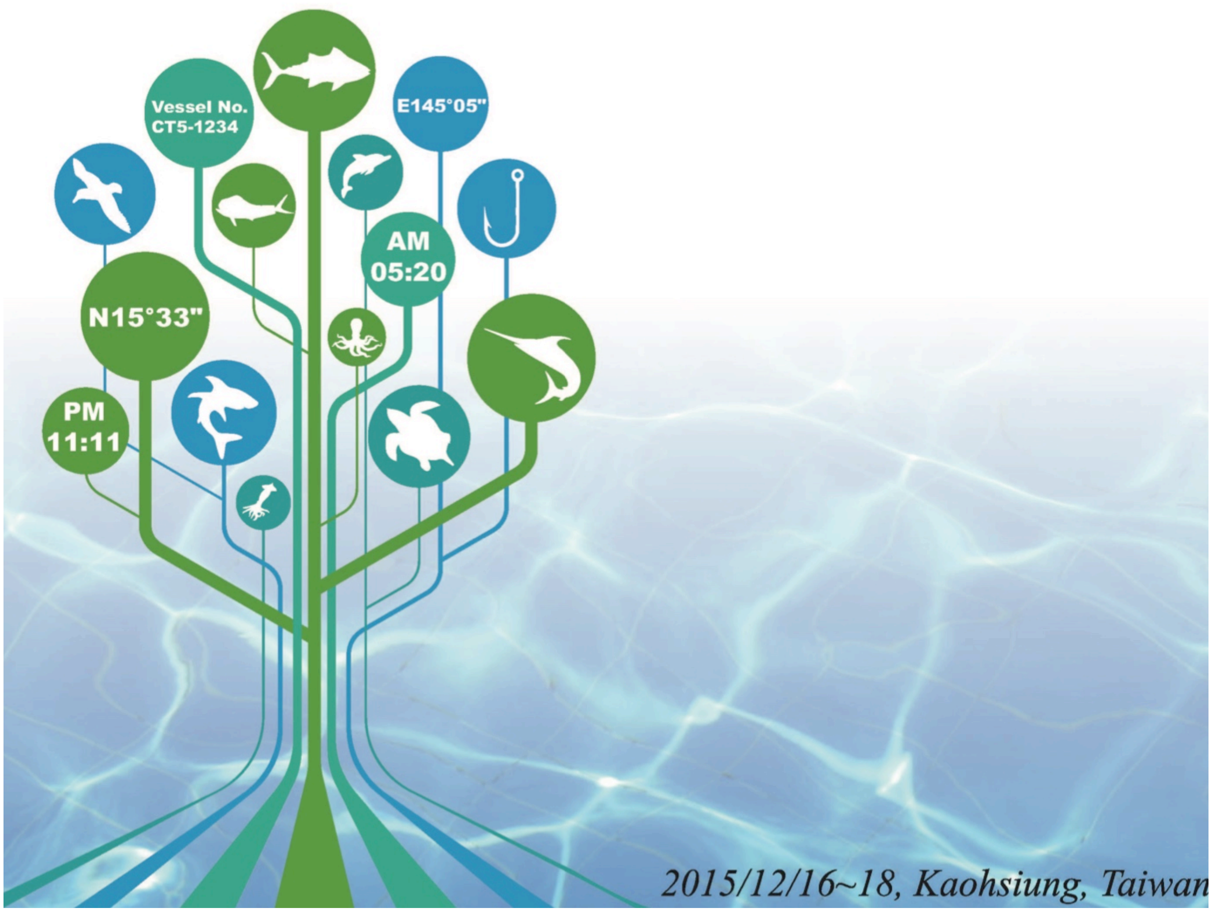
ISSF Technical Report 2016-07

Summary report of the International Workshop on Application of Electronic Monitoring Systems in Tuna Longline Fisheries



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Summary report of the International Workshop on Application of Electronic Monitoring Systems in Tuna Longline Fisheries

December 16 – 18, 2015
Kaohsiung, Taiwan

The Workshop was convened for the purpose of discussing the potential use of electronic monitoring system (EMS), particularly in tuna fisheries. The Workshop objectives were to (i) build on lessons learned to explore how EM can be implemented in tropical tuna fisheries; (ii) build broader awareness of EM technologies among stakeholders, including regulators, managers, industry and the public; and (iii) identify key implementation challenges and develop specific recommendations for EMS implementation in tuna RFMOs or in national programs. The Workshop was organized by the Fisheries Agency of Taiwan (FA) and the International Seafood Sustainability Foundation (ISSF). The Overseas Fisheries Development Council and the Fisheries Development Council International helped co-organize the Workshop.

