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IMPLEMENTATION OF ELECTRONIC MONITORING AND REPORTING IN THE WCPFC - ASSESSING POSSIBLE IMPACTS ON EMPLOYMENT IN SMALL ISLAND DEVELOPING STATES

Implementation of electronic monitoring and reporting in the WCPFC - Assessing possible impacts on employment in Small Island Developing States

Discussion Document

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The opinions expressed in this report are the responsibility of the author and do not necessarily reflect the opinions of the WCPFC Secretariat.

Executive Summary

The Tenth Regular Session of the Western and Central Pacific Fisheries Commission (WCPFC10) noted a report that looked at the potential for e-reporting and e-monitoring in the Western and Central Pacific fisheries (Dunn & Knuckey, 2013). Following the presentation of the report, many Small Island Developing States (SIDS) Commission Members, Participating Territories and Cooperating non-Members (CCMs) noted that an assessment of the impacts on SIDS of electronic monitoring and electronic reporting would be useful to consider alongside the report. WCPFC10 agreed that a workshop be held in early 2014 to further consider the recommendations.

This report presents a potential scenario where 100% of logsheets and observers reports were submitted electronically and 100% of vessels used electronic monitoring. The likely impacts on a single administration (the Federated States of Micronesia) are assessed and compared to this scenario. This report assumes that current data needs would remain unchanged.

A descriptive assessment is provided from a literature review and interviews with SIDS national fisheries authorities (NFAs), principally National Oceanic Resources Management Authority (NORMA), Forum Fisheries Agency (FFA), as well as the Secretariat of the Pacific Community (SPC), Parties to the Nauru Agreement (PNA) Secretariat and the WCPFC Secretariat. Individuals interviewed were typically involved in observer programmes and had experience in recent e-technology trials.

The report outlines, that during the programme implementation phase, there may be a net loss of jobs directly involved in data entry and data quality checks, however there is the potential for an increase in jobs involving data analysis, IT support, maintenance and development. These new services will involve higher skills and qualifications, leading to an overall increase in the skilled workforce and the quality of work available to SIDS communities.

The impacts of incorporating these technologies in a monitoring programme are described. The findings noted that the impact of adopting e-technologies would potentially create diverse employment opportunities in the private and public sectors including, but not limited to, IT and software development, administration/ coordination, business skills and technical maintenance. SIDS may wish to consider looking at strategies to increase vocational training and capacity building in these areas. Project management skills will be required to manage the initial implementation and to set up the programme objectives and methods. Once objectives and priorities for e-reporting and e-monitoring in the Pacific are more clearly defined, SIDS may wish to consider looking at consider a cost benefit analysis to determine if implementation of such technologies provide cost savings for their administrations.

1. Introduction

1.1. Background

Increasing data needs and the identification of data gaps has led to consideration, at a Commission level, of using technology as a potential option to complement or supplement the current observer and logbook programmes. Questions have been raised as to how such technologies might impact on employment prospects for SIDS. These questions relate to the facts that electronic reporting reduces the need for existing data entry while electronic monitoring offers a potential alternative to at-sea observers onboard fishing vessels.

The benefits that electronic reporting (ER) and electronic monitoring (EM) could bring to the fisheries management regime in the WCPO are documented in WCPFC10 meeting document, WCPFC10-2013-16_rev1, which looks at the potential for these technologies in the WCPO. The paper recommended that such technologies be implemented "without delay" following the development of certification procedures, standards and specifications (Dunn & Knuckey, 2013). It also recommended a phased approach to implementation and consideration of separate but parallel processes to move these technologies forward (Dunn & Knuckey, 2013). The paper acknowledged that further information on the costs and benefits to Small Island Developing States (SIDS) was required and this was reiterated by Pacific Island Forum Fishery Agency (FFA) members at WCPFC10 in Cairns, Australia.

1.2. Objectives and Scope

This report aims to provide an assessment of the costs and benefits of a data collection and monitoring programme in a future scenario using ER and EM against the status quo. Specifically, the objectives of this report are to:

- identify the impacts of implementing ER and EM on Pacific Islands employment and
- consider opportunities that might arise from the adoption of e-technologies.

It is important to note that this report is not a cost benefit analysis and does not deal specifically with direct costs. Until the Commission makes some decisions with respect to direction, these are difficult to estimate.

The future scenario is envisaged in WCPFC10-2013-16_rev1 and assumes current data requirements and reporting timeframes will remain the same. It is acknowledged that the benefits of ER are already being realised by some Commission Members, Participating Territories and Cooperating non-Members (CCMs) and that further enhancements and broader adoption of this technology could be progressed in a relatively short time. With respect to EM, whilst the technology and its benefits are proven, in the Pacific there are a number of practical constraints which warrant further consideration. A non-exhaustive list of these constraints include

- data management of fishing activities that take place in multiple jurisdictions,
- hard drive distribution, collection and management in remote or isolated environments, and
- the transfer of large packets of data.

This report does not elaborate on the benefits to national fisheries authorities of implementing ER and EM other than to reiterate they are potentially significant in terms of timeliness and accuracy of data. This report also recognises that e-technologies continue to gain traction in fishing sectors worldwide, both with industry and regulators, mainly because of the cost savings and efficiencies they can offer and the fact that they can provide a level playing field across fleets with diverse characteristics. If the Commission agrees with the recommendation in the Dunn and Knuckey report and adopts a phased-in-approach to these technologies, it is reasonable to expect that further technical options and innovations will be a natural progression with associated changes in pricing both for software, hardware and data transmission. This study takes into account current resources required to support existing technologies and does not attempt to predict possible changes to available technologies in the future.

