TECHNICAL AND COMPLIANCE COMMITTEE
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PRELIMINARY REPORT ON E-MONITORING AND E-REPORTING CONSULTANCY

WCPFC-TCC9-2013-15
3 September 2013

Background

At WCPFC9 the Commission in adopting the TCC8 Report decided on the following approach to Electronic Reporting:

> ***307. WCPFC9 adopted TCC8 recommendations contained in paras. 169 & 189 of the TCC8 Summary Report concerning ROP data entry. (the text of the TCC8 recommendation is included in Attachment N)***
> *Information Management System*
> *308. FFA members welcomed the implementation of electronic solutions for improved data management, but reiterated the need to ensure the migration of capacity from the regional to the national level over time. In addition, the importance of demonstrating the effectiveness of new technology before reducing funding for existing systems was emphasized.*
> *309. The EU also supported the IMS and continued assistance to SIDS for programmes such as debriefer training and observer data management.*
> ***310. WCPFC9 adopted TCC8 recommendations contained in paras. 184-185 of the TCC8 Summary Report concerning the Commission's Information Management System. (the text of the TCC8 recommendation is included in Attachment N)***

The TCC recommendations included the following:

> ***184. TCC8 recommended to WCPFC9 that it task the Secretariat, in cooperation with the scientific services provider, to consider electronic data entry for ROP as a priority.***
> ***185. TCC8 recommended to WCPFC9 that coastal States developing Information Management Systems receive assistance, including training of de-briefers, to improve their ability to meet their national obligations in providing observer data.***
> ***189. TCC8 recommended to WCPFC9 that the Secretariat be tasked with undertaking a more comprehensive analysis of future options for ROP data management, including options raised in the Cost Recovery and Optimization of Commission Service Costs Report.***

Progress to date

As advised in WCPFC Circular 2013/38 the Secretariat, as directed in TCC8 paragraphs 184 and 189, spoke to the Science provider (SPC) and the Chairman after WCPFC9 to try to map a way forward on these important issues. It was agreed that moving forward into an electronic world in the WCPFC involves elements of both electronic monitoring and electronic reporting as they are closely linked and in some aspects overlap. Electronic monitoring which includes electronic logbook systems and video monitoring is implemented in several fisheries worldwide and trials have been already conducted and are currently underway in some fisheries in the WCPF-Convention Area. Fiji will also be trialing electronic monitoring in its longline fisheries utilizing funding from the GEF ABNJ project. It was considered important for Commission members in taking informed decisions on these important issues to fully understand how electronic monitoring and reporting might work for the Commission in the future (including what technologies are currently available and have been trialed), what the terminology was, what are standards and protocols needed to accept electronic data and what the benefits might be for WCPFC.

With this in mind the SPC and the Secretariat developed a project specification that has six core elements.

1. To develop a common understanding and language of what these two practices -- electronic monitoring and electronic reporting -- will mean in the WCPFC region. This is important so that all members have a common understanding of what is being discussed and potentially developed.
2. To document and evaluate current and future **E-Reporting** technologies that are potentially suitable for collecting and reporting data in the WCPFC tuna fisheries, and to recommend the best potential options for WCPFC tuna fisheries
3. To manage/coordinate two **E-Reporting** trials on behalf of the SPC/OFP in at least one of their member countries.
4. To document and evaluate current and future **E-Monitoring** technologies that are potentially suitable for the WCPFC tuna fisheries.
5. To conduct two trials of **E-Monitoring** equipment.
6. To propose potential scenarios for implementation of **E-Reporting** and **E-Monitoring** to guide discussions of a dedicated small working group.

The SPC went to tender on this project in April and received three (3) tender proposals. The initial work of the two consultants (Mr. Stephen Dunn and Dr Ian Knuckey) was to work with members, the SPC, PNA, FFA, industry and the WCPFC to research and report on elements #1, #2, #4 and #6 above. The SPC decided to undertake Element #3 themselves and it has been decided not to progress Element #5 until such time as the initial studies are completed so that we are better understand what it is we might want to do.

The attached provides the preliminary report from the two Consultants undertaking this study. One of the two consultants, Mr Stephen Dunn, will be in Pohnpei for TCC9 to present this report and will be available for additional consultations with TCC9 delegates.

Potential for E-Reporting and E-Monitoring in the Western and Central Pacific Tuna Fisheries

Preliminary Report to the Technical and Compliance Committee

Steve Dunn and Ian Knuckey

(steve.dunn@icic.net.au) (ian@fishwell.com.au)

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Background

The Western and Central Pacific Fisheries Commission (WCPFC) is responsible for *the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean*. Funds have been provided through the WCPFC Secretariat to the Secretariat of the Pacific Community (SPC) for a consultancy to investigate the potential of E-Reporting and E-Monitoring for tuna fisheries in the WCPFC area of competence.

This interim report provides a high level progress report to the Commission's Technical and Compliance Committee (TCC) against the project terms of reference.