The Workshop was attended by 156 participants (**Appendix 1**) with diverse interests, including from government, fishing industry, research organizations, EMS service providers and NGOs. The Workshop was opened by Tzu-Yaw Tsay, Director-General of the FA.

The Workshop was organized into three sessions of presentations and question-answer periods and one general discussion session that were facilitated by different Moderators. Twelve presentations were made during the sessions, followed by question, answer and discussion periods. Copies of the presentations can be downloaded from http://www.ofdc.org.tw/websEn/List.aspx?main=21; summaries are attached as **Appendix 2**.

Summary of Session Discussions

Session 1: E-Monitoring System Use in Global Fisheries (Moderated by David Chang, OFDC)

Presentations by the representative of Fisheries Agency of Taiwan, International Seafood Sustainability Foundation and Australian Fisheries Management Authority were made. During discussions, the following main points were highlighted:

- Considering the factors of cost and convenience of deployment human observer, Electronic Monitoring System (EMS) could be advantageous in longer fishing trip or on small tuna longline vessels, and there are some information could be better collected by EMS, such as species identification.
- EMS could be a useful supplementary tool for human observer onboard. In some fisheries, it may even be used as an alternative measure.
- EMS may be a cost-effective option and is individual accountability, where management actions can be tailored to individual fishers based on their needs and performance.
- However, There are still some tasks can't be executed by EMS, such as biological sampling, tagging, weighting, validation for measures required, etc.
- EMS is not simply putting cameras onboard. A well-defined legal framework and management measure or plan is also needed to ensure its performance.

Session 2: Case-studies of EMS in Tuna Fisheries (Moderated by Peter Williams, SPC)

Presentations of case studies of longline fisheries in Solomon Islands, New Caledonia and Taiwan were made, as well as a presentation on case studies of purse seine fisheries in all Oceans. During discussions, the following main points were highlighted:

- Several Longline EMS have been developed and trialed independently, with broadly similar components and outcomes:
    - In general, the longline EMS were acknowledged to be a viable mechanism for acquiring observer data;
    - Most Regional Observer Program (ROP) requirements tended to be satisfied but certain requirements were difficult to address. On the other hand, EMS can collect some data that observers would find difficult to collect.
- EMS trials are essential for proof-of-concept and need an adaptive, iterative process to resolve issues in addressing certain requirements.
- A systematic approach to understanding the requirements and how EMS may satisfy them should be undertaken prior to the trials commencing.
- Understanding all sources of costs and cost-recovery mechanisms was acknowledged to be a key area requiring clarification and consideration.
- Collaboration amongst all stakeholders (preferably through MOUs) was acknowledged to a fundamental requirement for EMS trials.

- EMS for purse seine has similar opportunities and challenges as EMS for longline, although there are clear differences in the approach to collecting certain data fields from each of these fisheries.

Session 3: Recent Technologies Developed by Vendors (Moderated by Victor Restrepo, ISSF)

Presentations by three EMS providers (Archipelago Marine Research, Marine Instruments and Satlink) were made. During discussions, the following main points were highlighted:

- Human observer programs and EMS should not be expected to be equivalent tools in every respect. Each is superior to the other in some aspects. One advantage of EMS is the ability to monitor continuously and simultaneously in different parts of a fishing vessel. One disadvantage of EMS is the inability to take some types of biological samples (e.g. tissue) or to carry out activities such as fish tagging.

- EMS technology has been evolving rapidly during the past few years. The technology is mature enough for implementation, as demonstrated by the fact that it is being used to monitor several fisheries worldwide (including a tuna longline fishery in Australia). It is expected that the technology will continue to evolve and, therefore, potential users would benefit from foreseeing what these improvements will be to seek new monitoring opportunities.

- Different EMS providers offer systems with different technological capabilities to suit different needs. Potential users need to understand that there are tradeoffs between image resolution, storage size, required analysis infrastructure, etc.

- Currently, all EMS systems require some level of involvement by the crew in order to ensure operability and maintenance. For successful implementation, it is important to consider mechanisms that will incentivize the crew to collaborate.

- The existing EM systems are adaptable and scalable. EMS providers are keen to adapt their systems to suit their clients' needs. However, if the objectives of an EM program are not very clear, the iterative process required for system adaptation to the client's needs can take a long time.