Finally, the report does not make any attempt to assess WCPFC or national/subregional fisheries management data needs against the various monitoring options (observers, vessel monitoring systems (VMS), EM) to determine their feasibility and/or appropriateness. This was considered out of scope of this report and is therefore recommended for future work. Within the WCPFC context, it might be appropriate for the Scientific Committee, Technical and Compliance Committee and as applicable for the Northern Committee, to give further consideration to future WCPFC data needs.

2. Method

2.1. Assessment process

The assessment involved describing a potential scenario involving ER and EM as envisaged in Dunn and Knuckey 2013. This scenario was then compared against the current complement of staff in a national fisheries authority (NFA), in terms of numbers and services. The case study involved the National Oceanic Marine Resources Authority (NORMA) of the Federated States of Micronesia (FSM). It was considered that it would be useful for potential impacts on a single national fisheries authority to be explored in further detail. NORMA was selected as it has indicated some interest in these technologies to support their fisheries management arrangements, NORMA's observer programme is large and well established, there are some in-country data entry staff and Pohnpei is a significant port in the region for tuna fishing operations. It is suggested that SIDS may wish to undertake a more detailed assessment of impacts once decisions on the future direction of these technologies is made. The report was prepared at the WCPFC office in Kolonia, Pohnpei.

Interviews and a literature review were used to collect information on the activities undertaken by observers, observer debriefers, administrators/coordinators, data entry staff and quality control staff. Interviews and site visits were conducted with key officials in FSM (NORMA), the WCPFC Secretariat, the PNA/MRAG office, Republic of Marshall Islands (RMI), and SPC/FFA who have significant roles in observer programmes. One trip was undertaken to RMI to conduct interviews with staff from the Marshall Islands Marine Resources Authority (MIMRA) and to attend a workshop on ER trials that had been undertaken in RMI and FSM.

The report is a qualitative assessment of the impacts of ER and EM on employment in SIDS. Where possible, costs have been sourced to assist in the assessment. It is important to note that the report is not a cost benefit analysis of the options as they relate to ER and EM. It is recommended that a cost benefit analysis be considered in the future once objectives and priorities for ER and EM within the WCPFC context are more clearly defined.

2.2. Assumptions

It was necessary, when assessing a future scenario, to anticipate decisions of the WCPFC with respect to ER and EM. It should be noted that the base assumptions underlying the scenario are indicative only and do not aim to predict any decision the WCPFC may make on the future use and application of these technologies.

It was assumed that WCPFC would

- maintain current observer coverage levels noting that coverage levels may reduce in time as the adoption and use of e-technologies increases
- determine minimum standards and specifications for functional, technical and regulatory purposes
- accredit EM video systems (type approval) on a capability and functional basis
- accredit ER systems (type approval) on a capability and functional basis (taking into account systems already in existence in the region)
- continue to use SPC-OFP as the scientific service provider (consistent with Article 13).

3. Current data collection and monitoring programmes

In considering the delivery of ER and EM programmes, it is important to note the various reporting and monitoring programmes already in place in the WCPFC.

3.1. Reporting requirements

WCPFC members are required to report an array of information including but not limited to operational catch and effort data, observer reports, Part 1 and Part 2 member annual reports, CMM reporting obligations. Ultimately the information collected requires an integrated data management system that allows for easy cross referencing and validation to support fisheries management decisions, including monitoring, control and surveillance (MCS).

As was noted in the future scenario envisaged in WCPFC10-2013-16_rev1, there is scope for a number of paper-based WCPFC reports sent from flag States/vessels directly to the Secretariat, to be suitable candidates for electronic reporting. The current types of reporting from flag States/vessels to WCPFC Secretariat under CMMs include:

- high seas transshipment notices and declarations, (CMM 2009-06);
- eastern high seas pocket special management area entry/exit reporting, (CMM 2010-02);
- high seas purse seine catch discard reporting, (CMM 2009-02);

- non-target species incident reporting (cetaceans (CMM 2011-03), whale sharks (CMM 2012-04), oceanic white-tip sharks (CMM 2011-04), silky sharks (CMM 2012-sea birds (CMM 2012-07), sea turtles (CMM 2008-03));
- VMS manual reporting in the event of VMS malfunction (VMS SSPs 5.4 and 5.5); and
- Flag-based monthly catch and effort reporting of FAD sets and bigeye longline catches fisheries (CMM 2013-01).

For many SIDS, most of the above WCPFC reporting obligations are not presently applicable as they do not have flagged vessels authorised to operate in waters beyond their national jurisdiction. However, as SIDS fisheries develop and more SIDS take on flag State responsibilities or chartering state responsibilities for reporting, it can be expected that e-reporting could potentially reduce the burden of these and future WCPFC reporting requirements on SIDS. A useful complementary tool to e-reporting initiatives, which would assist SIDS in meeting their WCPFC reporting obligations, would be the continued development of national and regional integrated data management systems to support fisheries management.

In addition to WCPFC data collection requirements, national observer programmes have also been used to conduct specific studies. In Australia for example, observers have collected data and information on monitoring of bycatch of southern bluefin tuna fishing, analysing the effects of circle hooks on bycatch mitigation to support management decisions (AFMA, 2012).