The project terms of reference require the consultants to:

- Develop a common understanding and language of E-Reporting and E-Monitoring.
- Document and evaluate existing current and future E-Reporting technologies.
- Document and evaluate existing current and future E-Monitoring technologies.
- Propose recommendations for the most practical and efficient framework for implementation of E-Reporting and E-Monitoring to guide discussions of a dedicated small working group.

The full terms of reference are attached at Appendix 1.

Those responsible for fisheries management are becoming increasingly dependent upon electronic solutions for information management. These solutions have continued to evolve to the point where cameras can record fishing activity and catch, sensors can report on winch and engine activity, and computers and tablets can be used to capture and transmit fishery data in real time. The electronic solutions exist; the future is arguably clear; the path however is not.

It is recognised by both the WCPFC Secretariat and the SPC that a great deal of work has already been undertaken to develop E-Reporting and E-Monitoring systems.

The consultants engaged to undertake this project are Dr Ian Knuckey and Mr Steve Dunn. Dr Knuckey is a fisheries scientist with extensive experience in research and stock assessment. Ian has been involved in the development, trial and successful implementation of E-Reporting systems. Mr Steve Dunn is a former senior public servant in Australian state fisheries and maritime agencies, former Deputy Director General of the Forum Fisheries Agency, and is currently involved in the implementation of E-Monitoring for the Australian tuna longline fleet.

Consultations have been undertaken with relevant parties to discuss trials, developments, and the project more broadly. A schedule of consultations thus far is attached as Appendix 2. Those wishing to contact the consultants to discuss the project are encouraged to do so.

Common Language and Understanding

The terms "reporting" and "monitoring" are commonly used in fisheries management, science and compliance. The terms E-Reporting and E-Monitoring are used when hardware and software are combined for the electronic capture, recording and transmission of fisheries information. For the purposes of this project we are using (but constantly refining) the following broad definitions:

E-Reporting

E-Reporting is generally considered to be "***open system"*** because manual inputs are required and accepted, for example from skippers and observers.

Examples of E-Reporting include catch logsheets, observer reports, transhipment reports, and port sampling records.

E-Reporting provides the opportunity to store data for download at the end of a trip, as well as for real time reporting of critical information through satellite transmission or mobile networks.

E-Monitoring

E-Monitoring is generally considered to be "***closed system"*** because it does not accept external or manual input. It relies on automated operations, and sealed and tamper-proof or tamper-evident equipment.

A commonly used example of E-Monitoring is a Vessel Monitoring System (VMS), where GPS position and time data are collected automatically, and securely transmitted at prescribed intervals to relevant agencies.

There is generally no manual data input or external data manipulation throughout an E-Monitoring process. The use of on-board video, winch and engine sensors, vessel Automatic Identification Systems (AIS), satellite tracking of fish aggregating devices (FADS) and fish tagging program monitoring, are all examples of future potential opportunities for E-Monitoring in WCP tuna fisheries.

Preliminary Observations

Whilst this project will conclude with recommendations for a way forward for the Commission, our research and liaison during the initial phase of the project have revealed a number of points worth noting at this stage.

Proven technologies

Proven, ready to go, E-Monitoring and E-Reporting technologies already exist, many of which could meet the needs of the WPC tuna fisheries. There are already well established or well advanced trial programs in the Asia-Pacific, Europe, South Africa, North America, and Canada.

E-reporting

There is a wealth of examples of fisheries around the world that have trialled or adopted some form of electronic reporting system. These systems range from some very simple generic programs operating on off-the-shelf hardware that transfer minimal information, to highly customised software installed on purpose-built hardware that can transfer encrypted data with digital signatures in multiple formats through multiple transmission pathways. Various versions of these systems have been established for well over a decade, but their complexity and capacity is continually evolving as new technology is developed. Increasing computing power, memory and storage has been fundamental to this evolution, but because a significant proportion of fisheries data is collected on vessels working at sea, cost and capacity of data transmission has remained as the critical consideration in E-Reporting, regardless of the complexity of the system.

Data transmission options range from a virtually no-cost option of manually downloading data collected at sea to a digital storage device (e.g. CD or USB memory stick), through transfer via fixed line or mobile (cell phone) telecommunications systems, Wi-Fi or cable internet, to the most expensive option of digital data transfer via satellite. The quality and capacity of these options can vary from region to region, but this choice is also highly influenced by the distance from shore and duration of trip. Further, there are an increasing number of technical options for each type of data transfer method and a range of costs associated with each option depending on the frequency and amount of data to be transferred. Not surprisingly therefore, the question of what data is needed and whether E-Reporting needs to be made "real time" (immediately), "near real time" (within a day) or at "end of a trip" is critical.

E-Monitoring

Vessel Monitoring Systems (VMS)

VMS technology is well proven and used worldwide to provide fisheries information for both compliance and scientific programs.

