us a little bit to understand what those can mean from a fisheries standpoint.

Debra Duarte to panel
Q: Is AI going to be a cheaper alternative to human observers, or will the same work be done differently, but for the same costs?
A: Tom Catchpole: My perspective is from a European perspective, which is different from the U.S. EM is not viewed as cost saving, and I repeatedly mention that when I talk with EU fisheries colleagues. It's a solution to a problem, we're not collecting enough data to have confidence in the information and evidence which is being used to make decisions in fisheries management. We don't consider it to be a substitute for observers, and there's some data that EM will never be able to collect that observers collect currently, but I imagine that the two will become integrated, and we'll be using observers in a different way.
Josh Wiersma: So technology costs are decreasing, and will decrease exponentially over time, while human labor costs will increase. There is no doubt that, from a cost per unit of actual observation, EM looks at a lot more things than an observer does. Observers need to sleep, change, and eat while cameras systems don't need to, and while there are issues with camera systems, technology costs will get better. As we continue to look at how we share things like open image libraries, those training data sets are some of the largest costs associated with developing AI tools, which will continue to make EM review more cost-effective. It'll never be pretty though, the best AI will still have a price tag with it, so we'll need to find that marginal benefit vs the marginal cost.

Eric Brasseur to panel
Q: Are these AI/EM systems going to run on standard computer systems reliably, or will all these programs have to invest in much better computers to run the analysis?
A: Meghan Fletcher: I can at least say that for our pilot program, it's not just like a plug-in at this state, it's an NVIDIA Jetson (?) device that gets installed on the vessel.

Xabier Lekunberri: The expensive part is developing the program, both computer parts and to pay people to get the data and train models. Once you have the models, though, it's much cheaper to deploy them and you don't need that much computer power to analyze; maybe not a laptop computer, but a normal tabletop computer is enough to run the model.
Josh Wiersma: The computers need to be more specialized anyways to be on the boat – they need to be rugged, they need to be bandless, they need to have a high wide temperature range – so those are good, but the real advancement is the Edge AI cards that you can now use in those industrial computers. We use a two-Neousys models, we're now integrating with the Hailo-8 board, which just in the last two years, has increased the number of TOPs from 2 to 26, which means you can run very advanced models on the Edge. The other advancement we've noticed is that you don't need to do things on the Edge, most of this stuff you can do in the cloud, so you run the AI models in the cloud. Even at 1 FPS video, which we're streaming constantly off the vessel, even at a 360 P product, you can run mass detection models, object detection models, and some more advanced models than you can in the cloud, like the mask CRNN models or the key point models. So, the combination of hybrid approach, Edge plus the cloud and using StarLink as the link between, is where the future is going. The cost of our server is around $5000 (USD), and this is for a server with 20TB of internal storage. The cost of EM servers have gone down significantly - 10 years ago, an EM system with all the cameras, they're charging 15k or 20k for it, and now a complete system is under 10k, which includes advanced AI systems.
Tom Catchpole: To realize the potential of EM will require the application of AI. There is a trade-off between the accuracy of the models and the processing power required to drive the models, but we've seen in a short period that the speed of the development of these models and the improvements and the outsource that you get from these models is really impressive.
Miguel Nuevo: Regarding the cost of EM versus the cost of control at-sea - putting a patrol vessel at-sea, and having inspectors perform inspections is 100 times more costly than having an EM system employed.

Josh Tucker to Meghan Fletcher and Josh Wiersma, and panel
Q: Are there plans to expand or pilot your system on additional boats to see the functionality of how it translates across other vessels or other regions?
A: Meghan Fletcher: That's a huge priority for The Nature Conservancy. We don't want to make a model that's only applicable to one specific vessel for one specific type of fishery, our plan is definitely to expand this to as many fisheries as we can, starting with longline fisheries, knowing that's the experience our team has and the vessels we have partnerships with and are able to reliably work with. Right now, we have the pilot on semi-industrial tuna longline vessels based in the eastern tropical Pacific, and we're investigating expanding that to a much larger longline vessel, also in the eastern tropical Pacific. Our Phase 3, which is currently in the works, is going to be based in the western central Pacific on board some of those longliners.
Tom Catchpole: Having models that are specific to a vessel or a group of vessels is a challenge. When you develop a model around specific conditions on a vessel, then transfer it across to another vessel, there's no guarantee as to what kind of data you're going to get. This gives two choices, you can collect a range of training data that covers all conditions across fisheries, or you standardize the images that you're collecting on each of the vessels. That's why this idea of some combination of EM systems with a scanner may be the way we end up going.

Martin Beach to panel

Q: How did/does accuracy in EM systems change based on environment, such as if the camera got wet or had scattered droplets?

A: Xabier Lekunberri: Yes, it definitely affects the cameras. With a dirty camera, you can only get the physics of what the camera is seeing. You can segment the physics under a droplet.

Josh Wiersma: Touching on my statement from earlier, no matter how good the model is, if the camera is dirty, you're kind of shit out of luck. The guidance they came out with is you need daily QA reports to check on the status of the system, and we just had conversations before this, saying what should be included in that is actual images of every camera sent back daily, which can be part of QA/QC reports, and then continuously have feedback loop to the vessel; it's that constant nagging, "clean you're cameras, clean you're cameras". You need that feedback to continue to evolve and get the data we need for those purposes.

Meghan Fletcher: To that point, we have within 10% human review error rate that we're looking to achieve. With Tom, I think his quote was "the model is as good as our most inexperienced reviewer", and I think it was within 70%. I think there's a call-to-action that needs to happen with scientists coming together to agree on what scientific-based percent that we need to be achieving for, because at the end of the day, there are inevitably going to be occlusions in your video, such as water or arms in the way of the camera.

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

### Applications of AIML for catch detection in the Australian sub-Antarctic fisheries

**Tamre Sarhan[1], Goeff Tuck[2], Richard Little[2], Dadong Wang[3], Saqib Muhammad[3], Rizwan Khoker[3], Xinlong Guan[4], Xin Yuan[3], Jingyu Zhang[4], Candice Untiedt[2], Cara Masere[5]**

**[1]Australian Fisheries Management Authority, Canberra, Australia.**

**[2]CSIRO, Hobart, Australia.**

**[3]CSIRO, Marsfield, Australia.**

**[4]CSIRO, Eveleigh, Australia.**

**[5]Australian Antarctic Division, Hobart, Australia**

Fisheries worldwide are increasingly adopting on-vessel cameras, electronic monitoring (EM), for catch recording. AI-driven analysis of EM data offers the potential to improve data quality by providing accurate counts of target and non-target species for species-specific assessments. This presentation will share initial results and discuss challenges from a new project applying AI to EM in Australia's sub-Antarctic fisheries that target Patagonian toothfish (*Dissostichus eleginoides*), including those around Heard Island and McDonald Islands (HIMI), Macquarie Island and the Ross Sea. The HIMI fishery is a Marine Stewardship Council certified longline fishery that also incidentally catches grenadiers

(Macrouridae), deepwater skates (*Bathyraja* spp.), and to a lesser degree, morid cods (*Antimora rostrata*). The goal is to test AI's feasibility in delivering accurate counts and measurements of both target and non-target species, with new technologies enabling near real-time catch analysis. Automated species identification using AI could significantly reduce costs for industry and regulatory agencies while enhancing fishery monitoring coverage.

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### Automated AI-based analysis of subadult hake length distribution from landed box images for high-resolution spatial and temporal insights in the Balearic Islands

**Ignacio Catalán[1], Amaya Álvarez-Ellacuría[2], Manuel Hidalgo[3], Ismael Rodríguez[2], Hilmar Hinz[1], Miquel Palmer[1]**

**[1]IMEDEA (CSIC-UIB), Esporles, Spain**

**[2]FUEIB, Palma, Spain. [3]IEO (CSIC), Palma, Spain**

Mediterranean fisheries face significant challenges, with hake (*Merluccius merluccius*) being a key species of ecological and commercial importance. This study applies artificial intelligence to analyze over 18,000 images of landed hake boxes from 2021 to 2023, generating continuous, high-resolution spatial and temporal data on length distributions at the boat and day levels in the Balearic Islands. The automated image analysis captured 65% of the landed biomass in Mallorca, providing representative coverage of the region's diverse fishing grounds. Depth emerged as a major determinant of hake size, with smaller individuals dominating shallow NE and SW areas, aligning with known juvenile abundance zones. Self-Organizing Maps (SOM) and Random Forest analyses identified four distinct length patterns,

driven by environmental factors such as latitude, bottom depth, and temperature. The focus on late juveniles offered insights into environmental effects typically associated with earlier life stages. Spatial and temporal variations in catch length were largely boat-specific, reflecting métier-based fishing strategies. This approach complements existing fisheries-dependent and -independent data, offering a cost-effective, scalable, and spatially explicit tool to improve hake management and support sustainable fisheries.

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**Machine learning (ML) model innovations for bycatch detection in Hawaii's longline fisheries**

**Joshua Tucker[1,2], Jennifer Stahl[2], Andrew Lanza[1,2], Chloe Moore[1,2]**

**[1]Cooperative Institute for Marine and Atmospheric Research (CIMAR), Honolulu, USA.**

**[2]Pacific Islands Fisheries Science Center, NMFS, Honolulu, USA**

Electronic Monitoring (EM) paired with machine learning (ML) provides a technological solution to monitor fishing vessels globally, expanding coverage to fleets with limited or no monitoring. Incorporating ML detection models into the review process is essential to flag catch events and eliminate unnecessary data collection, potentially filtering out up to 90% of non-informative footage in pelagic longline fisheries allowing human reviewers to focus on the 10% showing catch and incidental catch (bycatch). However, developing ML models to detect bycatch is challenging due to limited imagery, particularly for rare events or confidential data. NOAA's Pacific Islands Fisheries Science Center is developing ML models to detect retained and incidentally caught species in the Hawaii longline fisheries by leveraging EM video footage from 20 volunteer vessels and at-sea observer video collected during interactions with protected species such as cetaceans, sea turtles, and oceanic whitetip sharks. Annotations from this imagery were used to train an object detection model to detect retained fish and bycatch species using YoloV5 base algorithm in a Google Cloud Platform environment, utilizing virtual machines resources. The developed model detects fish on deck, sea turtles, sharks, cetaceans and unidentified catch underwater using 222,564 annotations. Performance metrics indicate good accuracy and precision while raw video footage ("inferenced") run through the algorithm demonstrates the model's potential but highlights the need for enhancements to reduce false positives and missed catch events. Future techniques incorporating methods, such as tracking and unsupervised domain adaptation models, could improve bycatch detection. Applying such innovative ML technologies could allow for cost-effective EM programs, expanding EM-based fisheries monitoring to not only bycatch and protected species in Hawaii's longline fisheries but also to other pelagic fisheries globally.

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**Fully Documented Fisheries – creating an automated discard registration system**

**Maria Sokolova, Edwin van Helmond**

**Wageningen Marine Research, IJmuiden, Netherlands**

Over the last decades Electronic Monitoring (EM) has emerged as a successful and cost efficient technology to improve catch monitoring programmes of fisheries around the world. EM has the potential to provide improved representative coverage of a fishing activities

compared to any conventional monitoring method. In addition, EM incentivizes better compliance and initiates discard reduction. The common approach used to analyse the vast amounts of video recordings, often thousands of hour of footage, is an audit-approach: recorded footage is used to verify against a random selection, e.g. 10-20%, of (self-)recorded catch data in logbooks. This requires a contribution and cooperation from the fishers to provide catch data in logbooks. Implications for fishers are minimal, since providing detailed information on landed catch and fishing activity is common practice in most fisheries. However, when other information is required, for instance discard recording by species in a catch quota regime in a mixed fishery, the burden on the fishers increases rapidly. This is the current situation for European bottom trawl fisheries. To comply with regulations under the Common Fisheries Policy of the European Union (EU) sorting, weighing and recording of discards for several species on a haul-by-haul basis is mandatory. The EU landing obligation implies a significant increase in costs for fishers to sort and record quantities of unwanted catch, below minimum conservation reference size, of quota restricted species. In this study we investigate the possibility to use an automated catch recording system involving computer vision technology to record the discards of quota restricted species under the landing obligation. We would like to present our results and share our experiences in developing this innovation in monitoring fisheries.