3.2. Regional observer programmes

Observers have been collecting data on tuna fisheries in the Pacific since the 1960s. FSM's National Fisheries Observer Programme (NFOP) commenced in 1979. In 1987, FFA began training observers for deployment on United States Treaty (UST) vessels. Pacific observers are deployed under the Federated States of Micronesia Arrangement (FSMA) which allows for the joint licensing of vessels flagged or sponsored by members of the Parties to the Nauru Agreement (PNA). The WCPFC established its Regional Observer Programme (ROP) in 2007 which covers fishing that occurs in more than one EEZ or on the high seas. Standardised data collection forms and sampling protocols across the different programmes provide consistency in reporting. Regional observer data is collected and checked by dedicated data entry personnel before being integrated into a centralised database based at SPC-OFP.

In 2008, the Commission agreed to 100% observer coverage of purse seine vessel activity to monitor compliance with a ban on fishing on fish aggregation devices (FADs), the closure of some high seas pockets and requirements to retain all catches of target species. This decision led to an increased demand for Pacific-based observers, including associated trainers and debriefers, data management and data quality control staff. In addition, the range of data fields to be collected and/or monitored by observers is increasing (WCPFC, 2012). There are roughly 650 trained Pacific Island observers currently working across the Pacific. Current observer workbooks include roughly 380 fields of data to be collected, depending on the fishing method and length of trip. At the conclusion of a trip, usually between 7-14 days following disembarkation, and over the course of 2-3 days depending on the length of a trip, observers work with debriefers in port to check the data collected in the workbook. The workbook and

journals are then scanned and sent to SPC-OFP to be entered. Once again, the data goes through a quality control check to maintain integrity. Figure 1 summarises the process of observer data collection.

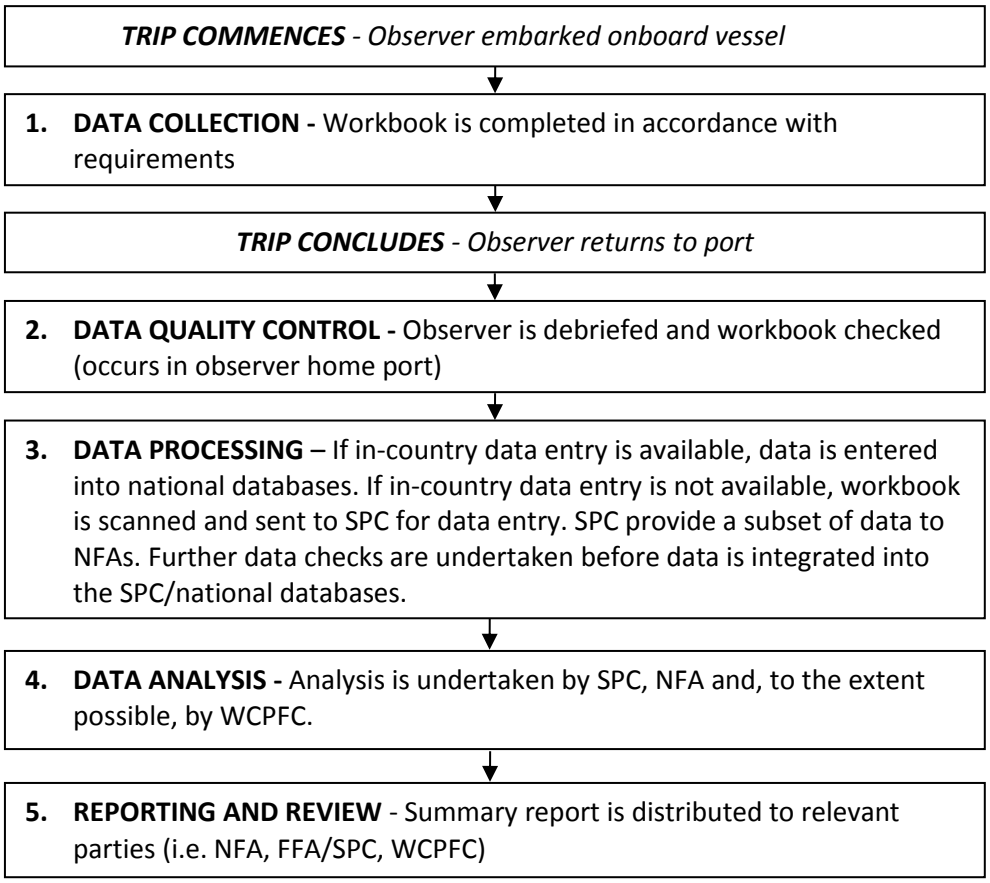

Figure 1 Key steps of an observer trip including data collection, processing and reporting

The majority of ROP data entry and data processing is undertaken by the SPC-OFP and, together with data collected by the US and the FFA under the US Multilateral Purse Seine Treaty, American Samoa, Australia, Chinese Taipei and New Zealand, is then made available to the WCPFC (Williams, Cole, & Falasi, 2013). There are 12 data entry staff employed by SPC-OFP and two technical staff in related administration, database development, training and management roles. In addition, there are a number of supporting roles that are involved in ROP management but are not explicitly funded as part of the ROP budget. The ROP budget for 2014 and 2015 includes total costs for the SPC-OFP ($US803,929 and $US923,904 respectively). This budget includes staff coverage to cover the current observer coverage rates (i.e. 100% in purse seine fishery, 5% in longline fishery (assumed 360 trips/year), 100% carriers) (Anon, 2013). This budget covers data entry only for the WCPFC ROP and does not cover logbook and observer data entry costs incurred by SPC, FFA and NFAs for national and other regional programmes. SPC have reported that while the majority of WCPFC observer data received has been entered, 6% of 2010 data, 8% of 2011 data and 3% of 2012 data received by SPC are waiting resolution of issues (Williams, Cole, & Falasi, 2013).