- For successful implementation of EMS, it is necessary to develop monitoring standards and a certification system. This is analogous to the WCPFC Regional Observer Program (ROP): The various national observer programs are audited against standards adopted by WCPFC in order to be accredited for participation in the ROP. Draft WCPFC E-reporting standard data fields for operational observer data are available at https://www.wcpfc.int/node/21569.

- Different vendors offer different solutions for analyses of data collected by EMS and associated report generation. These are generally to either train users (e.g. in a country's fisheries research or management agency), or to outsource to a third party. In either case, it would be beneficial to use observers who are already expert in the fishery being monitored so that they are familiar with the fishery's operations and catch composition. In addition, it is important to consider the certification of the unit in charge of analysis and report generation against standards (see previous point).

- The large amounts of data and images collected by EMS require that hard disks be swapped and retrieved at some point (e.g. at the end of a trip). For longline fisheries with very long trips (1+ years), it will be important to identify points at which hard disks can be swapped or retrieved (e.g. during transshipment operations or when vessels are being resupplied).

General Discussion and recommendations for future steps

A general discussion session followed the sessions in which presentations on various issues were made.

EMS has been proven as a tool to monitor tuna fisheries, for example as already implemented in Australia's eastern tuna longline fishery. Workshop participants agreed that EMS should not generally be viewed as a replacement for observer programs. Instead, EMS can complement regular observer programs, for example to enable longline fleets achieve the 5% observer coverage required by all tuna RFMOs (or higher coverage, if desired). Use of EMS is particularly attractive in fisheries with a high safety risk to human observers, e.g. because of lack of space on board. EMS can also help improve monitoring in fisheries that do not have some minimum observer coverage requirement (e.g., smaller purse seine vessels in various oceans), and to collect some data that cannot be easily collected in regular observer programs.

Trials of EMS in different fisheries are very important for several reasons. Trials are useful to develop minimum data standards and standards for how to collect EM data. In this sense, it is important to consider the results of all trials in similar fisheries, such as the case studies presented during the Workshop. Trials are also very important to acquaint key stakeholders (e.g., vessel owners/operators, crew, government officials, scientists, etc.) with the system's operations and the advantages and possibilities that they may offer. Finally, trials are desirable to compare and contrast the performance of systems from different providers.

Many fishing fleets are increasing required to fulfill different monitoring and reporting requirements. Workshop participants recognized that there are opportunities to integrate "e-systems" (VMS, EMS, e-reporting, etc.) in order to avoid unnecessary duplications and to achieve greater efficiency. Vendors present at the Workshop indicated that this is easy to achieve from a technical standpoint, once the objectives are clear.

Throughout the workshop, there were discussions on the costs of implementing EMS. More cost-benefit analyses can be useful to better understand the cost structure of different components (equipment, installation and maintenance, software review, training of staff, etc.) However, the discussion of who should ultimately bear the costs is something that will differ from country to country and which merits considerable discussion amongst involved stakeholders. It was also noted that there may be organizations such as NGOs that are willing to provide initial funding to kick-start EMS programs.

What's next for EMS? Participants discussed the steps that need to be followed in order to implement EMS in longline tuna fisheries in RFMOs such as the WCPFC. These steps are:

1. Establish standards for what data should be collected. These may or may not be the same fields as in a regular observer program. Consideration needs to be given to those data fields that can be easily collected by human but not by EMS, and vice-versa.
2. Establish standards for how the data in (1) should be collected. Standards should include protocols to ensure that equipment is suitably tailored to a particular vessel's operation. This requires dialogue between EM provider and vessel owner/operator.
3. Decide mechanisms for certification and auditing of EMS programs. This, in essence, would be similar to the way in which WCPFC's ROP certifies and audits the many national programs that make up the ROP.
4. Address harmonization between RFMOs to ensure data compatibility. Tuna RFMOs have taken steps to begin harmonizing some data fields collected by purse seine and longline fisheries. This can aid to ensure that regional studies are more comparable, and is also important for fleets that operate in different RFMO Convention Areas.

The organizers agreed that they would forward the report of this workshop to the different RFMOs in order to advance the implementation of EMS in these bodies. The workshop organizers thanked presenters and other participants for their active engagement and useful contributions to the discussion. The workshop was adjourned on December 18th.