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**Lessons learned from Solomon Islands EM program to better manage AI.**

**Derrick Tagosia**

**Ministry of Fisheries and Marine Resources, Honiara, Solomon Islands**

Solomon Islands EM program started in 2016, and to this date, a total of Nine (9) Longline Fishing Vessels are currently monitored 24/7, port to port by EM Cameras. There were a lot of lessons learned, some were exciting, others were unexpected, the rest were expected, but could not do anything about them. The Challenges were countless, especially technical and costs. These lessons learned will help us better prepare for AI.

Is Solomon Islands EM program ready for AI? With the current technical and costs challenges faced with our EM program, are we ready for AI? This study will outline the technical challenges that we learned, the ongoing unexpected costs that we continue to encounter, which will then help us whether we ready for AI or not, and/or what must we do to be ready.

Infrastructure wise, we are not ready. With technical challenges, we are not yet ready. With the ongoing costs, we are not ready. What then must we do to be ready for AI? Strengthens our Internet Infrastructures, address these ongoing technical challenges, and ensure that our EM program is cost effective and sustainable, only then that we will be ready for AI.

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**Red shrimp off-board EM approach in the W Mediterranean**

**Amaya Alvarez Ellacuria, Ignasi Catalán, Miquel Palmer**

**IMEDEA, Esporles, Spain**

The red shrimp *(Aristeus antennatus*) fishery in Balearic Islands, Western Mediterranean Sea, represents a significant percentage of the total catch and is the most economically valuable resource for the bottom trawl fleet. Its economic value is directly linked to the size of the specimens, which is why fishermen classify shrimp into different categories to maximize their price.

The trawling vessels of the Balearic Islands fleet do not yet have video-based electronic monitoring (EM) systems on board, relying solely on satellite positioning systems to infer when trawling operations take place during navigation. This information can be combined with images of shrimp boxes recorded for each vessel during the auction at the Mallorca fish market, where more than 80% of the total catch is sold.

Thanks to artificial intelligence, it is now possible to extract data on the average weight and number of shrimp per landed box. Combining this information with positioning data can improve decision-making and enhance natural resource management by identifying trends in shrimp size over time.

In this study, we present a methodology for an off-board EM approach by leveraging all available data from each vessel in the red shrimp trawl fleet. Using deep learning to extract shrimp size and numbers and AIS-derived spatial effort, we provide a comprehensive analysis of this fishery at a low human and economic cost, offering a scalable and easily replicable approach for other fisheries.

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**Developing electronic monitoring and artificial intelligence for data collection of fisheries landings in Portuguese ports**

**Rita P Vasconcelos[1], Ana Cláudia Fernandes[1], Vasco Luciano[2], Inês Correia[2], Pedro Afonso[2], Chloé Rouiller[3], César Silva[4], Alexandre Rosa[4], Rodrigues Flávio[4], Susanne E Tanner[2]**

**[1]IPMA - Instituto Português do Mar e da Atmosfera, Lisbon, Portugal.**

**[2]FCUL - Faculdade de Ciências da Universidade de Lisboa, Lisbon, Portugal.**

**[3]AgrocampusOuest, Rennes, France. [4]Fishmetrics, Lisbon, Portugal**

Fisheries management is fundamentally based on analyzing data on fishing activity and biological data on species, with the length of individuals being the main biological variable collected. The automation of species identification and individual length measurement allows improving and complementing data collection with traditional in situ manual methods. In a collaboration between IPMA and the Portuguese company Fishmetrics, the automation of species identification and measurement, namely through electronic monitoring and artificial intelligence (AI) are currently being developed. In a first case study, we manually measured a series of species on digital Fishmetrics images to identify the advantages and limitations of the method and setup; and moreover during the COVID-19 pandemic we used the obtained data as replacement / complement to data from traditional in situ sampling. In a second case study, we implemented manual measurements on digital Fishmetrics images of a series of morphometric measurements that can be used as proxies for total length (when not available) in a set of bony fishes and elasmobranchs. In a third case study, we manually measured a set of four bony fishes in a single fishing port and developed (including training, validation and testing) single-species AI models for measurement, and multi-species AI models for species identification and measurement. Further work is being developed, based on images from a series of fishing ports, which includes the testing of the previously developed AI models, and the development of AI models for those species as well as for a series of others.

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**Combining onboard observers and Electronic Monitoring to create an AI training database for tuna species identification**

**Alexandra Maufroy[1], Gérard Llort[2], Tiphaine Bettali[3], Romain Godefroy[2]**

**[1]Orthongel, Concarneau, France.**

**[2]THALOS, Lorient, France.**

**[3]Bureau Veritas, Rennes, France**

Identifying species-specific catch quantities onboard tropical tuna purse seiners is a challenge. The SIRCEO project explores the integration of electronic monitoring (EM) systems with artificial intelligence (AI) to address this challenge. The success of these models depends on the availability of high-quality training data, which includes diverse and well-annotated images of fish from various fishing contexts.

A core component of this effort is combining the work of onboard observers with EM systems to build a robust training database for AI. Observers provide critical ground truth data, ensuring the accuracy of species annotations and enhancing the quality of the AI model's training dataset. This collaboration bridges the gap between human expertise and automated systems, enabling the development of an AI solution that can improve segmentation and identification of tuna species in real-time.

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**Leveraging synthetic data for AI-driven fisheries monitoring: advancing fish identification in SynFish**

**Sander Delacauw[1], Sam Vanhoorne[1], Glenn Aesaert[2], Els Torreele[1]**

**[1]Flanders Research Institute for Agriculture, Fisheries and Food, Ostend, Belgium.**

**[2]Vintecc, Roeselare, Belgium**

Synthetic data is emerging as a powerful tool in AI-assisted fisheries monitoring, addressing key challenges such as data scarcity, class imbalance, and the high cost of manual annotation. Unlike real-world datasets, which are often limited by the uneven occurrence of species and environmental variability, synthetic data allows for controlled augmentation of training sets. This enables AI models to better recognise individual fish, differentiate between species, and ignore non-target objects, ultimately improving accuracy and efficiency.

Building on this potential, the SynFish project investigates the application of synthetic data to enhance fish identification technologies. A key focus is generating high-quality training datasets for data-poor species, including ETP (Endangered, Threatened, and Protected) species, which are often underrepresented in traditional datasets. By artificially increasing the presence of these species in training data, AI models can develop better recognition capabilities. Additionally, synthetic data allows for controlled variation at both the species level and in abiotic environmental factors, making models more robust in real-world conditions. The ability to simulate diverse scenarios also supports the development of AI systems that can accurately detect relevant fish while ignoring unwanted objects in more complex catches.

The decision to further explore synthetic data within SynFish is driven by the successful proof of concept (PoC) developed in VISIMII. This PoC demonstrated that synthetic data could be effectively used to train neural networks for fish detection and classification. The promising results highlight the efficiency gains in dataset creation, improved model generalisation, and reduced reliance on labour-intensive manual labelling. Given these advantages, it is expected that future AI training sets will increasingly rely on synthetic data. However, challenges remain, particularly in replicating the organic structure and natural variability of fish in synthetic environments. Addressing these complexities is a critical step toward fully leveraging synthetic data for AI-assisted fisheries monitoring and management.

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**AI and machine learning in electronic monitoring**

**Katie Archer, Maria Jose Pria Ramos, Robin Prussin**

**Archipelago Marine Research, Victoria, BC, Canada**

As electronic monitoring (EM) programs evolve, emphasis is increasingly placed on reducing program costs, improving data quality, and accelerating data delivery. In response, Archipelago is developing and implementing artificial intelligence (AI) and machine learning (ML) in its long-running Groundfish Hook and Line Catch Monitoring Program (GHLCMP) in British Columbia, Canada. Since the implementation of 100% at-sea monitoring with EM in 2006, this fishery monitoring program has benefited from the active engagement of fishermen, industry representatives, Fisheries and Oceans Canada (DFO), and other stakeholders who have invested in sustainable fishery management. There are 172 active vessels completing over 800 fishing trips and 15,000 fishing events annually in the fishery. The proactiveness within this fishery made it a great candidate for implementing ML and AI. We had early interest from fishers and industry associations willing to partner with Archipelago to provide permissions to analyze EM data and collaborate on ML and AI development projects.

Traditional EM data review is constrained by time and cost affecting accuracy and scalability. Archipelago has responded by developing AI-driven fish detection and implementing it in longline EM review in the GHLCMP. This technology can enable more hours of electronically monitored fishing activity to be reviewed within the same budget and timeframe, reduce program costs while improving data delivery speed, or provide the opportunity to review a greater proportion of fishing activity and collect additional data such as hook or trap counts beyond what was previously reported.

New AI applications are being tested for release later this year, including automated fish fate classification (retained or discarded) and species-specific counting. Future developments will bring AI-assisted EM for size composition sampling at

sea. Through these innovations, Archipelago is advancing EM program efficiency, meeting evolving industry needs, and setting a new standard in sustainable fisheries management.

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**MaxN estimation for specific fish populations in unconstrained underwater videos using foundation models**

**Isaak Kavasidis[1], Amelia Sorrenti[1], Orazio Tomarchio[1], Daniela Giordano[1], Marco Milazzo[2], Gabriele Turco[2], Carlo Cattano[3], Concetto Spampinato[1]**

**[1]University of Catania, Catania, Italy.**

**[2]University of Palermo, Palermo, Italy.**

**[3]Anton Dohrn Zoology Station, Palermo, Italy**

Estimating the maximum number of individuals (MaxN) in underwater videos is a fundamental challenge in marine ecology, particularly for fish population assessments and biodiversity monitoring. Traditional methods rely on manual annotation or deep learning models requiring extensive labeled datasets, which are often unavailable or difficult to obtain in marine environments.

In this work, we introduce a novel training-free few-shot classification pipeline for MaxN fish species estimation, eliminating the need for training on extensive datasets while maintaining high accuracy and efficiency.

Our approach leverages a pre-trained foundation model for object detection (SAM2) for extracting and segmenting with high precision fish in unconstrained and populous underwater videos acquired by using a Baited Remote Underwater Video (BRUV) system. The extracted fish are then fed and a foundation model pre-trained on joint image-text pairs for deriving image descriptors to classify user specified fish species based on few known examples gathered automatically from the internet in order to distinguish and count individual fish across frames and derive the MaxN metric.

We validate our pipeline on a real-world underwater video dataset gathered from the Tyrrhenian sea and demonstrate its robustness across diverse marine settings. The results indicate that our approach achieves competitive performance with state-of-the-art deep learning methods, without the burden of extensive training data. This innovation presents a scalable, low-cost alternative for ecological studies and fisheries management, offering a practical solution for automated marine biodiversity assessments.

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**Reduce project: deep learning integration for bycatch reduction and data harmonization**

**H.Nina del Rio-Ares, Juan Carlos Ovalle, Luis T. Antelo**

**Institute of Marine Research, IIM-CSIC, Vigo, Spain**

Bycatch refers to the unintentional capture of non-target species by fisheries. This study, conducted within the framework of the REDUCE project, presents a novel approach to addressing the bycatch of ecologically significant megafauna species of conservation concern, including various species of sea turtles, seabirds, cetaceans, and sharks, interacting with commercial fishing fleets in the East Central Atlantic Ocean (ECAO). We implement an image segmentation model based on *YOLO V8* from *Ultralytics* for real-time, automated detection of bycatch events, using remote electronic monitoring (REM) images provided by collaborators of the REDUCE project. In this first step, the images used to train the model so far are all from two cameras strategically installed on longliners vessels, one located on the deck and another outside, near the longline pulling machine which also capture the water's surface. Capturing these areas is crucial, as many bycatch species never make it onboard. Due to the current limitation in the quantity of available training data, it has been necessary to combine the images from both cameras into a single dataset for model training. This approach allows the generation of a first operational version of the proposed model to address the pursued objective of identifying bycatch while

additional data is collected and integrated in the dataset. Preliminary evaluations indicate that the model performs effectively, successfully distinguishing and segmenting bycatch species even under challenging conditions. This study shows the potential of significant advances of AI-based tools integrated in REM systems in improving the monitoring of endangered megafauna bycatch species and supporting their proper management, contributing to the protection of the marine ecosystem while reducing costs.