In 2013, WCPFC noted that, while catch and effort data and size composition data on the target species was available, notable gaps relating to catches of bycatch and byproduct species remain (Williams, 2013). In addition, mechanisms are in place to improve data on annual catch estimates from Indonesia and the Philippines. For the longline fishery, estimates of key shark species remain uncertain because of under-reporting by vessels and low observer coverage of these vessels. Anecdotal evidence exists of observers offering to misreport fishing on FADS in return for a monetary incentive (WCPFC, 2012). Trials of electronic technologies have indicated that they can resolve some of these issues (McElderry, Pria, Dyas, & McVeigh, 2010).

4. A future data collection and monitoring scenario

4.1. Electronic reporting

Electronic reporting (e-reporting or ER) enables the timely submission of quality fisheries data to assist in decision making. The technology involves a computer or tablet device and a web-based database or an interactive pdf form that enables the collection of data. Online forms allow for automated fields and inbuilt quality control processes, eliminating the majority of errors relating to poor transcription or illegible entries. An interactive pdf form can be populated then printed and signed when necessary. ER is attractive to national fisheries authorities as it provides a cost effective solution to manual data entry. Figure 2 shows the general path of electronic data from the vessel to the various bodies.

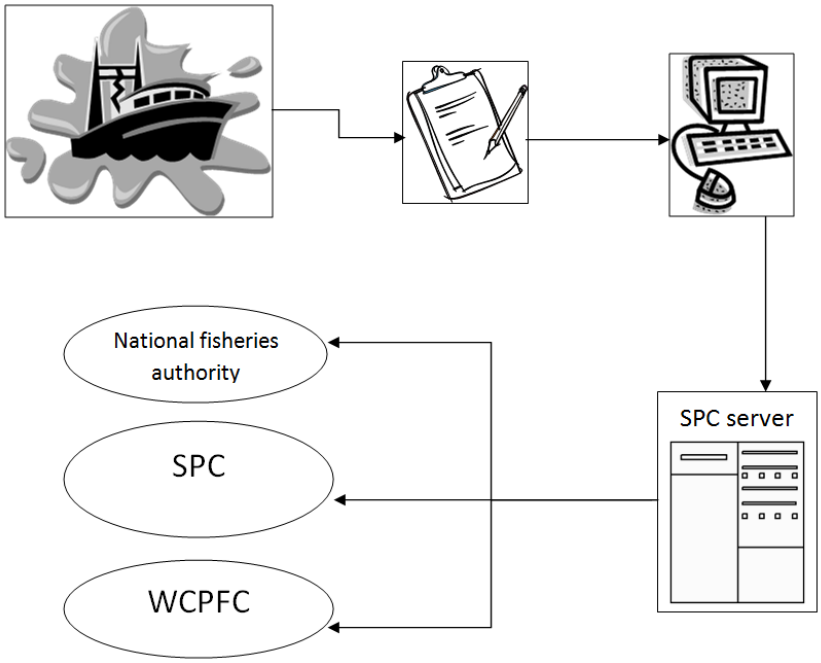

Figure 2: Schematic diagram of electronic reporting

4.1.1. Recent ER trials in SIDS

SPC-OFP and FFA are leading work in developing an integrated management system however this system requires timely and accurate data to be of benefit to national fisheries authorities. Requests from countries to improve the timely submission of data to facilitate management decisions led SPC-OFP and FFA to investigate the potential for e-reporting in the WCPFC and a number of trials are currently at various stages (Schneiter & Williams, 2013). Specifically, SPC are developing an electronic tuna observer reporting system (eTUBS) which is a web-based observer data entry system for the purse seine and longline observer programme. eTUNALOG is an onboard logsheet data management system using a SMART pdf entry form for fishing masters. Fishing masters are able to enter catch and effort information online which minimises the amount of data entry by NFAs and fishing masters as fields can be set up to be automatically populated or to use drop down boxes with common responses. These trials are aimed at providing practical experience for NFAs in implementing and managing e-reporting initiatives. PNG has also independently developed web based systems that allow for the electronic submission of logsheets and catch information and observer reports (WCPFC, 2013).

4.2. Electronic monitoring

Electronic monitoring (also known as e-monitoring or EM) is an electronic system for fishing vessels that consists of sensors, fixed cameras and data recording and communications equipment (refer Figure 3). Fixed cameras are placed on a fishing vessel to monitor onboard fishing activities, in particular catch handling and processing. Sensors that independently record movement can be placed on fishing gear such as hydraulics and drums. The sensors activate the cameras to record imagery and other relevant data onto the systems hard drive when the fishing gear is operational. EM systems also have a GPS which records vessel position and system status information at a configurable sample rate (i.e. at least once every 10 seconds). Satellite modems transmit aggregated system ‘Health Statement’ data every hour. This enables near-to real time monitoring of the functionality status of the EM system as well as vessel speed, position and the status of sensors which is indicative of fishing activity.