Appendix 1
List of Participants

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- **Mike Gerner** (*Presenter*). Australian Fisheries Management Authority

INDONESIA
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- **Philip Lens**. Observer Program. National Fisheries Authority

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Peter Williams (*Moderator and Presenter*). Oceanic Fisheries Programme, Secretariat of the Pacific Community
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Victor Restrepo (*Moderator and Presenter*). International Seafood Sustainability Foundation.
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Appendix 2

Abstracts of the Presentations

Introduction of the observer program on Taiwanese tuna longline fisheries

Ted Tien-Hsiang Tsai (Fisheries Agency, Taipei, Taiwan. tehsiang@ms1.fa.gov.tw)

Catch information obtained from the commercial fishing vessels is an essential element for stock assessment of fisheries resources. Based on the status of fish stocks evaluated by scientists through stock assessment, the fishery managers therefore are able to make better decisions on adopting conservation and management measures. In addition, monitoring on fishing activities of vessels operating at sea is a key factor for ensuring the implementation of those measures.

Dispatching observers onboard fishing vessels through observer program has been recognized as one of the most efficient ways to collect catch information and monitoring fishing activities at sea. Taiwan, as one of the major players in global marine capture fisheries, has been implementing observer program since 2002.

This presentation introduces the observer program on Taiwanese tuna longline fisheries, including history, training courses, information and data collected, and examples of outcomes using those information and data.

POTENTIAL USE OF EMS IN TUNA FISHERIES: CHALLENGES AND OPPORTUNITIES

Victor Restrepo (International Seafood Sustainability Foundation. vrestrepo@iss-foundation.org)

Electronic monitoring is used today in many fisheries to improve data collection and general monitoring tasks, including compliance. Tuna fisheries are worldwide account for over 4.7 million tons of catches, which are made by a variety of fishing vessels with different levels of sophistication, which are flagged to many States with varying levels of capacity and resources. A monitoring system needs to be tailored to each fishery, taking into account the objectives of the program, the characteristics of the vessels and the infrastructure and resources available. If this is properly done, electronic monitoring offers great value to augment or complement existing monitoring programs and, in some cases, can be used in situations where monitoring by human personnel is not feasible. This presentation summarizes the experience gained by ISSF in various projects and highlights some of the main challenges and opportunities for implementing electronic monitoring in tuna fisheries.

COST EFFECTIVE MONITORNG IN AUSTRALIA'S TUNA LONGLINE FISHERIES

Mike Gerner (Australian Fisheries Management Authority. mike.gerner@afma.gov.au)

In the pursuit of improved data and cost effective monitoring of fishing operations, electronic monitoring has been seen as a viable alternative to human observers in some fisheries around the world. Electronic monitoring (e-monitoring) can provide fishery management agencies with increased confidence in catch and effort data to improve management decision making and increase flexibility for fishers. Traditional catch monitoring using human observers has commonly incurred impacts such as observer effects and bias toward regions or boats, however with e-monitoring, these impacts can be alleviated. An added benefit of e-monitoring is individual accountability, where management actions can be tailored to individual fishers based upon their needs and performance. In this way, the need for large-scale, blanket measures across fleets or sectors is removed.

The Australian Fisheries Management Authority (AFMA) and the Australian commercial fishing industry have been trialling e-monitoring technology for some years in a number of fisheries including Australia's Antarctic fisheries, prawn fisheries and tuna fisheries. A further long term trial involved the small scale implementation of e-monitoring on 10 gillnet hook and trap (GHaT) boats between 2010 and 2015. The results of these trials identified that e-monitoring could provide an effective monitoring alternative to human observers, thereby reducing the monitoring cost to industry operators.

E-monitoring in Australia, provides independent measurable data, which is used as an audit tool to verify fishers logbook data.

The key drivers for e-monitoring in Australian fisheries are:

- the need for accurate, robust data to better manage fisheries in the long-term
- the need for better monitoring of threatened, endangered and protected species such as seabirds, dolphins and sea lions.
- the need for cost reductions in the monitoring of fishing activities.

To implement e-monitoring in Australia's tuna longline fisheries, AFMA engaged a third party provider to install e-monitoring systems on fishing boats and complete the ongoing data analysis.

From 1 July 2015, e-monitoring became compulsory for full time fishers in the Australian Commonwealth tuna longline fisheries, with e-monitoring systems now installed on 36 fishing vessels.

Since the implementation of e-monitoring, there have been significant monitoring cost savings for the fishing industry as well as an increase in the accuracy of log book reporting. In particular, the reporting of the number of species caught and the amount of fish released has significantly increased in comparison to reporting in the previous year. This has subsequently led to higher confidence in tuna fishing data and will ultimately lead to better, more targeted management processes in the future.