## Session 11. Standardization of at-sea monitoring programs

**Leader: Melanie Williamson**

The standardization of at-sea monitoring programs is key for maximizing data quality, particularly if the data from these programs are shared and pooled between countries, regions, and stocks. Examples of this are the disparate at-sea monitoring programs in the U.S. and EU and their common data uses. These coordinated approaches reflect the diverse needs of regional and/or national observer and technology-based programs while achieving consistency in key areas of importance, such as funding, safety, health, and data quality. This session reviewed and identified best practices adopted in national and regional programs and explored various approaches for coordinating monitoring programs.

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## Oral Presentations - Extended Abstracts

### Using EM to quantify catch and verify best handling and release practices for ETP species

**Craig Heberer[1]; Bubba Cook[2]**

**[1] The Nature Conservancy, Large Scale Fisheries Program**

**[2] Sharks Pacific**

Introduction

According to the IUCN, more than a third of all global sharks, rays and chimaeras species are threatened with risk of extinction, with overfishing being a primary driver (Pacoureau *et al*., 2021). Oceanic shark populations have undergone an average 71% decline over the last half century, owing to an 18-fold increase in relative fishing pressure (Pacoureau *et al*., 2021). Longline fishing results in significant bycatch of sharks and rays, but global catch, condition, and fate estimates are highly uncertain due to inaccurate or absent reporting in fishing logbooks and historically low human observer coverage on these "hard to observe" vessels (Peatman, *et al*., 2018).

The Western and Central Pacific Ocean (WCPO) hosts approximately two-thirds of the global tuna catch, with longline fishers deploying over a billion hooks annually into these productive waters. As much as a third of the catch consists of sharks and rays, including blue sharks, silky sharks, thresher sharks, and pelagic stingrays, making this fishery the primary source of mortality for many of these species (Clarke, *et al*., 2014). Despite limits and outright bans on shark finning practices across the region, anecdotal evidence suggests these wasteful practices remain widespread, frustrating catch accounting and management efforts.

Methodology

This study examines the implementation of electronic monitoring (EM) systems on longline fishing vessels to collect species-specific data on sharks and rays for stock assessment purposes while verifying compliance with Best Handling and Release Practices promulgated by National Fisheries Authorities and Regional Fisheries Management Organizations

(RFMOs). The analysis draws from operational data collected through EM deployments across Pacific tuna fisheries, with particular focus on the WCPO region.

The Nature Conservancy conducted a comprehensive assessment of EM pilot programs and implementations to evaluate the practicality and feasibility of the technology in multiple contexts. The methodology included analysis of hundreds of longline sets with EM coverage to quantify shark and ray bycatch patterns and assess handling practices. The approach included evaluation of operational procedures required onboard vessels to ensure data quality, specifically examining requirements for crew to haul branch lines closer to vessels so EM camera arrays may obtain critical information including species identification, condition assessment, and trailing gear minimization.

The study incorporated evaluation of artificial intelligence (AI) and machine learning (ML) applications for automated video analysis, examining recent technological advancements including improved AI algorithms for species identification, real-time data transmission capabilities, and integration with other monitoring technologies (French, *et al*., 2024; Marques, *et al*., 2024).

<u>Results and Discussion</u>

Electronic monitoring systems have proven mostly "ready for prime time" with scaled implementations across multiple fisheries, representing significant technological advancement in fisheries monitoring capabilities. Recent developments include improved AI and ML to enhance data analysis and species identification, higher-resolution cameras providing clearer footage for better monitoring, real-time data transmission enabling quicker compliance and enforcement actions, and more compact, powerful hardware supporting expanded coverage for distant-water and small-scale fisheries.

Analysis of EM data from hundreds of longline sets suggests approximately 3 million sharks and rays are caught annually in the fishery, highlighting the significant scale of elasmobranch interactions with commercial fishing operations. Moreover, problematic shark and ray handling practices remain rampant, including illegal retention of prohibited species, extensive trailing gear upon release, physical abuse such as slamming rays against vessels to release hooks, and gaffing sharks before dragging them aboard for dehooking and release.

Current observer coverage requirements in the Western and Central Pacific Ocean include 100% coverage on purse seine vessels, while longline coverage remains limited with only a 5% requirement that is not regularly met. This disparity in coverage creates significant data gaps for longline fisheries, which represent the primary source of shark and ray mortality in the region.

The study reveals that observer or EM coverage alone is insufficient for effective monitoring of endangered, threatened, and protected (ETP) species, such as elasmobranchs. Current retention prohibitions for some species have created perverse incentives for crew to cut gangions at the mainline, providing little opportunity to assess species, condition, or fate of sharks and rays. Thus, operational procedures onboard vessels must be implemented to require crew to haul branch lines within view of cameras or observers to ensure species identification, condition and fate assessment, and minimization of trailing gear.

Programs like French Polynesia have demonstrated the practicality and feasibility of mandatory hauling procedures, with vessels successfully pulling sharks alongside within view of cameras before cutting gangions near hooks and documenting animal condition upon release. These practices are critical for developing and training AI algorithms and ML models to automate video review and data annotation processes, making EM systems more efficient and cost-effective.

Market-based incentives have proven effective in encouraging adoption of best practices. The Nature Conservancy's partnerships with major US tuna brand suppliers and retailers like Walmart are driving 100% monitoring commitments from key seafood stakeholders, deepening market engagement across supply chains, and aligning supply chain incentives around delivering legal, sustainable seafood products that enhance supply chain resilience.

The integration of EM technology with mandatory handling procedures represents a transformative approach to fisheries monitoring, enabling comprehensive data collection on ETP species while reducing post-release mortality through improved handling practices. This approach addresses fundamental challenges in fisheries management by providing the granular, independent observation of on-vessel activities necessary for effective fleet management and conservation of threatened species.

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**Key definitions and considerations for the implementation and operation of scientific observer programs: lessons from the Chilean experience**

**Erick Gaete Alfaro**

**Instituto de Fomento Pesquero (IFOP), Central-Southern Zone of Chile**

<u>Introduction</u>

Fisheries observer programs play a vital role in the sustainable management of marine resources, serving as key mechanisms for the systematic collection of scientific and operational data (IFOP, 2019). These programs have become increasingly relevant due to growing demands for certification, traceability, ecosystem-based management, and access to international markets. This paper shares insights drawn from the Chilean experience with observer programs implemented by the Instituto de Fomento Pesquero (IFOP), highlighting core definitions, operational conditions, and strategic considerations that shape long-term success.

<u>Principles or Definitions</u>

A fisheries observer program can be defined as a system designed for the systematic and ongoing collection of data on fishing activities, whether on board vessels or at landing sites. While their role might seem self-evident, observer programs serve a range of functions, from supporting research and stock assessments to ensuring compliance with regulatory frameworks.

It is important to distinguish these programs from research projects. Observer programs typically operate over broader temporal and spatial scales and generate multidimensional, long-term databases that support diverse analytical applications. For instance, data collected decades ago may be used to identify changes in fishing patterns or environmental trends. In contrast, research projects are more targeted, time-limited efforts that often produce two-dimensional datasets tied to specific hypotheses or problems (Figure 1).

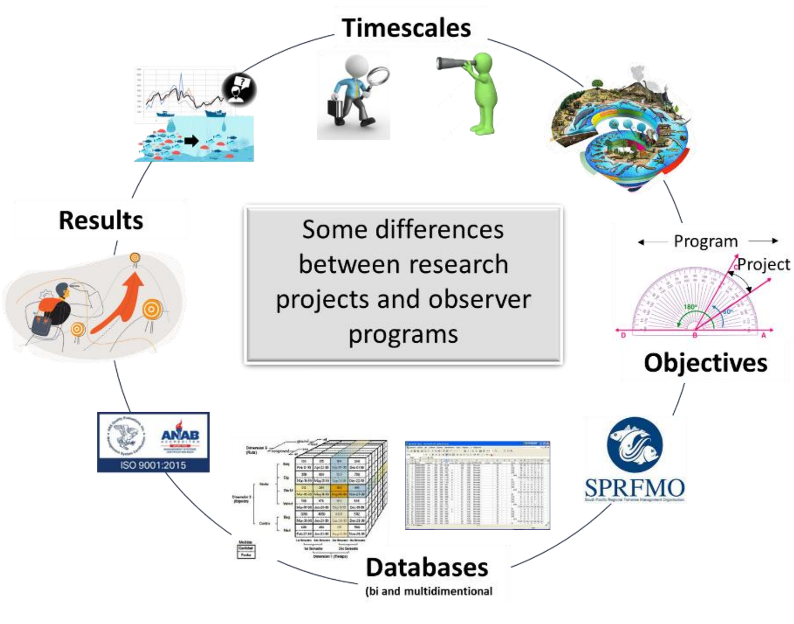

Figure 1. Key differences between fisheries research projects and scientific observer programs, focusing on objectives, results, databases, and timescales.

An effective observer program must therefore be designed with its scope, purpose, and operational demands in mind. It requires stable funding, technical infrastructure, and trained personnel capable of continuous data collection in diverse and often challenging conditions.

In Chile, the national observer program is designed strictly for scientific research purposes. Although some fisheries, such as industrial trawlers and factory vessels, maintain near 100% coverage, most large artisanal fisheries operate with much lower levels—often under 5%. Chilean legislation prohibits the use of observer data for enforcement actions, preserving the scientific neutrality and trust needed for long-term cooperation with the fishing sector.

Public funding offers several advantages, especially in terms of institutional independence and accreditation. It supports observer safety, facilitates long-term planning, and aligns with requirements set by international organizations and certifiers. However, public programs may also suffer from structural rigidity, slower decision-making, and limitations in operational agility compared to privately managed alternatives.

## Results and Discussion

The Chilean observer program employs more than 200 observers along the coast, managed centrally by IFOP. Observer profiles range from technicians to professionals with postgraduate degrees, and training is a cornerstone of the program's strategy. This approach allows for adaptability to a wide array of tasks—from monitoring industrial pelagic fisheries to recording benthic landings in remote ports or documenting marine mammal interactions.

Unlike seasonal or voyage-based contracts common in other countries, Chile favors permanent contracts. This ensures availability for deployment when needed, prevents loss of trained personnel during critical periods, and contributes to job security and morale (and helps retain qualified personnel over time). Observers receive base salaries plus per-diem sea bonuses, and time spent working on weekends or holidays is compensated with additional rest days.

This model brings operational resilience, but also demands strong logistical and financial planning. For example, long cruises may render observers unavailable for extended periods, requiring internal rotation systems.

When deploying observers across borders, a number of cultural and operational barriers may emerge (Figure 2). Language, religious customs, dietary preferences, and onboard accommodations are just a few examples that can impact the efficiency and wellbeing of observers in foreign vessels (Gaete, 2018).

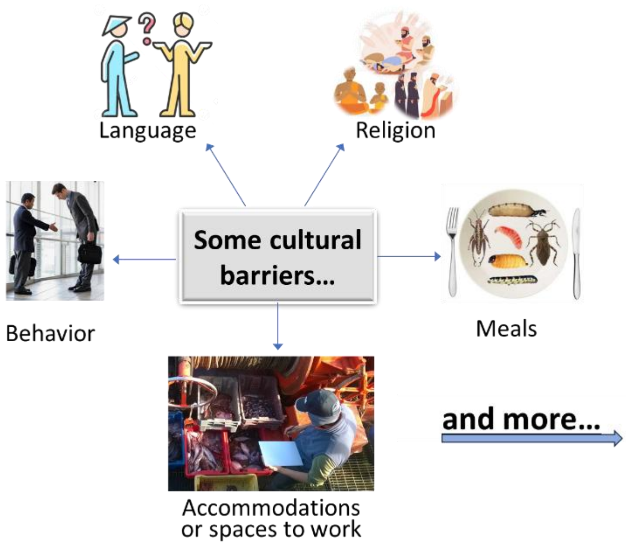


Figure 2. Examples of cultural barriers encountered in international fisheries observer programs, including language, behavior, religious practices, work environment, and food preferences.

Although Chile does not frequently engage in international observer exchanges, the potential for such collaboration exists and can be successful if these barriers are acknowledged and mitigated through adequate planning, cultural sensitivity, and mutual understanding. Regional fisheries management organizations (e.g., SPRFMO, ICCAT, CCAMLR) are ideal platforms for piloting and improving such exchanges.