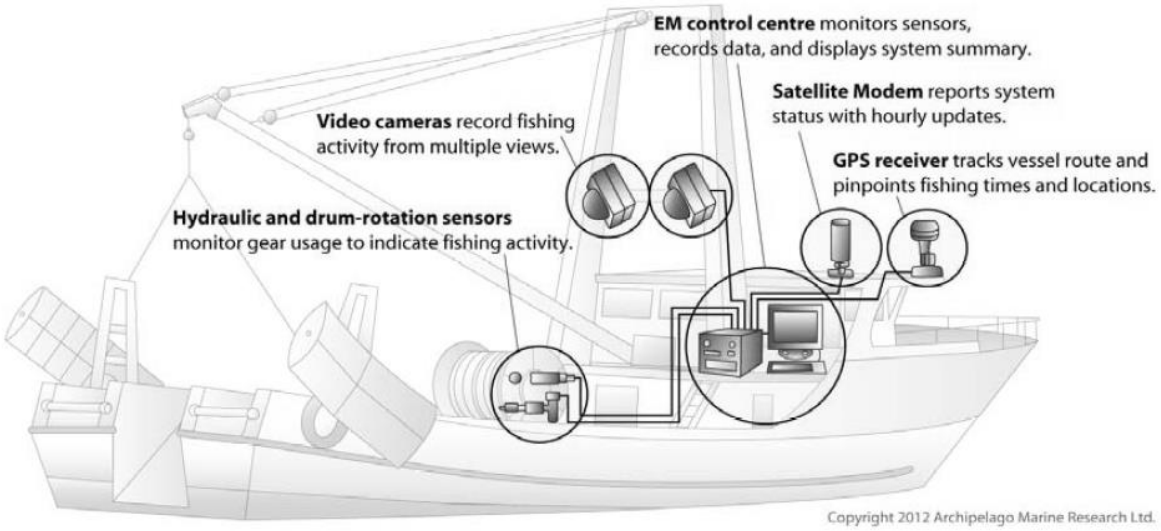

Figure 3 Schematic diagram of EM equipment. Source (Piasente, et al., 2012)

Camera footage and sensor data files are stored on a removable hard drive which needs to be physically exchanged to retrieve the data from the vessel. In fisheries where EM has been implemented, the data stored on the hard drive is then examined by analysts who review the footage and validate the catch and effort data in a fishers' logbook by comparing the footage (either in whole or part) against the data in the corresponding logbook. Figure 4 outlines a high level process map of key operational activities, data movement and management requirements for an EM programme. This map describes the data lifecycle to help understand the movements of data in an EM programme. Procedures and standards are required for each step.

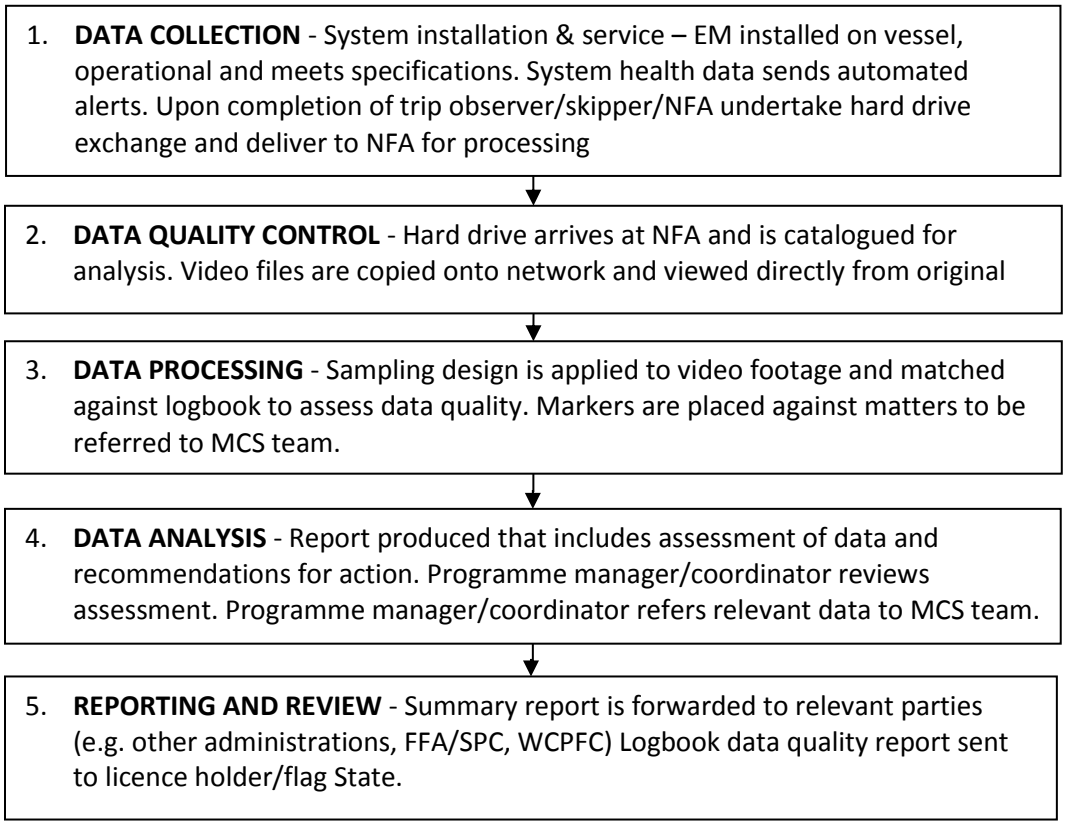

Figure 4 High level business process map - E-monitoring

5. Assessing impacts of ER and EM

ER and EM offer data collection and monitoring options that enable the integration of electronic services, digital video and programmable data loggers. The implementation of these tools comes at a considerable investment both to industry and to national fisheries authorities. This section will describe the existing resource requirements for the observer programme administered by an NFA, elaborate on some of the business processes under an ER and EM scenario and compare resource requirements to existing arrangements.