RESULTS AND RECOMMENDATIONS FROM ELECTRONIC MONITORING TRIALS ON TUNA LONGLINE VESSELS IN THE SOLOMON ISLANDS AND NEW CALEDONIA

Malo Hosken (Oceanic Fisheries Programme, Pacific Community. maloh@spc.int)

In 2014 and 2015, the Oceanic Fisheries Programme (OFP) of the Pacific Community (SPC) collaborated with national fisheries authorities in the Solomon Islands and in New Caledonia, regional fisheries management organizations, non-government organizations, fishing companies and a technical service provider to conduct video electronic monitoring trials onboard three tuna longline fishing vessels. This presentation highlights the results and recommendations from the trials in the Solomon Islands and provides an update on the trial in New Caledonia.

The trials in the Solomon Islands consisted of equipping two CT-4 freezer class tuna longline vessels with the Satlink Sea Tube (SST) video E-Monitoring (EM) system (central processing unit, three cameras and GPS antennae). Both vessels fished in the Solomon Island Exclusive Economic Zone. The main objective of the project was to investigate the extent to which video E-Monitoring can generate the data normally collected by observers on-board tuna longline vessels based on the required minimum data fields specified under the Western and Central Pacific Fisheries Commission (WCPFC) Regional Observer Programme (ROP). A fisheries observer from the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR) was placed on each vessel to collect regular effort and catch data. Each vessel conducted two trips each which lasted between 51 and 81 days. The raw EM data were analyzed by two MFMR office observers using the Satlink View Manager (SVM) software. A basic comparative analysis between the EM-analysed data and the on-board observer data was undertaken. The results from this comparative analysis show that EM is a viable technology for collecting observer type data from longline tuna vessels. Two of the main recommendations are (i) Future trials of E-Monitoring should be established through a Memorandum of Understanding (MOU) clearly outlining the work involved and the roles of each stakeholder. As this type of work is innovative and evolving rapidly, the MOU should be as flexible and adaptive as possible while ensuring the focus remains on the main objectives and (ii) Any future E-Monitoring trials should consider a review of how each of the WCPFC ROP minimum data fields can be collected using EM before the trial starts.

The ongoing trial in New Caledonia consists of an on-ice tuna longline vessel equipped with the Satlink Sea Tube Lite (SSTL) EM system (central processing unit, three cameras and GPS antennae). The vessel conducts fishing trips which last on average 14 days. Since the start of this trial in July 2015, five trips have been conducted. On the most recent trip, an observer from the Direction des Affaires Maritimes de la Nouvelle-Calédonie (DAM) was onboard to collect regular effort and catch data. Two DAM office observers have been trained to analyze the raw EM data using an updated version of the SVM which notably includes an electronic fish measuring tool. This tool when calibrated correctly allows the office observer to collect precise size composition data. This project is schedule to be completed in July 2016.

The OFP is the Pacific Community's regional centre for tuna fisheries research, fishery monitoring, stock assessment and data management, and is also the contracted science and data service provider to the WCPFC. As such, we strongly encourage relevant consultation with the OFP in the planning process of future EM trials in the Western and Central Pacific Convention Area.

ELECTRONIC MONITORING TRIALS ON THE TROPICAL TUNA PURSE-SEINE

Jon Ruiz (AZTI-Tecnalia, Spain. jruiz@azti.es).

The difficulty of ensuring adequate statistical coverage of whole fleets is a challenge for the implementation of observer programs and may reduce the usefulness of the data they obtain for management purposes. This makes it necessary to find cost-effective alternatives. Electronic monitoring (EM) systems are being used in some fisheries as an alternative or a complement to human observers. Two studies were conducted with the aim of testing the use and reliability of EM on the tropical tuna purse seine fishery. To achieve this objective, several trips of tuna purse seiners operating in the three Oceans were closely monitored to compare the information provided by EM and onboard observers to determine if EM can reliably document fishing effort, set type, tuna catch and bycatch. Two different EM systems, manufactured by different vendors, were used. During the first trial, the Archipelago EM ObserveTM system was used. Secondly, the Electronic Eye was tested, which is an EM system based on the automatic photo taking developed by Marine Instruments S.A. Different systems showed different strengths and weaknesses, but in general this research showed that this kind of EM technologies have great potential for the monitoring of the tuna purse seine fishery. Results indicated that is a valid tool for monitoring number of sets, set-type and total tuna catch; however some future adjustments are still needed for the monitoring of the bycatch. We concluded that the EM systems could be a complement to observers or even a real alternative, according to the final goals of a monitoring program.