The Chilean experience offers several insights for other nations or agencies designing or refining observer programs. Depending on the main focus and coverage, the following strategies may be effective:

- International accreditation: Ensure public or independent funding to meet transparency and neutrality requirements.
- Low coverage monitoring: Avoid mixing research and enforcement roles, especially where low observer presence may influence crew behavior.
- Remote area coverage: Hire and train local personnel, fostering community integration and logistical efficiency.
- Reliable deployment: Use permanent contracts or attractive seasonal salaries to ensure workforce availability at critical moments.
- Long-term scalability: Invest in robust IT systems for data entry, validation, transmission, and storage. Logistical and technical support are essential to handle the large datasets generated over time.

Each context will demand its own balance of flexibility, specialization, and institutional support. There is no universal template, and as highlighted in the presentation: “Silver bullets do not exist.”

Conclusions

The Chilean observer program illustrates the importance of defining clear roles, stable financing, and professional capacity building as cornerstones of effective implementation. Public financing, long-term contracts, and a focus on research integrity have enabled Chile to sustain a large, adaptable observer network despite geographical and operational challenges.

Countries and organizations aiming to strengthen their observer systems can benefit from considering these elements, tailoring them to their own realities while remaining open to innovation, collaboration, and continuous learning. By aligning goals, structures, and resources, observer programs can not only meet scientific and management needs but also enhance transparency, trust, and sustainability in fisheries governance.

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**Observers as facilitators: addressing fishermen concerns about the increasing number of at-sea observation programs**

**Claire Assaily, Fabien Noel, Alex Chailloux**

**Sinay, Caen, France**

In the southern Bay of Biscay, the fishing fleet is characterized by its diversity in both gear types and vessel sizes. Gillnetters and trawlers dominate the sector, with a smaller proportion of longliners. Notably, the fleet is largely composed of small-scale vessels (69% of the fleet). Larger vessels over 20 meters represent only 22% of the fleet.

In recent years, fishers have faced increasing demands to participate in at-sea observation programs. Most of these observation programs rely on voluntary involvement. These initiatives monitor not only target fish species but also the bycatch of sensitive taxa such as marine mammals, seabirds, elasmobranchs, and other non-target species. Monitoring is conducted through onboard observers and, to a growing extent, electronic monitoring systems.

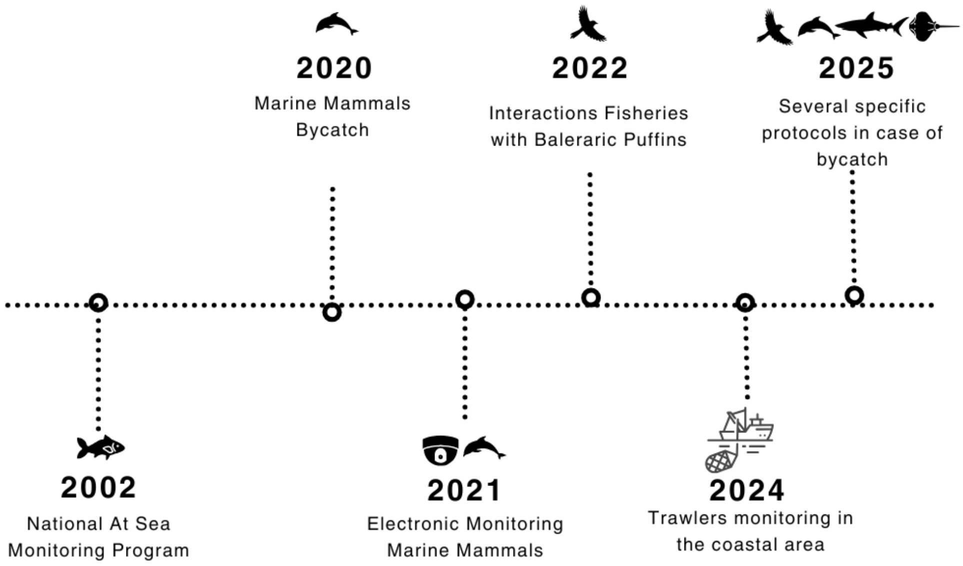


*Figure 7 Main observation programs in the Southern Bay of Biscay*

However, as observation initiatives multiply, especially those focusing on interactions with endangered, threatened, and protected (ETP) species—skepticism among fishers has grown. The cumulative burden of participation in multiple overlapping programs is often perceived as excessive. In this context, some fishers have refused to embark observers, signaling a sense of saturation and resistance to new requirements.

Despite these challenges, field experience from SINAY—a company involved in deploying observers across much of the Bay of Biscay—highlights the important role observers can play as mediators and trust-builders. When observers are embedded over several years within the same geographic and professional communities, they establish meaningful relationships with fishers, enhancing mutual understanding and facilitating engagement.

These long-term observer-fisher relationships have helped ease the implementation of new monitoring tools. For instance, prior interactions with familiar observers have facilitated the acceptance of onboard camera systems. In some cases, initial camera installation efforts have catalyzed fishers' willingness to host human observers and engage in dialogue.

Observers, through their multidisciplinary training and field exposure to a variety of protocols and scientific programs, are uniquely positioned to address fishers’ questions in real time or to relay concerns to program coordinators. This feedback loop has occasionally led to adjustments in monitoring protocols, enhancing their operational relevance and field feasibility.

Recognizing the value of this dynamic, SINAY has adopted a strategic approach to observer deployment, aiming to limit the turnover. This strategy notably includes the diversification of missions, the development of responsibilities, and enhanced company benefits. First, Observers are gradually integrated into a wide array of monitoring programs under the guidance of regional coordinators. Then, as they gain experience, some evolve into "lead observers," serving as key liaisons between scientific coordination teams and local observer networks.

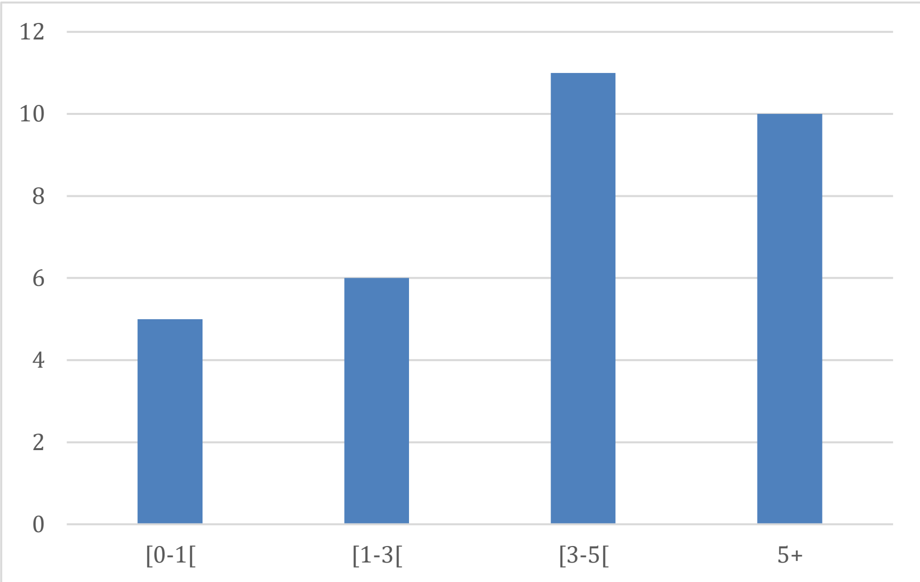


*Figure 8 Years of experience of the SINAY observers' team (32 observers)*

In this role, they also become reference figures for fishing professionals—maintaining ongoing, trusted relationships with skippers, vessel owners, producers' organizations, fishery committees, and management authorities. These experienced observers also contribute to training, mentoring, and operational support for their colleagues, helping them navigate the priorities and complexities of different monitoring schemes.

In contexts where observation programs remain not always standardized, both the observers and the organizations that deploy them can play a role in harmonizing methodologies. Their involvement ensures the consistent application of robust, validated protocols drawn from experience across multiple projects and geographic areas, using the same databases formats and protocols.

By fostering stable, informed, and professional observer networks, we can improve the quality of data collection, enhance fisher participation, and ultimately support more effective, science-based fisheries management in the Bay of Biscay and beyond.

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

### Technical guidelines for the use of Remote Electronic Monitoring systems (REM) in EU fisheries

**Miguel Nuevo, Cristina Morgado**

**European Fisheries Control Agency, Vigo, Spain**

The EU Common Fisheries Policy (CFP) introduced the reduction of unwanted catches and the elimination of discards, the landing obligation. To comply with these requirements, Remote Electronic Monitoring (REM) systems was identified as a tool for fisheries monitoring. REM systems provide continuous monitoring and data collection, offering an efficient and cost-effective alternative to traditional control and monitoring tools. Recently, regulation (EU) 2023/2842 ("Control Regulation") mandates the use of REM systems on high-risk vessels.

EFCA in collaboration with EU Member States and the European Commission developed "Technical guidelines for the use of Remote Electronic Monitoring systems (REM) in EU fisheries", which provides comprehensive guidelines for the implementation and use of REM systems in EU fisheries. The document outlines the minimum technical requirements and standards for REM systems to assist in the efficient and uniform implementation of the landing obligation, and the implementation of the revised Control Regulation.

Key points covered in the Guidelines include:

- Technical Specifications: Minimum technical requirements for REM systems.
- Implementation and Compliance: Guidelines for the creation of Vessel Monitoring Plans (VMP) tailored to each vessel's characteristics and other aspects of the management of REM programs (Rules of operation, catch handling, logbook recording, etc.).
- System Health and Maintenance: Regular system health checks, data encryption, and secure communication protocols are essential for maintaining the integrity and reliability of REM systems.
- Data issues and AI Integration: Also covered topics related to data handling and the integration of Artificial Intelligence (AI) and Machine Learning as a means to enhance the analysis of REM data, improving quality assurance and efficiency.

The implementation of REM systems supports the enforcement of fisheries regulations, contributing to sustainable fishing practices and the protection of marine resources.

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### Harmonization of Pacific Islands' observer programmes

**Timothy Park**

**Pacific Community (SPC), Noumea, New-Caledonia**

The Western and Central Pacific Ocean (WCPO) tuna fishery is huge, the 2023 tuna catch was 2,630,858 mt, worth $6.1 billion. This represents 79% of the Pacific Ocean tuna catch and 52% of the global tuna catch. The fishery is composed of 281 purse seine, 568 longline, and 21 pole and line vessels: representing 24 flags.

Unlike other oceans, over 80% of the catch occurs in the EEZs of the 14 Pacific Island Countries, and three Territories (PICTs) . Thus, their tuna resource is a significant component of their GDP, and its management is critical to their sustainability as independent nations.

SPC, in collaboration with 2 subregional (FFA, PNA) and one regional (WCPFC) fisheries management organisations, develop regional operational standards and facilitate harmonisation among PICTs' 16 national and 2 subregional observer programmes. Their 800+ observers reported 1382 purse seine, 254 longline and 21 transshipment carrier trips in 2023 .

Harmonization of PICTs observer operations has been critical to ensure the utility of observer data for effective regional management. All WCPO observer data is stored in a single regional integrated database. Harmonization includes standard data collection fields, formats and protocols, training, and regional cooperation allowing national observers to operate in multiple jurisdictions.

The Pacific Islands Regional Fisheries Observer (PIRFO) qualifications are independently recognised as the regional standard for observer training by the Pacific Board for Education Quality. PIRFO is trademarked under the PICTs programmes' ownership, further enhancing alliance among programmes.

Harmonisation among national programmes improves the monitoring efficacy across the region, allowing Pacific Island states meet their national aspirations and managing their regional fisheries resource.

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**Standardisation of observer data collection in the WCPFC region**

**Penihulo Lopati**

**PNA Office, Brisbane, Australia**

The Parties to the Nauru Agreement (PNA) Observer Program is one of the largest international observer programs, delivering around 25,000 sea days of observer coverage annually in the Western and Central Pacific Ocean tuna purse seine fishery. The program involves independent monitoring of fishing activity on around 110 vessels operating on shared stocks across around 10% of the earth's surface. The enormous logistical and resourcing challenges of monitoring vessels across such a vast area are at least partially addressed by harmonising systems across the 8 Small Island Developing State (SIDS) members of the PNA. Coordination of the program is managed centrally, with standardised observer training, data collection forms, briefing/debriefing, e-reporting, safety equipment, data handling and payment arrangements for all Party observers involved in the program. The standardised and inter-operable nature of arrangements means that observers can be efficiently deployed as across the region as the distribution of fishing effort shifts, and data is collected in a standardised format, with standardised quality assurance procedures, that can be easily interpreted and used by all Parties. This presentation will explore some of the main practical forms of standardisation across the PNA Parties and the benefits to fishery management.