5.1. Case Study - Federated States of Micronesia

The Federated States of Micronesia (FSM) is one of the largest and most productive fishing zones in the WCPO. It contains some 600 islands that stretch about 2500km in an east west direction north of the equator. It shares maritime borders with Guam, Palau, the Republic of Marshall Islands and Papua New Guinea. A 2011 census revealed that the population is 106,863 with an average age of 21.5 years. In 2012, FSM had 29 domestic-flagged purse seine and longline vessels operating in the WCPFC area with a total estimated catch of 37,764mt. FSM licensed another 299 foreign fishing vessels, under bilateral arrangements, typically Japan (41%) and Chinese Taipei (24%). Fisheries employment has declined from 658 in 1995 to 246 in 2007 (Government of the Federated States of Micronesia, 2008). The potential for

greater industry development exists but a number of challenges, including the remote location, lack of adequate facilities and limited air connections hinder development.

NORMA is the regulatory body for the 200nm Exclusive Economic Zone. NORMA is established under FSM's *Marine Resource Act 2002* and is responsible for adopting management measures which promote the objectives of

- utilising the fishery resources of FSM in a sustainable way
- obtaining the maximum, sustainable economic benefits from these resources and
- promoting national economic security through optimum utilisation of resources.

A national observer programme is administered by NORMA with 83 observers covering 360 trips in 2013. NORMA also has a port sampling regime and observers are used to monitor unloading and transhipment activities in FSM ports, principally Pohnpei. In addition to its' national observer programme, NORMA supplies FSM observers to the Parties to the Nauru Agreement observer programme, the United States Treaty (UST) observer programme and to the WCPFC ROP. Candidates for FSM's observer pool go through a recruitment process, involving initial testing, short listing, interviewing and training. Training is typically four weeks in duration and includes fire fighting training, communication, first aid training, safety of life at sea training and technical training in identifying, measuring and counting fish. Following the training, candidates are again tested before being certified under the SPC-OFP and FFA observer standards. Since 2011, FSM have been an active participant in the eTUBS and eTUNALOG trials being run by SPC-OFP and further trials are planned for the future. Current NORMA resources involved in the observer programme are listed in Table 1.

Table 1: Resources currently associated with NORMA's observer programme[1]

Staff	No.	Role description
Observers	85	Includes senior, junior and new observers. Observers are responsible for collecting data and monitoring compliance with obligations. Observers do on average 3-4 trips per year for a total of ~360 trips/year
Data entry staff	2	Responsible for entry of catch and effort logsheets only (Observer data is scanned and entered by SPC staff).
	5[2]	Responsible for entry of purse seine observer data. Longline observer data is currently scanned and entered by SPC staff in Noumea.
Support staff	1 Chief of Research/observer coordinator	Responsible for the administration and delivery of the programme in accordance with agreed standards.
	1 assistant observer coordinator	Responsible for responding to vessel requests for observers, arranging travel, providing equipment, organizing medical checks, training, account keeping, providing debriefing support
	10 debriefers	Includes trainee debriefers. Responsible for quality control checks of workbooks, for providing services for observers
	1 quality control	Responsible for ensuring data is checked before sent to SPC-OFP
	1 trainer[3]	Trainers are required to deliver annual refresher training, to coordinate and deliver training to new observers and to ensure training standards are met
	1 port sampler and 1 observer/port sampler	Responsible for checking unloads and transshipments in the port of Pohnpei (up to 30 transshipment events/year). Port monitors also undertake port sampling of UST purse seine vessels in accordance with agreements between FSM NORMA and US NOAA.
	1 IT Manager	Responsible for hardware and software maintenance, update and support for NORMA servers, LAN and Clients.

5.2. E-reporting services and costs

For the purposes of this assessment, it is envisaged that a future scenario would involve 100% of both catch and effort logsheets and observer reports for all fleets being submitted on line, either via customised software or an interactive pdf form. The scenario assumes that fishing masters/observers will have access to the necessary equipment onboard the vessel (i.e. computer, power, internet connection). A secure log-in will enable fishing masters/observers to access a web-based portal. Log-ins and data entry would be auditable and able to be monitored remotely. Data is stored and uploaded to the national

[1] Resources are limited to those directly involved in NORMA's observer programme and does not take into account FFA/SPC technical support services (including training and database development and management).
[2] These positions are locally recruited and based in Pohnpei at WCPFC offices. The data entry staff were SPC staff, but are now employed as WCPFC staff, but who enter NORMA observer data with direct support from SPC.
[3] PNA observer coordinator – Training is done in coordination and collaboration with SPC.

database in accordance with requirements or once access to a secure internet service is available. The data is banked and upon return the observer is debriefed or the catch and effort data is validated against other data sources (i.e. port monitoring information, VMS information). Data is then integrated into the SPC-OFP database.

Table 2 provides an estimate of costs associated with a scenario where 100% of observer reports are submitted electronically. As observer coverage rates will remain the same, it is assumed that the observer administration and coordination costs will remain the same. Built in error checking will reduce the time taken to complete the forms and will reduce the length of observer debriefing from 3 to 2 days (sensitive observer data such as GEN-3 forms will not be entered on-line). For observer data, a technical support officer will work together with the debriefer to audit the data and facilitate transmission of the data to the national and regional databases.

Table 3 provides an estimate of resources associated with a scenario where 100% of catch and effort logsheets are submitted electronically. Data entry services will no longer be required but there is potential for staff with data entry experience to be retrained to provide IT support/technical advice and provide a more in-depth data audit role. Consideration should also be given to training and capacity building for managers and debriefers in IT skills and analysis. Under this scenario, there is a potential for a debriefing session to involve a number of sources of data, an observer's e-report, an electronic report from the vessel master including catch and effort data and finally video footage of fishing events. Standards will need to be developed to ensure that the data is handled consistently and the maximum benefit is derived from the analysis (i.e. timely and quality catch and effort data, enhanced MCS responses, improved understanding of fisheries operations).