THE E-OBSERVING SYSTEM FOR SMALL LONG-LINE FISHING VESSELS DEVELPOED BY THE FISHERIES AGENCY OF TAIWAN

Chung-Hung Lin (National Cheng Kung University, Tainan, Taiwan. z8208037@email.ncku.edu.tw)

An Electronic Observing System including an Electronic-Monitoring System installed on fishing vessels, and an Electronic-Reporting system on shore-side is developed by the Fishery Agency of Taiwan government. The E-Monitoring System is applied to monitor and record the activities of the fishing operation. As to the E-Reporting System, it helps observers survey those recovered videos from the E-Monitoring System and retrieve valuable fishing operating data.

The E-Monitoring System has four cameras, two of them are mounted on stern deck to record baits casting activity and the others are mounted on front deck to record the activity of line hauling. The images are recorded by a digital video recorder (DVR) with GPS module. Because the memory space of the DVR is insufficient for a longer voyage, therefore a control system was designed to synchronize the on/off of the DVR with casting and hauling machines.

The E-Reporting System has an easy handling interface so that observer can pick out the useful fishing operation data by clicking the mouse. The obtained data are divided into two categories: the fishing operation information and catch's information, and there are saved into two files separately. The contents of fishing operation files include operation type, date, time, location, hooks number and bait type. As to the catch file it has date & time, location, fish length fish species. In addition, every catch is freeze into a picture and saved for further reference.

This system was installed on a 17 meter long long-line fishing boat and tested for 20 voyages, the total catches of 2178, including: 312 Yellow fin tuna, 1060 Dolphin fish, 104 Sailfish, 702 others are recorded. The length of catch measured by the computer-aided measurement are quite close to actual length that measured by the crews.

It is believed that the E-Observing System is able to collect valuable information and is an appropriate substitution for the current physical observers on board.

E-MONITORING CHALLENGES AND OPPORTUNITIES FOR PELAGIC LONGLINE FISHERIES - AN ARCHIPELAGO PERSPECTIVE.

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Established in 1978, Archipelago Marine Research Ltd. is a products and services company, employing over 150 marine scientists, technicians and support staff to provide comprehensive monitoring in a number of commercial fisheries, using at-sea observers, shore-based plant monitors, and Electronic Monitoring (EM) technology. Archipelago pioneered EM technology and has successfully applied this in several fisheries in Canada, the United States, Europe, Australia and elsewhere. Over its 15 year history developing and deploying EM technology, Archipelago has been involved in testing EM across a broad range of high seas and coastal fisheries representing a variety of geographies, fishing gears, catch profiles and monitoring objectives.

EM technology consists of a comprehensive data collection platform integrating positional data, fishing gear sensors, video camera imagery, and other data, to provide a rich data set that can be used to create standard fisheries catch and effort data, similar to data provided by observers. In addition to the at-sea data collection platform, Archipelago has developed specialized data analysis software to synchronously display of sensor and image data, automatically detect events of interest (e.g., fishing operations), and enable data entry of what was caught and discarded.

Archipelago has been directly involved in the application of EM technology in pelagic longline fisheries in Australia, New Zealand and the USA (Hawaii). Currently, 100% of the pelagic longline fleet in Australia carries Archipelago EM systems on all fishing trips as part of a comprehensive operational EM program. Our experience has shown that EM technology holds great promise for pelagic longline fisheries. Most vessels are well suited to host EM technology and fishing operations and target catch items are easily distinguished. Unwanted catch not brought aboard may be more difficult to identify and enumerate unless there are catch handling protocols to ensure this is visible with outboard cameras. Overall, rapid data processing enables EM data sets to be analyzed at a fraction of the vessel time at sea, resulting in very cost efficient monitoring method for this fishery.

The successful use of EM technology for fisheries monitoring involves a number of design considerations. An iceberg is a useful analogy to characterize the design challenge; the technology representing the visible, above water part, while the larger underwater portion corresponds to other important program design elements that are critical if EM technology is used for commercial fisheries monitoring purposes. In particular, operational systems are necessary to successfully deploy EM technology on fishing vessels and manage the data sets created from them. As well, the quality of EM data and therefore its use to produce fisheries data relies on vessel compliance with specific on-board obligations. These requirements are discussed in the context of a vessel monitoring plan which is used to clearly define host vessel responsibilities. A number of fishery context considerations that have a significant impact on the efficacy and cost effectiveness of an EM-based monitoring approach are also discussed.