## Open Discussion Session

Teresa Athayde to panel
Q: In Southwest Indian Ocean area, countries are trying to create a sub-regional observer program and facing problems. How did you overcome the sharing of observers and the sharing of data? How did countries agree on memorandums of understanding?
A: Tim Park: Giving ownership of the concept to the countries helped the process. The PNA took a leadership role in facilitating agreements.
Peniihulo Lopati: The commonality of the tuna fishery and the knowledge that tuna swim between countries sparked cooperation.

Craig Heberer to panel
Q: We've heard about the reluctance of fishers to carry EM, how did your countries convince vessels to carry human observers?
A: Claire Assaily: Because observers in France are long tenured, the fishers have comfortability taking the observers. We promote the benefits of data collection to help keep fisheries open.
Penihulo Lopati: We place observers at 100%, so it's either carry the observer or don't fish.
Erick Gaete: In Chile the big vessels have no problem carrying observers, but on small boats it's more complex but we need to have observers on small vessels too.

Monique Arsenault to panel
Q: In the Northeast U.S program, we have 130 observers but most last less than one year. We have a retention problem. What incentives help retain observers?
A: Erick Gaete: In Chile, Observers are full-time employees, with benefits, funded by the Government. Government funding helps; observers are seen as a worthwhile use of public funds. Fisheries are very important to the Chilean people and government.
Penihulo Lopati: Employment opportunities in our island region are limited. Observers are paid well, and the good pay helps. We have a career path, good observers are promoted to debriefers and eventually to trainers. Having a career path helps with retention.
Claire Assailly: In France, carrying an observer is voluntary. The boats that accept observers tend to be comfortable, so the job tends to be relatively pleasant for our observers.

Laure McGovern to Penihulo Lopati
Q: How does the Pacific Island culture color observing programs?
A: Observer programs tend to be competitive with each other to see which program does the best work. Accommodation is challenging, and the variability of observer acceptance of accommodation conditions is a challenge. Since observing is a sizable profession, many observers know fellow observers and have a collegial support network.

Laure McGovern to Bubba Cook
Q: How can we shift fishers' perception around sharks towards more humane handling and an appreciation for their role in the ecosystem?
A: Money drives actions for crew. It's a challenge because each shark is one less tuna in the short term, but sharks killed as bycatch can be detrimental to the long-term health of the ecosystem and fishery. Observers play an important role in educating the crew and help encourage best practices. Certification of fisheries, or loss of certification could also be an incentive.

Teresa Athayde to Miguel Nuevo
Q: How much training will be needed for the brand-new REM guidelines in the European Union?
A: We're not sure how much or what form of training will be needed. It will be up to the member states. EFCA will support the member countries.

Teresa Athayde to Penihulo Lopati
Q: For deployments across such a wide geographical area, how do you determine which observer to deploy?
A: If a boat is flagged, we exclude observers from that flag state. We work through coordinators, preferably in advance of departures. Airline flights are sometimes required to get observers to their assigned vessel. Shared safety equipment is available in many ports, so observers are not always required to travel with all their safety gear.

Derrick Tagiosa to panel
Q: In the next 3-5 years, how will at-sea observer programs change because of increasing electronic monitoring and artificial intelligence?
A: Tim Park: The objectives of an EM program should be really clear at the start. Having integrated systems is stronger than having one form of monitoring form replace another.
Bubba Cook: EM can lower the burden on observers by collecting complimentary data, cameras can also verify that the observer is on deck when they claim to be.

Unidentified to Tim Park
Q: Why do purse seiners have 100% coverage but longliners only have 5%? What are the targets of the purse seiners.
A: Coverage rates are often determined by politics. Ideally, we should have at least 20% coverage for the longline fishery. Purse seine vessels target three species of tuna: Skipjack, Bigeye and Yellowfin.

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

**The development and implementation of an observer training program to support the implementation of the Regional Observer Scheme in the Indian Ocean.**

**Melanie Williamson[1], Teresa Athayde[2]**

**[1]CapMarine, Cape Town, South Africa.**

**[2]Independant International Consultant, Frontignan, France**

The Indian Ocean Tuna Commission (IOTC) established the Regional Observer Scheme (ROS) in 2009 to collect verified scientific data on tuna fisheries. While broad guidelines existed, National Observer Programs (NOPs) lacked standardised procedures, leading to inconsistent data and non-compliance with IOTC requirements.

To address this, the IOTC launched a pilot project to promote ROS by developing uniform standards, improving training, and enhancing data collection methodologies. Between March and June 2018, T. Athayde developed ROS standards and guidelines for accreditation and improved data collection fields. From June 2019 to November 2022, CapMarine (with T. Athayde) implemented a training program to support ROS adoption across the Indian Ocean. This aimed to standardise NOPs through structured training for coordinators and field observers, updated manuals, and electronic reporting tools. The program also reinforced compliance with the mandatory 5% observer coverage outside CPCs' Exclusive Economic Zones.

Challenges included limited CPC commitment, logistical and economic constraints, and the lack of a finalised IOTC e-Collection database. The COVID-19 pandemic further disrupted training schedules and equipment procurement, requiring local sourcing and remote training via email and WhatsApp. National fisheries structures varied, necessitating customised training approaches.

Despite these difficulties, key lessons emerged. Hybrid training (online and practical sessions) improved efficiency, and stakeholder engagement ensured progress. Standardised curricula and data collection forms enhanced effectiveness, and national fisheries agencies played a vital role in observer deployment. CapMarine adapted by using e-learning, adjusting training formats, and offering post-project support. Internet disruptions delayed training, but flexible self-learning options helped. Rising travel costs due to the Ukraine war required strategic adjustments.

Ultimately, the project succeeded through standardisation, adaptation, collaboration, and innovative training solutions.

## Workshop 1 – Observer Safety on board Sæbjörg

**Leader: Bogi Þorsteinsson, captain, and his crew of Sæbjörg**

Observers face many challenges and risks while deployed on a variety of vessels worldwide. They must deal with infectious disease, cultural differences, stress, fatigue, isolation, unsafe vessels and sometimes even violence. Programs have the task of helping observers to cope with these factors through support, training, technology, and equipment. This session explored some of the issues faced by observers and how programs can help reduce the risks associated with observing.

73 Participants took part in a unique hands-on workshop aboard Sæbjörg, the training vessel of the Icelandic Maritime Safety and Survival Training Centre. Participants rotated through three interactive stations, each focusing on a critical aspect of maritime safety.

**Station 1: Sea Survival**

Hands-on experience in maritime survival techniques:

- Introduction to sea survival equipment
- Try on an immersion suit
- Board a liferaft
- Simulated helicopter hoist

**Station 2: Fire Safety**

Experience realistic fire safety training:

- Overview of fire hazards onboard ships
- Suit up in firefighting gear
- Enter a container with live fire
- Practice with fire hoses

**Station 3: Training & First Aid**

Discover the work of the Maritime Safety Training Centre:

- Practice casualty handling and transport techniques
- School presentation and mission overview
- Introduction to essential onboard first aid kits

## Workshop 2 - Electronic Monitoring

**Leaders: Holly McBride[1]; Lauren Clayton[2]; Helen Holah[2]; Mark Michelin[3]**

**Workshop Facilitator: Mark Michelin[3]**

**[1] NOAA Fisheries Northeast Fisheries Science Center, USA**

**[2] Marine Directorate, Scotland, UK**

**[3] CEA Consulting**

Introduction

It has been approximately 25 years since the first electronic monitoring (EM) systems were deployed on fishing vessels and there are now several thousand systems installed around the globe. Interest in deploying EM where its efficacy, operational feasibility, and cost effectiveness can be demonstrated continues to grow, but there is significant operational complexity and stakeholder dependencies that must be addressed for successful EM implementation. As EM participation and adoption increase, discussions around interoperability and the development of raw EM video and data standards are gaining traction across several jurisdictions. At the same time, conversations are emerging about the use and acceptance of artificial intelligence (AI), the regulatory hurdles it presents, and how AI fits into the EM workflow. The EM workshop explored these two themes of artificial intelligence and interoperability.

Session 1: Artificial Intelligence

As AI is being considered, and in some cases, integrated into EM workflows, questions still remain about balancing AI complexity with operational, performance, and economic costs, as well as understanding acceptance criteria and the regulatory hurdles that still exist around its use.

This session gauged the audience's experience and understanding of the use of AI in fisheries monitoring, discussed the trade-offs associated with integrating AI into the EM workflow, and the hurdles faced by regulators with AI acceptance criteria and integrating AI into EM programs.

**Presentations**

Presenters: Ben Woodward, CVision.AI, USA

Lauren Clayton, Marine Directorate, Scotland, UK

Tom Catchpole, Center for Environment, Fisheries and Aquaculture Science, Lowestoft, UK

The first presentation, by Ben Woodward, provided an overview of several technical and human aspects of AI applications for EM. Key takeaways included:

1. **Hierarchy of video analysis automation and tradeoffs** - AI can be used across a spectrum of analysis needs that vary in complexity. At the more basic end of the spectrum is simple activity recognition (e.g., I saw gear deployed) and on the more

complex end of the spectrum is individual fish identification and tracking. As AI is used for more complex analyses, it further reduces the review burden on human analysts, but it comes with additional challenges of cost, data requirements, robustness, and generalizability. Given these tensions, it is important to ask what level of analysis is needed to solve pain points and to evaluate the costs and benefits.

2. **Evaluating Model Performance** - Defining and measuring performance against expectations is important for developers and ongoing assessment. Different performance metrics can be used but should always be linked back to the specific use case and objectives of the analysis. These metrics should consider what level of accuracy is actually needed. It was noted that AI is sometimes held to a higher performance standard than human reviewers.
3. **Navigating Regulatory Hurdles** - Regulatory approval processes for AI can be lengthy and not well defined. Although AI is new, it should be treated the same as any other technology or process and audited against a defined set of standards. This should include standard measurement procedures and infrastructure, such as testing on independent data sets, testing environments for code, and clear performance thresholds.

The next presentations, from Lauren Clayton and Tom Catchpole, provided perspectives from fisheries regulators and data users on AI applications for EM. Key takeaways, included:

1. **Identifying the best use cases for AI** - A combination of the monitoring objectives of the fishery, an identification of the biggest cost/time sinks in EM analysis, and an assessment of AI capabilities can help identify where AI is best suited in both the near and long-term.
2. **Successes**
    a. **Multidisciplinary research** - A combination of dedicated research funding and partnerships with research institutes and other organizations with AI expertise has helped advance AI applications and raised the profile of AI with stakeholders.
    b. **Using a research vessel to test across a range of scenarios/conditions** - The availability of a research vessel with an EM system has helped generate significant volumes of training data, and test AI algorithms to understand their performance across a range of conditions.
    c. **Performance of some AI classification models** - For some applications and scenarios, the performance of AI classification models has been as good as an inexperienced human analyst and has achieved 95% agreement with human classification.
3. **Challenges and Barriers**
    a. **Labeled Training Data -** AI models require a significant volume and variety of labelled training data (e.g., different vessels, lighting, occlusions, sizes and orientation of fish, images of similar species), and this can be a bottleneck for improving AI performance. In many cases, generating labelled training data can be logistically complex and resource intensive.
    b. **Determining appropriate performance levels** - Setting and building consensus on minimum performance standards for AI models is required for acceptance, but AI models are often held to unnecessarily stringent standards. Especially for use cases where AI is expanding available

information on a fishery, users should balance the costs and benefits of higher accuracy.

c. **AI cannot capture the full experience of human reviewers** - Experienced human reviewers are able to make determinations using a breadth of information (e.g., location of fishing, knowledge of the vessel, other catch on the trip/haul). With more training data and model enhancements AI performance can improve, but this is resource intensive, and it is difficult for fisheries models to capture the full breadth of human experience.
d. **Data storage and security** - EM is generating huge volumes of imagery, and storing this data is a novel challenge for regulators. It also requires data security provisions, and clear rules for data sharing and access.
e. **Difficulty demonstrating cost savings** - Developing AI applications for EM requires significant resources and investment. With EM programs and AI development at relatively early stages, it is difficult to demonstrate the cost savings of AI. This is especially true when there is low observer coverage to begin with, and AI/EM is used to create additional data and is thus an additional cost.
f. **Regulator driven** - Unlike in other industries, much of the push for AI in commercial fisheries is being driven by regulators to improve management and compliance, rather than by the private sector out of commercial interests.