Additional services that will be required under an ER scenario where 100% of observer reports and 100% of catch and effort logsheets are submitted electronically include:

- data integration specialists – once the observer has been debriefed or the catch and effort data has been validated against other data sources, the electronic report will need to be integrated into the SPC-OFP database. This process will require technical computer skills to ensure that fields are translated correctly. It is assumed that integration specialists will work alongside debriefers.
- IT support staff – responsible for providing training and logistical support to vessel masters/observers in the field. Excellent communication and IT skills would be required for this role. Previous experience in data entry and data collection may be considered beneficial.

Table 2 Estimated resources associated with ER of observer data

Electronic reporting of observer data	Current NORMA resources	Possible resources under ER scenario
1. Data collection	- 1 observer coordinator - 85 observers - 1 IT manager	- 1 observer coordinator - 85 observers - 4 IT support staff (assumes IT support required for 16 hours/trip, 360 trips/year)
2. Data quality control/validation	- 1 quality control manager - 10 debriefers (includes trainees, 1 debriefer per trip, 3 days per debriefing, 360 trips/year)	- 1 quality control manager - 5 debriefers (1 debriefer per trip, 3 days per debriefing (incl. data integration), 360 trips/year)
3. Data processing	- 0[4]	- 2 data integration specialists (work alongside debriefers in delivering training and ensuring data is integrated correctly into database)
4. Data analysis	- 0[5]	- 0[6]. No additional resources as trip analysis would be undertaken as part of debriefing.
5. Reporting and review	- 1 manager	- 1 manager
TOTAL	99	99

Table 3 Estimated resources associated with electronic reporting of catch and effort data

Electronic reporting of catch and effort data	Current NORMA resources	Resources under ER scenario
1. Data collection	- 2 port samplers	- 2 port samplers - 4 IT support staff (assumes IT support for 16 hours/trip, 360 trips/year)
2. Data quality/validation	- 1 quality control manager	- 1 quality control manager
3. Data processing	- 2 data entry staff	- 0
4. Data analysis	- 0[7]	- 0[8]. No additional resources as trip analysis would be undertaken as part of debriefing.
5. Reporting and review	- 1 manager	- 1 manager
TOTAL	6	8

[4] SPC has 12 staff and WCPFC has five staff currently employed that undertake data entry of observer reports for SIDS. In a scenario utilizing both ER and EM, entry data staff could be retrained to view and collect data from EM video footage.
[5] In depth analysis is typically undertaken by SPC. Trip analysis, for MCS purposes, is undertaken by FSM.
[6] In depth analysis is typically undertaken by SPC.
[7] In depth analysis typically undertaken by SPC.
[8] In depth analysis typically undertaken by SPC.

5.3. E-monitoring services and costs

For the purposes of this assessment, it is assumed that a future scenario would involve EM installed on all fleets, including purse seine vessels that currently carry observers. This would have a number of benefits – all vessels would be subject to the same monitoring standard, cameras can be used on vessels that cannot practically carry an observer and observers would be able to focus on technical work allowing the camera to collect routine data.

The estimated resources associated with an EM scenario are provided in Table 4. In general, when compared to the current resources, it is anticipated that a future scenario would require an increased number of data analysts, marine technicians and IT support personnel. It is worth noting that it is anticipated that one of the main benefits (cost reduction) of EM will be realised when there is a significant reduction in observer coverage. It is anticipated that as EM uptake increases, observer coverage will decrease over time. Additional services that would be required under an EM scenario include

- system install and operational matters (including maintenance, diagnosing incidents/problems and co-ordinating field service events)
- coordination of hard drive exchange events. In the FSM, hard drive collection and exchange could be undertaken by fisheries observers and port samplers.
- EM data processing including hard drive cataloguing, cleaning and destruction
- EM data analysis. Trip analysis could be undertaken by debriefers and used as part of an observer debriefing. Time taken to undertake analyse footage is dependent on a number of variables. A conservative estimate would be 1:0.5 (i.e. 1 hour takes 30mins to view and analyse). It is recommended that footage be evaluated by someone with an understanding of the licence obligations as well as fish and species of special interest identification, fishing operations and basic navigation.
- programme reporting and review standards
    a. MCS reporting requirements
    b. logbook data quality reports to industry
    c. audit methodology.

Table 4 Estimated resources associated with an EM scenario

Electronic monitoring programme	Current NORMA resources	Estimated resources under EM scenario
1. Data collection	- 85 observers - 1 IT manager	- 85 observers - 8 marine technicians to install equipment, conduct performance testing of equipment, support and maintenance[9]
2. Data quality control/validation	- 1 quality control manager - 10 debriefers (includes trainee debriefers. 1 debriefer per trip, 3 days per debriefing, 360 trips/year)	- 1 quality control manager - 48 analysts/debriefers (If 100% of trips were analysed, assuming trip:analysis ratio is 1:0.5 then 360 trips/year @average trip length of 30 days = 10800 days of analysis. Analysis + debriefing time (10800+2days x360trips)/242 (average working year) suggests 48 analysts)
3. Data processing	- 0[10]	- 2 data integration specialists (participating in debriefing to deliver training and to ensure data is integrated correctly into database) - 3 data processors to provide hard drive catalogue services, clean and destroy hard drives[11]
4. Data analysis	- 0[12]	- 0[13]. No additional resources as trip analysis would be undertaken as part of debriefing.
5. Reporting and review	- 1 manager	- 1 manager
TOTAL	98	148