ELECTRONIC EYE™ - A HD PHOTOGRAHIC ELECTRONIC MONITORING SYSTEM APPLIED TO LONGLINE TUNA FISHERIES

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Fishery management organizations require timely accurate information about the vessels activities and catches. The Electronic Eye™ (EE) is an electronic monitoring system based on High Definition (HD) automatic photography developed by Marine Instruments, S.A. This system was developed with the aim of being an alternative for smaller vessels where human observers are not feasible, or to complement human observers on larger fishing vessels. Studies have shown this system to be feasible for purse seine and longline fishing vessels to reliably document fishing effort, catch, discards, and bycatch, as well as help determine fish size and species. While large vessels such are factory trawlers and tuna purse seine vessels typically have nearly 100% coverage with human observers, smaller vessels such as longliners have low percent effort coverage by human observers, and data useful for management is scare and often of poor quality.

There are two models of the EE: The EE Plus for larger vessels with up to seven cameras and a central indoors controller; and the EE for smaller vessels with up to three cameras and an outdoor, weather resistant central controller. The system is unique in that HD photographs are collected at a configurable rate instead of video; this is very efficient on storage space requirements. Trip data are downloaded from a USB port leaving the internal Solid State Hard Drive in place to prevent any risk of data loss. Data from most fishing trips will fit on an external thumb drive. The High Definition photographs allow for much detail to be recovered during analysis. To save hard drive space and aid in privacy concerns, the imaging rate is configurable and can be linked to changes in the vessel's speed based on GPS, and/or hydraulic and proximity sensors monitoring the fishing gear. Typical configuration is to collect photographs around the clock with a faster collection rate only during fishing operations.

The EE includes an Iridium-based Vessel Monitoring System (VMS) which sends a position and system status message at configurable rates to authorized e-mail addresses; the vessel's position, direction and speed are recorded every 10 seconds. The EE has a backup battery system and four levels of security to access configuration tools and data transfer; all data is encrypted. The photographs are georeferenced with position and date.

The software Beluga™ is used to visualize and analyze the photographs which are linked to the vessel's track. Specialized personnel can use Beluga to collect fisheries data necessary to complete the required logbooks. An as option, EE can be linked to the OLRAC Electronic Logbook software for optimal event and data recording.

SATLINK SEATUBE AND DIGITAL OBSERVER SERVICES EM TECHNOLOGY FOR A LONG-TERM SUSTAINABLE TUNA FISHERY

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Along the years, the technology has been providing new solutions for sustainable fishing. Technology improves quality and time accurate data for governments, RFMO, ship owners and scientist. Long-term sustainable fishing is based on the improvement of data collection and monitoring of the tuna fleet. The technology has reduced the Illegal, Unreported and Unregulated fishing to make it almost disappear.

In the WCPO the electronic monitoring began when the FFA requested a Vessel Monitoring System in each vessel back in 2008. The following step was the Electronic Reporting system in 2013 and the last step has been the Electronic Monitoring system in 2014, based on camera systems in order to control the activities and the catch onboard the vessels.

Based on the future needs of the market, Satlink began to develop an Electronic Monitoring system to fulfill the requirements of governments, RFMO, ship owners and scientist. After years of developments the Satlink Seatube was launched giving the possibilities of full control of the fishing activities. The SeaTube E-Monitoring system was developed in conjunction with many players from the fishing industry. The SeaTube system was developed in order to be used as a complementary tool to human observers in order to provide more information to what can not be covered by the human eye. It is important to remark that there are no jobs at risk. Actually, the EMS let the human observer stay at home at night while analyzing catch during the day instead of two or three months at sea.
The system provides independent, verified, real and accurate information about the fishing activities, regardless the vessel size or fishing zone and improves the transparency of the fishing reports.

Satlink works together with Digital Observer Services (DOS), which is an independent provider of Electronic Monitoring services, formed by a professional team with deep experience of infield fishing activities as human observers. DOS uses the Satlink View Manager (SVM) software to analyze the videos recorded by the Satlink SeaTube and makes the inspection reports that will be provided to governments, RFMO, ship owners and scientist.

STATUS OF THE WCPFC WITH ER/EM REPORTING

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There is a wealth of experience at this workshop, and the WCPFC has come with a purpose of listening and learning of the many contributions that will assist in improving the management of data and streamlining information from the vessels that are generally too small or are difficult to place observers aboard; The WCPFC has a number of its members represented at this workshop as well as SPC who are the data providers for the WCPFC. The focus of the WCPFC is not so much to recommend particular systems but to collect data and information for both science and compliance purposes. The Commission will focus on development of Electronic reporting and Electric monitoring standards; Commission members will utilize the electronic technologies they choose to meet their fisheries data reporting obligations but will do so under the Commission agreed standards on ER/EM Reporting however in doing so will consider Small island Developing States member needs in the further development of ER and EM in the region.