4. **Opportunities to improve AI data capture**
    a. **Training data -** When labeled data is limited, semi-supervised learning and synthetic data techniques can improve AI model training.
    b. **Image quality** - Technological solutions, such as self-cleaning cameras can ensure better images.
    c. **Catch handling** - Changing catch handling processing can improve the performance of AI models, and leveraging data such as morphometric relationship models can help manage occlusions.
5. **Opportunities to support the application AI in EM**
    a. **Assess AI model performance -** Define clear performance standards and assess model performance against those standards across a variety of conditions and scenarios.
    b. **Integrate AI models into EM workflows** - AI models need to be integrated into EM analysis software or on the vessel (or edge).
    c. **Co-design integrated monitoring programs** - EM and AI are tools that should be part of integrated monitoring programs that are co-designed with multiple stakeholders (e.g., regulators, fishing industry, scientists, compliance).
    d. **Clear EM policies and timeline**s - EM remains primarily regulatory driven technology, and policy direction will encourage investment in EM and the application of AI in EM workflows.

**Question and Answer Session**

*Q: Bubba Cook to Lauren Clayton. Lauren is using a laser system to assess when fish are going under a camera. Is anyone using spectrometry (hyper spectral cameras) in your AI systems?*
A: Lauren Clayton: No. CatchScanner is the tech we used, developed by a Norway company. Testing abilities and training data side of it. But I'm interested in exploring new technologies

going forward. The laser was quite simplistic. They told it what type of fish was going underneath the camera.

Tom Catchpole: No. There has been work on 3D scanners and generating much higher resolution images. Tom's objective was to make as much progress as possible without interfering with what fishermen are doing. Just by positioning cameras in the right places. There will likely be a point where they'll need to incorporate new technologies to make further progress.

Ben Woodward: Similar to the idea of using stereo cameras. The challenge there tends to be as you get further away from monocular views, the information needs to become much more complex. Adds cost and complexity at a high rate. Need to ensure you have the expertise to curate the data inputs and what you are telling the model, as well as interpreting the outputs.

*Q: Dataset diversity from the perspective of regulators. How representative is the dataset? Overexposure etc. For AI model developers, how can we communicate and standardize the robustness of the dataset to assure regulators?*

A: Lauren Clayton: Sometimes regulators are not aware of the perspective of the AI developers and what is actually needed for a project. E.g., orange oilskins versus yellow ones confusing the AI model. When algorithms are more transferable there is more of an opportunity to transfer across vessels.

Tom Catchpole: It's important for the developers, researchers and data users to come up with the tools to demonstrate the accuracy of the models but also put it into the context of other data that you use in fisheries. For example, comparing AI generated data to observer data can provide reassurance to the regulators that the data from different methods are consistently generated.

*Q: Is there a risk of holding AI to a higher accuracy standard than human observers? How might this delay innovation?*

A: Ben Woodward: Yes. Need to tamp down expectations. The idea of taking human data as being 100% correct is a bad idea. People make mistakes and get tired. The same thing can happen in video review. It's really important to recognize that human data is not perfect and holding AI to the same standards will hold back innovation. Need to communicate clearly what kind of failures they are willing to tolerate? And what failure feedback mechanisms are needed.

Tom Catchpole: Different methodologies generate different estimates through different protocols. Neither one is the truth. That is the challenge. Trying to exactly match (comparing directly) the AI outputs to the human reviewers may not be sensible, when different methods are being used.

*Q: Zoom out on the promise of AI. There has been a promise that AI is a silver bullet but there has been a lot of overpromising and underdelivering. TNC launched Fishnet.AI, which helped support AI development, but what are the next set of challenges that need to be addressed for AI to finally deliver on its promise? What are the sticking points?*

A: Ben Woodward: Have run an open data competition that demonstrated the promise of an incredibly complex workflow. It worked really well. But the cost of integrating it into a program was prohibitive. Sometimes it's not a tech problem. Sometimes we try to run before we can walk. Great from a research perspective but not so great when you are trying to develop a solution. Sometimes it comes down to over-promising but sometimes it comes down to clearly communicating expectations.

*Q: Does anything from the audience poll on challenges to advancing AI strike you as worth highlighting?*

A: Ben Woodward: Data sharing- there should be a mechanism for sharing data appropriately. Especially rare events. Aggregating data for these events is absolutely critical. There is a lot of data out there, but it is often not together and very hard to find.

*Q: For AI to work well you are often asking fishers to change their handling protocols and impacting fisher safety. How do you, on the panel, think about that in your programs?*

A: Lauren Clayton: From a safety perspective, no. We are never going to do anything that causes fishers to be unsafe. Camera placement is normally a discussion with the fishers and adapting to them. It's a matter of conversations with fishers to improve the system together.

Tom Catchpole: Agrees. Constant communication with fishers is key. Assess the joint benefits/costs of various configurations.

*Q: The regulator burden of AI development. Security and privacy. E.g. in Australia it is very hard to get data for training. How do you solve privacy and data sovereignty barriers?*

A: Ben Woodward: It is unfair to shift all of that burden on to model developers. If regulators who impose those restrictions also want progress on AI, they have an obligation to find a way to get the data to the developers. There are lots of potential solutions but none of them are as good as opening up the data. Re: synthetic data, Ben has found there are limitations on synthetic data given much of the limitations are due to environmental issues, not about having enough views of the right fish.

*Q: Lots of people think AI is magic. How do you level-set expectations?*

A: Lauren Clayton: AI is not going to perform as well as humans right now. But it's still never going to be 100% accurate. It's a problem- how do we communicate that?

Tom Catchpole: It has been a problem managing his own expectations. Showing realistic examples of what it takes to get AI to a good place in a real scenario is important. Getting case studies up and running and illustrating what is needed and what is possible is a good place to start.

Ben Woodward: People focus too much on the promise. They need to focus on the failure pieces of AI. Building trust in algorithms depends on understanding when and why they fail. They often fail spectacularly! Need to manage this.

*Q: Who are the AI regulators at the moment? Are there any lessons learned from other sectors?*

A: Ben Woodward: Very hodgepodge. In the U.S. there is no regulator for AI at the moment. In the EU, just in the last couple of years there has been a framework and law in place that apply if you are developing a fully automated AI system that deals with enforcement mechanisms, e.g. speeding tickets.

Tom Catchpole: In the UK there is no overarching AI regulatory framework.

Ben Woodward: NOAA tends to regulate EM video processing. But they are vastly underprepared for issuing regulatory guidance on AI.

**Audience Polling**

Throughout the session, the audience was polled using an interactive software platform. Below is a summary of the polling questions and audience responses.

**Question 1: What type of institution do you work at? (n=89)**

| | |
|---|---|
| Academic / independent research institution | 11% |
| EM/Observer service provider | 21% |
| Government agency | 49% |
| Nonprofit / nongovernmental organization | 9% |
| Other | 9% |

**Question 2: What is your level of expertise with AI for EM? (n=92)**

| | |
|---|---|
| High - I work with AI for EM regularly and understand its strengths, limitations, and most of the technical details. | 21% |
| Low - I know what AI for EM is and generally how it can improve EM programs, but I don't know much about the technical details of the technology. | 34% |
| Moderate - I am familiar with AI for EM and how it connects with my work, but I only understand some of the technical details. | 39% |
| Novice - I know what AI is but know very little about its application to electronic monitoring. | 7% |

**Question 3: Do you use AI in your work with EM? (n=91)**

| | |
|---|---|
| Yes | 40% |
| No | 40% |
| NA - EM is not a part of my work. | 21% |

**Question 4: How mature is your use of AI in your EM workflows? (n=56)**

| | |
|---|---|
| It is fully operational and integrated into our standard EM workflows | 7% |
| We are using it on a pilot basis, but it is working pretty well. | 20% |
| We are using it on a pilot basis and trying to figure out what it does well and what it doesn't do well | 34% |
| We are just exploring the use of AI | 39% |
| We are not using or considering using AI in our EM workflow. | 0% |

**Question 5: What do you see as the main barriers to using AI in EM? (n=56)**

Audience members submitted multiple responses, most of which were closely aligned with the barriers and challenges identified in the workshop presentations. These included challenges such as cost versus available resources, training data availability, data storage and access, access to AI expertise, confidence in AI model performance, diversity of contexts in which AI needs to be applied, etc.

**Question 6: If you are using AI/EM in your EM work, what is working well? (n=25)**

There was a diversity of responses to this question, but responses included:

1. Preprocessing lots of raw EM data (e.g., eliminating non-relevant footage)
2. Automated fish counting and catch identification
3. Easy problems like trap enumeration and fish detection
4. Collaborating with skilled observers to build training data
5. Analysis time reduction
6. Better spatial and temporal coverage

Raw data from audience polling can be found here.

Session 2: Interoperability

The second session explored raw data exchange interoperability in the fisheries monitoring landscape. Workshop presentations and discussions centered around what successful EM interoperability looks like, barriers to achieving it, and the role of the fisheries managers / the international scientific community in driving it forward. The session was introduced by a presentation:

- Bubba Cook, Sharks Pacific - Interoperability of Electronic Monitoring Systems and Data Exchange

The presentation set the scene for the second session of the workshop by providing an introduction to interoperability. Main themes of the presentation included:

**Definition of interoperability** - interoperability was the ability of different systems, devices, or applications to communicate and exchange information effectively, *without requiring special effort or modification from the user* with the key characteristics being communication, data exchange, and coordination. To achieve interoperability, systems must be able to understand and respond to each other's signals, information must be shared in a compatible format and structure, and systems must work together in a planned and effective manner.

**Types of interoperability -** there are several types of interoperability, especially as it relates to electronic monitoring systems: organizational, semantic, syntactic, and technical. Organizational interoperability refers to the integration of business processes beyond the boundaries of a single organization. Semantic interoperability ensures the same meaning of exchanged data through predefined and shared meaning of terms and expressions. Syntactic interoperability involves the use of standards of information exchange through predefined data format and structure. Finally, technical interoperability refers to the technical end-to-end data exchange among systems.

**The importance and benefits of interoperability** - interoperability enables seamless communication across diverse platforms and entities and ensures secure and accurate information flows that results in enhanced collaboration, maximized data utilization, cost and resource savings, greater accessibility to data, and scalability.

**Key drivers and barriers to interoperability** - there are several key drivers to the development and adoption of interoperability standards. These include regulatory requirements for data security, privacy protection, and data sharing needed to meet multi-jurisdictional reporting requirements. Another driver is preparing for technological advancements in satellite data, cloud computing, and artificial intelligence. The desire to integrate with supply chains, access global markets, meet certification standards, and improve operational efficiency are motivators for business and marketing needs. Finally, ease of use and providing economically valuable solutions for end users.

There are also barriers to developing and adopting interoperability standards. These include a lack of standardization, concerns about interfering with proprietary systems, security risks, and the cost and complexity associated with implementing these standards.

**Examples of interoperability -** the standardization of Internet Protocol (IP) and the role TCP/IP played in creating global connectivity that led to innovations in Hypertext Transfer Protocol (HTTP) is a key example of interoperability.  Lessons learned from this case study can be used when facing challenges in developing today's interoperability standards.

After the presentation, the delegates were randomly broken into 15 breakout groups with a predetermined breakout lead. Each group had 7 questions that were designed to encourage direct conversations and gain alternate perspectives. Group discussion was captured by the breakout lead.

**Question 1. What are the drivers for interoperability of EM video and data? (e.g., multinational program, data access and storage from multiple providers, multi-provider program with centralized review or audit)**

Data sharing and data collating were identified by the majority of the groups as a driver for interoperability. Programs that support multiple providers or support vessels fishing in multiple jurisdictions that use multiple review platforms, rely on EM providers modifying file outputs, and data sharing between jurisdictions and with other users are concerns. Interoperability would allow for an open EM provider market, while centralizing review and not needing multiple backend software platforms. It was noted that EM offers an opportunity to deliver EM data faster, both video and processed.