5.4. Implications for SIDS

It is recommended that NFAs considering the implementation of these technologies consider the resources required to manage such a project. A dedicated project manager and project team may be required in order to manage the various elements related to implementation of the programme. Additional resources may include, but are not limited to

- development of standards and specifications for each of the data processes (data collection, data quality control, data processing, data analysis, reporting and review)

[9] Assumes install/operational support would be required for 328 fishing vessels a year licensed by FSM. Assumes each vessel undertakes three trips a year.
[10] SPC has 12 staff currently employed that undertake data entry of observer reports for SIDS. In a scenario utilizing both ER and EM, entry data staff could be retrained to view and collect data from EM video footage.
[11] Assumes 924 hard drive exchange events a year (~3 hard drive exchange events/day, (328 fishing vessels undertaking 3 trips a year))
[12] In depth analysis of data is typically undertaken by SPC.
[13] In depth analysis of data is typically undertaken by SPC.

- reviewing (future) data needs against monitoring options (observer coverage) including assessing the effectiveness of e-technologies in collecting data
- undertaking a database assessment for any potential redesign (including accommodating integration where necessary and mechanisms that enable provision of data/reports to industry/stakeholders)
- consider a regulatory reform process once programme is adopted
- assess cost recovery options for ER/EM programmes, including cost effective field servicing options
- procuring PCs to load hard drives and data analysis
- developing capacity building and training needs to support future programmes
- developing a communication and engagement strategy to ensure stakeholders are kept informed
- data security matters
- disposal of corrupted hard drives.

The resources required to complete this body of work should be costed out as part of a NFA's consideration of implementation of EM. Understanding the data lifecycle is a useful starting point for identifying and communicating the business processes, service requirements and implementation costs.

It should be noted that not all onboard data can be obtained by EM and a data needs analysis of the fishery and collection options will need to be completed and regularly reviewed to ensure the most appropriate mix of data collection tools are used. Some level of observer coverage is typical in fisheries using EM as part of a monitoring programme.

6. Outcomes

This report identifies a number of specific impacts on SIDS employment as a result of the implementation of ER and EM in the WCPO. It is important to note that these impacts are specific to the case study and other NFAs will potentially realise different opportunities and impacts from the introduction of e-technologies. In all cases, consideration will need to be given to current employees and their training needs to support the integration of these technologies as part of a monitoring and data collection programme. In general terms, benefits stemming from the introduction of e-technologies are wide ranging and include

- enhanced data quality and timeliness supporting responsive and robust management of fisheries resources and thus providing greater security in the economic benefits to be derived from the fishery
- a diverse and multi-skilled workforce servicing the fishing industry. SIDS will require initial funding to support vocational training and up-skilling in order to meet the demand, particularly in IT and software specialists
- flow on and complementary effects to other sectors.

NFAs may wish to consider resources required to project manage the implementation of an ER/EM programme. When considering existing arrangements against anticipated needs, it is suggested that NFAs

undertake a needs assessment to understand administration requirements for back end support, servers and data warehousing. Areas that will require further development, including operating procedures and frameworks, include

- programme structure
- administration, including considering how regional and sub-regional bodies may assist
- service delivery (outsourced or integrated with existing programmes)
- data processing/audits.

NORMA have participated in a number of successful ER trials over the past 12 months. The trials have indicated that, with strong observer support and with further programme refinement, ER could be used to support NORMA's observer programme with no change to employment numbers. In terms of employment, it is anticipated that the use of ER for observer and catch and effort reporting would see an initial reduction in data entry personnel, offset by an increased need for IT support and data integration staff. Observers would gain additional skills in terms of computer literacy and word processing while data entry staff could be retrained as analysts.

For EM, there are a number of unknowns that are difficult to anticipate and resource without further Commission guidance on priorities and objectives. EM has been trialled and considered in a number of developed fisheries as an alternative onboard monitoring tool. In some cases where data needs are well understood, it is assessed as a viable alternative to onboard observers to reduce industry costs. Without fully understanding how EM could benefit the WCPFC, it is presumptive to assume that EM could replace observers at this stage. An assessment of how EM could be integrated and its application is therefore required to determine how best to structure an EM programme. It is worth noting fisheries that have adopted EM have integrated EM as a compliance based logbook auditing tool. If this approach was considered in the WCPFC, the roles of observers and EM could largely be independent of each other and observers would simply be used to collect fisheries data. An EM programme would also require additional resources in the form of data analysts to undertake analysis of video footage. Clearly, EM is an attractive option to consider when validating data and assisting managers in decision making, however the specific benefits of EM to longline, purse seining and transhipment operations will need to be explored, to determine if the technology meets the data needs of these sectors.

It is important to note that there are a number of specific challenges in the WCPO relating to the implementation of these technologies. Geographic isolation, sparse population distribution and lack of funding have all meant that telecommunication services, particularly broadband internet access, are historically expensive in the Pacific. This situation is changing with increasing cooperation between business, the global community and local government seeing greater investment in infrastructure, such as submarine cables, providing Pacific Island countries with fast and affordable access to the internet. It is likely that the broad suite of potential applications will see a general increase in IT service capacity potentially encouraging new providers to operate in the region. Fisheries is one area that could see a direct benefit from the application of such technologies to support a data collection and monitoring programme.

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