E-MONITORING – DATA REQUIREMENTS FOR SCIENCE IN THE WCPFC TUNA FISHERIES

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Acknowledging the importance of having standardized data available for scientific analyses, the Western and Central Pacific Fisheries Commission (WCPFC) established minimum data requirements for both operational logbook and Regional Observer Programme (ROP) data in 2004 and 2007, respectively. E-Monitoring systems have considerable potential for obtaining scientific data in tuna longline fisheries. The Oceanic Fisheries Programme (OFP) of the Pacific Community (SPC) is the contracted science and data service provider to the WCPFC and has actively engaged in two E-Monitoring tuna longline observer trials over the last two years.

An important prerequisite of the E-Monitoring observer trials was consideration of how E-Monitoring would satisfy the WCPFC minimum ROP data field requirements. This presentation provides a brief overview of how this work was approached and the importance of liaison with the technical service provider. There are instances where data fields generated from E-Monitoring are inherently far more accurate than those collected by an on-board observer. The generation of the most of the required data fields from E-Monitoring is straightforward, but we highlight the challenges to obtain information covering some of the required fields. There has been gradual progress to address some of these issues and as long as technical service providers pursue innovative solutions, we can be assured of efficient and viable E-Monitoring systems in the future.

In anticipation of E-Monitoring becoming widespread, the WCPFC recently established draft E-Reporting and E-Monitoring data standards; these standards are a work-in-progress and not intended to restrict a member country's aspirations to develop their own E-Monitoring system, but were developed to provide some guidance on how and what data from their potential E-Monitoring system should be provided to the WCPFC, according to member-country data provision obligations. Certification of E-Monitoring systems by the WCPFC has been touted but would appear to be a long-term goal (if considered at all). Instead, the WCPFC may decide that the auditing of the E-Monitoring data provided by a member country against the WCPFC E-Reporting and E-monitoring standards will be sufficient in the short term.

Another recent development is the initiative to harmonize longline observer data fields throughout all tuna RFMOs, with the first meeting held in Taipei in January 2015. This forum has the potential to expand discussions on, and harmonize standards related to E-Monitoring across all tRFMOs in the future.

THE INTER-AMERICAN TROPICAL TUNA COMMISSION (IATTC): OVERVIEW OF THE OBSERVED AND UNOBSERVED DATA, AND SOME ASPECTS ON THE POTENTIAL USE OF THE ELECTRONIC MONITORING SYSTEMS (EMS) IN THE TUNA PURSE-SEINE FISHERY

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The IATTC was created in May 31st, 1949 in agreement between USA and Costa Rica to maintain the tuna populations in the Eastern Pacific Ocean (EPO). The IATTC Observer Program started in 1979. The observers were assigned to purse-seiners greater than 363 metric tons carrying capacity (Class 6) to collect data related to fishing activities. Since 1992 observers from different National Programs started collecting purse-seine fishery data on board vessels class 6 vessels, and the observer coverage was nearly 100%. Purse-seiners less than class 6 are unobserved and comprise about 15% the tuna captures in the EPO, the tuna data is collected thorough unloading logbooks, but the majority of non-tuna data is not collected. In addition, the IATTC also keeps summarized data information from industrial longline fisheries. The tuna purse seine fishery occupies a vast portion of the EPO. This fishery catches tunas according to their association: sets on a free school of tunas, sets on tunas associated with dolphins, and on tunas associated with floating objects. The main species caught by this fishery is the yellowfin, the skipjack and the bigeye tuna. Several non-target species are incidentally caught by this fishery (bycatch). The IATTC observer database keeps data collected by observers since 1979. The focus of the data collecting was marine mammal involvement in the tuna purse-seine fishery and vessel activity. Along the years, new data variables have been incorporated into the database. The taxonomic resolution of the IATTC bycatch database has evolved from taxonomic group of individuals to identifications down to species. The potential use of the electronic monitoring systems (EMS) in the tuna purse-seine fishery is explored on fishing data collecting for vessels where the observer placement is logistically difficult as well as in class 6 vessels to back up the *dolphin safe* condition recorded by the observer for the tunas caught in sets associated with dolphins, or to validate the observer data and facilitate the government interpretation of possible infractions to the Agreement on the International Dolphin Conservation Program (AIDCP).