**Question 2. What are the barriers to interoperability in your field / organization? What are the barriers for regulators and what are they for EM service providers?**

Legal constraints, data ownership, data sovereignty, and political reasons were identified as a barrier by several groups, suggesting that some of the barriers to overcome are not technical. Cost associated with adopting interoperability, transmitting and storing data were also factors. There was some concern about developing flexibility in the standards to accommodate future sensors.

Participants also mentioned concern with stifling innovation and overcoming business competition between EM providers, as well as getting consensus agreement amongst all parties to agree, develop, and adopt a standard.

**Question 3. What is a minimum viable product, or first step of interoperability that would solve a challenge you are facing? (e.g., standardized file formats and metadata for video and sensor data; EM software that analyzes EM Records from multiple providers, etc.)**

The most common response from the groups was minimum standards for data, but common encryption protocols, performance standards, and a software platform that can accommodate inputs from multiple providers was also discussed. It was mentioned that any standards developed should not impede innovation.

**Question 4. Is there a need for a glossary of terms to facilitate EM interoperability in the international context?**

The majority of the breakout groups responded “yes”, with some “no”, and one “I don’t know” for the need for a glossary to facilitate EM interoperability. One group that responded “no” cited that implementing a single global glossary of terms could be problematic to both create and maintain.

**Question 5. Is your organization actively thinking about or encouraging/requiring interoperability of EM data? If so, can you please describe the effort and its objectives?**

Many of the groups had participants that were aware of or involved in interoperability conversations, either directly within their organization or external conversations. Specific countries and justifications actively discussing and encouraging interoperability are England, Scotland, the EU, and the United States. Many EM providers are also encouraging developing standards. There are national organizations and RFMOs that have invited EM providers to be part of the discussion to help address the reporting challenges. Those encouraging the conversation think interoperability is important for multinational programs and accessing data from vessels fishing across boundaries.

There were those that weren't optimistic about the ability to come to an agreement on interoperability or the need to share data cross-jurisdictionally.

**Question 6. Are there other examples of standards from the fisheries monitoring technology sector that we can learn from as we think about interoperability for EM?**

Several groups referenced the Fisheries Language for Universal Exchange (FLUX), the standardized data exchange framework developed by the Food and Agriculture Organization (FAO), that can be used to transmit Vessel Monitoring System (VMS) data as well as other fisheries data. Another example included Closed Circuit Television (CCTV) used aboard Icelandic ships that have standardized file formats.

**Question 7. What other important themes were discussed in your group?**

Additional themes discussed included the need to work with EM providers while determining interoperability standards. Flexibility and foresight of future standards and use cases need to be considered. Additionally, there was an emphasis on communication and collaboration between jurisdictions and making sure that provider/regulator incentives are aligned. It was noted that more interoperability discussions should be happening to share ideas, issues, and successes around EM and dedicated platforms. Use knowledge or standards learned from other industries that have had success with video collection, like casinos, home surveillance systems, and airports.

The groups reconvened into a panel discussion where questions were received either in person or by Slido and discussed by the panel.

**Panel participants:**

Bubba Cook, Sharks Pacific, USA

Bryan Cowan, Anchor Lab, Denmark

Josh Wiersma, Integrated Monitoring, USA

**Panel questions and discussion:**

Josh Wiersma: Tech providers got together and realized that if they did not come together to develop interoperability standards then it would be imposed upon them. They came together on 1) Requests for Proposal (RFP) format and 2) what an interchange format would look like for interoperability. This means the raw data coming from the vessel. The providers found that their formats were all about 90% similar and came up with a format that looked good.

The effort floundered because of COVID and then last year ICES started to think about this a lot more. It would probably be a 10–12-month process and EM providers would have to agree to work together and then agree to have their IT people work together. Then do a hackathon to figure out the nuts and bolts. Then how do you do outreach and educate people about this to have different governments and programs around the world use the standard. This is a different level of cost. From their perspective it is not free.

Brian Cowan: If providers are proactive and understand they are going to be required to have EM in the future then they have more of an incentive to work with regulators to come up with their own interoperability standards. If providers are proactive then it will hopefully go smoother than otherwise.

*Q: What does standardization/interoperability actually look like?*

A: Josh Wiersma: Interoperability of hardware is not needed. It is the raw data and the data interchange format. The ability of each individual provider to go on their own proprietary systems with their own innovations- 4G, etc. and then to put the data into a format that is standardized and that can be read by several different video review platforms.

Brian Cowan: All providers are collecting broadly similar data. We do want to future-proof things but don't want to put the cart before the horse. Do we base it around video files? Or video meta-data files?

*Q: We've heard the challenges laid out. In the Pacific we are 2 years out from the implementation of the EM Program so there is a need to have these standards in place by that time. Critically important! If there isn't a plan or budget to put together the plan, NGOs can help. Time is of the essence.*

A: Josh Wiersma: Yes, always ready to accept funding. The ICES model has potential (hackathon idea).

*Q: Wouldn't interoperability vary based on the EM data user?*

A: Brian Cowan: Not really.

Josh Wiersma: Perhaps when defining video quality and recording standards.

*Q: AMR has fully incorporated interoperability standards as a result of the EM provider working group. The question is, where are we seeing the drivers of this?*

A: Bubba Cook: There is an inherent tension between providing more open and interoperable data and tech providers' business prerogatives. But at the end of the day, we have to provide a product to industry that enables tech providers to compete and differentiate their products. Drivers are increased traceability and transparency, and those things are only going to get bigger. Donor funding is never going to be enough. Until we have robust cost-recovery systems somebody is going to have to fund the programs. Otherwise, we'll be in perpetual pilot mode.

Brian Cowan: Yes, we are right at the spot where interoperability is going to be really necessary.

*Q: Do you see interoperability stopping innovation or helping?*

A: Josh Wiersma: If people are trying to get each tech provider in a fishery to do the same thing, then no problem, but don't stop us innovating in terms of things that we are doing on the vessel. From an EM scaling perspective, interoperability is vital for scaling EM. Whoever is looking at the video is interested in driving down the cost. Archival value of interoperability- looking at old video- is important.

*Q: Transparency in data is the key thing. Lives by the mantra that fisheries are a public resource managed using public funds. The default should be that data are public. Can't manage the resource if data is locked up.*

A: Brian Cowan: Data sovereignty. Managing data between jurisdictions, guidance and rules for sharing that video data between jurisdictions is important. Guidance on data sovereignty is something that would be useful.

Josh Wiersma: RFMOs are taking some of the necessary steps in driving some of this forward. Lots of folks are talking about this. All of these conversations are necessary and become essential for EM providers to take that next step. The more discussions that happen at conferences like this, and the different standards development that happens at government and RFMO level, the better, and will be enough to convince tech providers to make changes.

## Best Poster Awards

As with all our previous conferences, in keeping with our desire to highlight the all-important poster presentations, we only give awards for what are judged 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. All conference attendees scored all the posters presented and decided on the following winners:

**First Prize:**

**Leveraging Synthetic Data for AI-Driven Fisheries Monitoring: Advancing Fish Identification in SynFish**
**Sander Delacauw**
**Flanders Research Institute for Agriculture, Fisheries and Food, Ostend, Belgium**

**Second Prize:**

**Reduce project: Deep Learning Integration for Bycatch Reduction and Data Harmonization**
**H. Nina del Rio-Ares**
**Institute of Marine Research, IIM-CSIC, Vigo, Spain**

**Third Prize:**

**Catching the right boat' - minimising bias in vessel selection.**
**Sam Birch**
**Cefas, Hayle, United Kingdom**

Congratulations to our winners and to all the poster presenters for their fantastic displays.

## Concluding Session and Discussion

Comments from the Conference Chair

The Conference Chair, Viðar Ólason began the concluding session by noting that this conference has had a total of 225 delegates representing 34 countries. A truly outstanding result! And the feedback received so far from delegates has been really positive.

Viðar concluded by thanking everyone for their attendance and participation. He noted how honoured and proud he and Directorate of Fisheries were to have hosted the conference in Reykjavík, Iceland. He then opened the floor for any comments about the conference: what was liked, what wasn't and suggestions for the next conference.

Comments from the Open Discussion

Miguel Nuevo would like to see more sessions and discussions on control and compliance aspects of monitoring programmes.

Teresa Athayde proposed to have a session on observers training and new technologies.

Bubba Cook would also like to see a session dedicated to new future tools for monitoring such as genes or drones.

Martin Beach suggested that to improve accessibility the questions and answers can be transcribed on the conference app.

Sarah Williamson recommends having an observer only panel, to discuss whatever subject they want! Megan Miller added that more observers' programmes should be discussed in the conference trough the point of view of observers.

Finally, Siosifa Fukofuka endorsed sessions on AI applied to EM and on observers training.

Viðar assured all present that the conference organising committee will consider all these very positive and useful comments as we prepare for the next conference in 2 years' time.

## The next conference

**Finally, it was announced that the next conference, the 12th International Fisheries Observer and Monitoring Conference will be hosted by Undersecretariat for Fisheries and Aquaculture in:**

# <u>Chile in 2028!!!!</u>

# See you all there!!

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# Conference attendees

| First Name | Last Name | Organization | Country |
|---|---|---|---|
| Þorsteinn | Ágústsson | Trackwell | Iceland |
| Amaya | Alvarez | Imedea | Spain |
| Magnus | Andersson | Swedish University of Agriculture SLU | Sweden |
| Caitlin | Anthony | Cefas | United Kingdom |
| Anna Guðrún | Árnadóttir | Fiskistofa | Iceland |
| Monique | Arsenault | ERT, LLC | USA |
| Hrannar Mar | Asgeirsson | North-East Atlantic Fisheries Commission | Iceland |
| Jóhann | Ásmundsson | Fiskistofa | Iceland |
| Claire | Assailly | Sinay | France |
| Maria Teresa | Athayde | Independent Fisheries Consultant | Portugal |
| Leontine | Baje | Pacific Community | New Caledonia |
| Benaia | Bauro | MFMRD | Kiribati |
| Martin | Beach | | USA |
| Bryan | Belay | MRAG Americas | USA |
| Catherine | Benedict | PSMFC | USA |
| Karl | Bentley | Marine Institute | Ireland |
| Sólmundur Gísli | Bergsveinsson | Fiskistofa | Iceland |
| Sam | Birch | Cefas | United Kingdom |
| Colin | Bishop | Archipelago | Canada |
| Ben William | Blackburn | SEAGULL OFFSHORE LTD | United Kingdom |
| Filip | Bohlin | Swedish University of Agriculture SLU | Sweden |
| Lisa | Borges | FishFix | Portugal |
| Eric | Brasseur | PSMFC | USA |

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| Elinor | Brett | Defra | United Kingdom |
| Dion | Browne | Department of Fisheries and Oceans Canada | Canada |
| Maël Manuel | Bueno | Norwegian College of Fishery Science | Norway |
| David | Byrom | MRAG Asia Pacific | Australia |
| Ezekiel | Capelle | NFMRA | Nauru |
| Gilberto | Carreira | Regional directorate of maritime policies (DRPM)/Regional Secretariat for the Sea and Fisheries | Portugal |
| Ignacio | Catalán | Imedea(csic-uib) | Spain |
| Thomas | Catchpole | Cefas | United Kingdom |
| Carolina | Cavero | Satlink SL | Spain |
| Andrea | Chan | | USA |
| Samantha | Chicos | Alaskan Observers Inc. | USA |
| Chen | Chun | Wageningen Marine Research | Netherlands |
| Lauren | Clayton | Marine Directorate of the Scottish Government | United Kingdom |
| Luis | Cocas | Subpesca | Chile |
| Greg | Connor | Biorex Inc | Canada |
| Bubba | Cook | Sharks Pacific | New Zealand |
| Brian | Cowan | Anchor Lab | Denmark |
| Éilís | Crimmins | Cefas | United Kingdom |
| Stefania | Crotti | Trackwell | Iceland |
| Rodolfo | Curralo | Apoam - Portuguese Association Of Marine Environment Observers | Portugal |
| Christopher | Cusack | Environmental Defense Fund | USA |
| Ratko | Cvitanić | Institute of Oceanography and Fisheries | Croatia |
| Danielle | Damato | | USA |
| Hubert | Dawe | Teamsters Local 855 | Canada |
| Lina | De Nijs | Pelagic Freezer Trawler Association | Netherlands |
| Fríðhild | Debes | Vørn | Faroe Islands |
| Helena Nina | Del Río Ares | Iim-csic | Spain |

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| Sander | Delacauw | EV-ILVO | Belgium |
| Sebastien | Demaneche | Ifremer | France |
| Ivanna | Diaz | | USA |
| Jillian | DiMaio | Teem Fish | USA |
| Jan | Djurhuus | Vørn | Faroe Islands |
| Jeff | Douglas | Integrated Monitoring, Inc | USA |
| Debra | Duarte | University Of Massachusetts, Dartmouth | USA |
| Merryn | Edwards-Moore | Cefas | United Kingdom |
| Arinbjörn | Elíasson | Fiskistofa | Iceland |
| Meghhan | Fletcher | The Nature Conservancy | USA |
| Drew | Forward | Seawatch Incorporated | Canada |
| Kristin | Frotvedt | The Norwegian Directorater of Fisheries | Norway |
| Javiera | Fuentevilla | Servicio Nacional de Pesca y Acuicultura | Chile |
| Siosifa | Fukofuka | SPC | New Caledonia |
| Erick | Gaete | Instituto de Fomento Pesquero (IFOP) | Chile |
| Romain | Godefroy | Thalos | France |
| Natalio | Godoy | The nature conservancy | Chile |
| Guilherm | Goudjil | APTATIO | France |
| Cara | Green | Seawatch Inc. | Canada |
| Madeline | Green | University Of Tasmania | Australia |
| Christopher | Green | Seawatch Inc. | Canada |
| Sue | Gregory | Government of South Georgia & the South Sandwich Islands | South Georgia and the South Sandwich Islands |
| Birgir Mar | Guðfinnson | Fiskistofa | Iceland |
| Hákon Dagur | Guðjónsson | Fiskistofa | Iceland |
| Heiðmar | Guðmundsson | Fisheries Iceland | Iceland |
| Kolbeinn | Guðmundsson | Trackwell | Iceland |
| Sævar | Guðmundsson | Fiskistofa | Iceland |

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|---|---|---|---|
| Sofie | Gundersen | Institute of Marine Research | Norway |
| Kolbeinn | Gunnarsson | Trackwell | Iceland |
| Kirsten | Håkansson | DTU Aqua | Denmark |
| Ragnar | HARDARSON | Akor ApS | Denmark |
| Mack | Hardy | Fisheries Immersed Sciences Inc. | USA |
| Lesley | Hawn | NOAA | USA |
| Craig | Heberer | The Nature Conservancy | USA |
| Jade | Heidt | AIS Inc | USA |
| Elaine | Herr | Alaskan Observers Incorporated | USA |
| Marcelo | Hidalgo | Seafoodmatter | Netherlands |
| Axel | Hjelm | Swedish University of Agriculture SLU | Sweden |
| Nathan | Holden | Cefas | United Kingdom |
| Jannik | Holm | KANUAPNA/GFJK | Greenland |
| Áslaug Eir | Hólmgeirsdóttir | | Iceland |
| Graham | Hooper | Department Of Primary Industries And Region South Australia | Australia |
| Ole | Høstmark | The Norwegian Directorater of Fisheries | Norway |
| Igor | Isajlović | Institute of Oceanography and Fisheries | Croatia |
| Holly | Isnor | Ecology Action Centre | Canada |
| Petur Meinhard | Jacobsen | Vørn | Faroe Islands |
| David (Dave) | James | Pinpoint Earth | New Zealand |
| Matt | Jenkins | Falkland Islands Government | Falkland Islands |
| Haukur | Johannesson | Marel Inc. | USA |
| Guðni Th. | Jóhannesson | HÍ | Iceland |
| Jan-Erik | Johansson | Swedish University of Agriculture SLU | Sweden |
| Daniel | Jones | Cefas | United Kingdom |
| Erna | Jónsdóttir | Fiskistofa | Iceland |
| Pia | Jonsson | The Norwegian Directorater of Fisheries | Norway |
| James | Kamola | NFA | PNG |

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| Hrefna | Karlsdóttir | Fishieris Iceland | Iceland |
| Jacob | Kasper | Hafrannsóknarstofnun | Iceland |
| Vanja Čikeš | Keč | Institute of Oceanography and Fisheries | Croatia |
| Ken | Keene | NOAA | USA |
| Owen | Kelley-patterson | Mrag Ltd. | United Kingdom |
| Joseph | Kendou | PNA Office | Marshall Islands |
| Lotte | Kindt-Larsen | DTU Aqua | Denmark |
| Vaughn | Kohl | | USA |
| Alyssa | Lambert | HGS | USA |
| Andrew | Lanza | CIMAR | USA |
| Amanda | Leaker | Department of Fisheries and Oceans Canada | Canada |
| Braven | Ledgerwood | AIS Inc | USA |
| Gonzalo | Legorburu | Digital Observer Services | Spain |
| Xabier | Lekunberri Mezo | AZTI | Spain |
| Laura | Lemey | ILVO | Belgium |
| Penihulo | Lopati | PNA Office | Marshall Islands |
| Willem | Louw | CapMarine | South Africa |
| Miguel | Machete | Imar - Instituto Do Mar | Portugal |
| Kimberley | Mackey | MRAG | United Kingdom |
| Josip | Maleš | Institute of Oceanography and Fisheries | Croatia |
| Kaloliane | Manuopangai | Tonga Ministry Of Fisheries | Tonga |
| Ereniti | Mareko | MRAG Asia Pacific | Marshall Islands |
| Estibaliz | Martinez De Lagos Guevara | Datafish | Spain |
| Gerald | McAllister | Scottish Fishermens Federation | United Kingdom |
| Holly | McBride | NOAA Fisheries | USA |
| Lauren | McGovern | Fisheries Immersed Sciences, Hawaii | USA |
| Martial | MEDJBER | APTATIO | France |
| Damir | Medvešek | Institute of Oceanography and Fisheries | Croatia |

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|---|---|---|---|
| Mark | Michelin | CEA consulting | USA |
| Meghan | Miller | | USA |
| Chloe (Pixie) | Moore | Cooperative Institute Of Marine and Atmospheric Research (CIMAR) | USA |
| Inga | Nesheim | The Norwegian Directorater of Fisheries | Norway |
| Fabien | NOEL | Sinay | France |
| Miguel | Nuevo | European Fisheries Control Agency | Spain |
| Patrick | Nugent | Teem Fish | Ireland |
| Alvaro | Nuñez | Zunibal | Spain |
| Macdara | Ó Cuaig | Marine Insititute | Ireland |
| Birkir Freyr | Ólafsson | Fiskistofa | Iceland |
| Vidar | Olason | Fiskistofa | Iceland |
| Jeremy | Olden | Network Innovations Maritime | USA |
| Hans Jakob | Olesen | DTU Aqua | Denmark |
| Kristófer Leó | Ómarsson | Fiskistofa | Iceland |
| Timothy | Park | Pacific Community | New Caledonia |
| Jen | Paton | Ecotrust Canada | Canada |
| Edward | Phillips | Fisheries Immersed Sciences Hawaii | USA |
| Jude | Piruku | Pacific Islands Forum Fisheries Agency (FFA) | Solomon Islands |
| Charlie | Pitts | AIS Inc | USA |
| Maria Jose | Pria Ramos | Archipelago | Canada |
| Benjamin | Querné | THALOS | France |
| Elise | Quinn | Marine Stewardship Council | United Kingdom |
| Elín Björg | Ragnarsdóttir | Fiskistofa | Iceland |
| Njáll | Ragnarsson | Fiskistofa | Iceland |
| Keith | Reid | Fao | Australia |
| Ríkarð | Ríkarðsson | Fiskistofa | Iceland |
| Ronja | Risberg | Swedish University of Agriculture SLU | Sweden |

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| Grainne | Ryan | Marine Institute | Ireland |
| Shyla | Ryan | Seawatch Incorporated | Canada |
| Marcelo | San Martín | Instituto de Fomento Pesquero (IFOP) | Chile |
| Nicole | Santoyo | Alaskan Observers, Inc. | USA |
| Tamre | Sarhan | Australian Fisheries Management Authority | Australia |
| Nick | Schiltz | Ilvo | Belgium |
| Everson | Sengebau | MAFE | Palau |
| Ivan | Sesebo | MFMR | Solomon Islands |
| Stephen | Shaw | Cefas | United Kingdom |
| Mary | Sheehan | Techglobal in support of NOAA Fisheries | USA |
| Þórir | Sigfússon | Fiskistofa | Iceland |
| Þorvarður Kjerulf | Sigurjónsson | Trackwell | Iceland |
| Jóhan | Simonsen | Vørn | Faroe Islands |
| Benjamin John | Simonson | Vanguard Tech Enterpise Ltd | United Kingdom |
| Ole | Skov | Anchor Lab | Denmark |
| Skúli Kristinn | Skúlason | Ministry of Industries | Iceland |
| Runar | Smestad | Institute of Marine Research | Norway |
| Kate | Smithers | Defra | United Kingdom |
| Mathias | Søgaard | Danish Pelagic Producers Organisation | Denmark |
| Maria | Sokolova | Wageningen Marine Research | Netherlands |
| Amelia | Sorrenti | University of Catania | Italy |
| Duncan | Souter | MRAG Asia Pacific | Australia |
| Jón Þrándur | Stefánsson | Ministyr of Industries | Iceland |
| Kevin | Stockmann | Alaskan Observers Inc. | USA |
| Marie | Storr-Paulsen | DTU Aqua | Denmark |
| Erik | Sundholm | Network Innovations Maritime | USA |
| Wouter | Suykerbuyk | Wageningen Marine Research | Netherlands |
| Derrick | Tagosia | Ministry Of Fisheries and Marine Resources | Solomon Islands |

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|---|---|---|---|
| Amelia | Taholo | | Tonga |
| Ána F. | Taholo | Pacific Islands Forum Fisheries Agency | Solomon Islands |
| Onosai | Takataka | Tuvalu Fisheries | Tuvalu |
| Sunny | Tellwright | Conservation International | USA |
| Alvaro | Teran | The Nature Conservancy | Costa Rica |
| Björg | Þórðardóttir | Fiskistofa | Iceland |
| Sveinn Andri Brimar | Þórðarson | Fiskistofa | Iceland |
| Jóhann | Þórhallsson | Verðlagsstofa | Iceland |
| Baldvin | Thorvaldsson | Swedish University of Agriculture SLU | Sweden |
| Steven | Todd | Wcgop | USA |
| Els | Torreele | Ilvo Marine | Belgium |
| Lauren | Trainor | AIS | USA |
| Þórarinn | Traustason | Fiskistofa | Iceland |
| Þórir | Traustason | Fiskistofa | Iceland |
| Patsy | Tremblett | Seawatch Inc. | Canada |
| Toni | Trevizan | Falkland Islands Government | Falkland Islands |
| Daði | Tryggvason | Fiskistofa | Iceland |
| Joshua | Tucker | Pacific States Marine Fisheries Commission (PSMFC) | USA |
| Ryann | Turcotte | | USA |
| Stella | Tuuau | Samoa Ministry Of Agriculture And Fisheries | Samoa |
| Diego | Undurraga | Fundación Future of Fish | Chile |
| Callum | Vale | Seagull Maritime Ltd | United Kingdom |
| Yoeri | van Es | Wageningen Marine Research | Netherlands |
| Rita | Vasconcelos | IPMA - Portuguese Institute of the Sea and Atmosphere | Portugal |
| Jason | Vestre | PSMFC | USA |
| Tiffany | Vidal | Pacific Community (SPC) | New Caledonia |
| Anna S | Vilhelms | Fiskistofa | Iceland |
| Josee | Vincent | FISHERIES IMMERSED SCIENCES HAWAII | USA |

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|---|---|---|---|
| Nedo | Vrgoč | Institute of Oceanography and Fisheries | Croatia |
| Amy | Westell | Noaa | USA |
| Racheal | Weymer | Ecotrust Canada | Canada |
| Amelia | White | Defra | United Kingdom |
| Shane | White | AIS | USA |
| Joshua | Wiersma | Integrated Monitoring | USA |
| Melanie | Williamson | CapMarine | South Africa |
| Sarah | Williamson | Alaska Pacific University and Saltwater Inc. | USA |
| Benjamin | Woodward | Cvision Ai | USA |