There is 100% VMS coverage in the WCPFC area of competence. Every vessel either fishing for tunas or involved in fishing for tunas, is captured by someone's VMS:

- The Commission VMS monitors all fishing and carrier vessels when fishing or transiting international waters, but not in national waters. Some members have included their national waters as part of the Commission VMS including Australia, FSM, New Caledonia, New Zealand, French Polynesia, Wallis and Futuna, Nauru, USA, and Tokelau.
- The FFA VMS monitors all fishing and carrier vessels registered with FFA and fishing or transiting the national waters of members.
- The FFA VMS enables its members to monitor vessels in high seas areas if the vessel holds a licence from the coastal state.
- Other coastal state Commission members generally monitor their fleets when fishing, transhipping or transiting their national waters, as well as in international waters.
- The Commission VMS gives coastal states the option to monitor vessels operating in the high seas, up to 100 nautical miles beyond its EEZ.
- Many companies monitor their vessels in all waters.

Video and Sensors

Video monitoring in conjunction with winch, engine and hydraulic sensors is now well proven technology, progressively developed over more than fifteen years and able to provide independent data to support monitoring objectives for science and compliance.

Wherever there is a need for observers, video monitoring can supplement some aspects of human activity. It never sleeps, does not require food or companionship, and can be used in multiple positions on boats where observers cannot be placed.

Whilst observer programs are the traditional and primary method of gathering independent data, video monitoring can now supplement and support these programs. These can be easily added as monitoring programs grow, and can be targeted at limitations identified in observer programs. Video monitoring can be used as an audit tool to verify observer and catch logsheet data, can monitor use of mitigation measures and can also free up observers to undertake data collection tasks whilst the video records fishing operations. It has been suggested that in the future, video monitoring may well be the only way some sectors can remain fishing if they are to comply with future CMMs and certification requirements.

Efficiency

Some of the most inefficient aspects of the current information regime reported by many countries and agencies is the double handling of data, multiple data entry points and the considerable (and differing) time lags between data collection and data input into databases. These inefficiencies at the initial stage of the data management process have a flow-on effect that cause further inefficiencies for many of the WCPFC research, compliance and management activities. Use of E-Reporting could significantly improve the efficiency and cost-benefit of the entire system, through more efficient use of all fisheries data and enabling a realignment of resources to optimise the value of the current data that is collected.

Direct onboard input of electronic data into an E-Reporting system by a vessel officer or an observer has immediate efficiency returns. First, many onboard E-Reporting systems have software designed

to directly capture date, time and location data from GPS, and to retain the data in repeated fields at either the trip level (e.g. vessel and crew details) or set level (e.g. gear configuration). In addition, at the point of entry the software can ensure that mandatory fields are not skipped, data formatting is correct, data is entered within acceptable ranges, and use of dropdown boxes and lists ensure data consistency in non-numeric variables. This can significantly reduce the observer debriefing time. Further, problems and mistakes associated with post-event transcription from hardcopy to computer during key-punching of logsheets and observer reports is greatly reduced or eliminated. Once entered and transmitted in an electronic form, the process of data validation and verification can begin immediately, including cross-verification of data from multiple sources. For example: real time data from E-Monitoring (e.g. VMS, equipment sensors) can be automatically cross-checked against near real time E-Reporting of observer daily reports or transhipping reports; or at the end of a trip other observer data (e.g. catch composition) can be cross-checked against the vessel's logsheets. The current situation, where these multiple data sources are not received at the same time and then not keypunched and transferred for many weeks (if not months or years, and sometimes never), undermines timely identification of potential compliance issues and reduces opportunities to improve the quality of some aspects of the scientific data.

Observer Coverage

It is estimated that less than 3% of the longline fishery currently has observer coverage, and that due to the small size and relatively poor working conditions on many of these longline vessels, observer coverage is likely to remain low. The bycatch data from longline logsheets is considered generally poor. Current E-Monitoring technology could dramatically increase information coverage and quality, and collect representative information on fishing activities and species composition.

Whilst the purse seine fishery already has 100% observer coverage, E-Monitoring could assist in or augment the ever-increasing workload placed upon observers, could be used to validate observer data, and watch areas and activities the observer cannot. E-Monitoring is highly resistant to corruption.

Employment

There is a concern that E-monitoring and E-reporting will come at a cost to employment opportunities for Pacific Islanders. These concerns are unlikely to be borne out. There is, in fact, a real opportunity for E-solutions to create additional and better quality employment with advancement opportunities in data analysis and reporting from data collection and entry. This would be likely to result in a net gain in employment, an increase in the quality of employment, and a marked increase in the efficiency and effectiveness of compliance, research and management.

Observers undertake a wide range of tasks whilst onboard commercial fishing vessels, only some of which can be replaced or augmented by an E-Monitoring system. To simply state that the use of onboard video monitoring for example can replace observers is incorrect. The question therefore becomes what level of coverage of the different tasks is required and what is the cost effective means of acquiring this data. This should be considered explicitly with respect to monitoring Conservation Management Measure (CMM) requirements and meeting scientific and compliance objectives. With this in mind, the current mindset may need to change from achieving "*x percent observer coverage*" to "*x percent information coverage*". For example in the longline fleet, video monitoring offers a realistic option to increase the current 2-3% of observer coverage to 100% information coverage. Rather than a reduction in observer employment, there would be in increase in information monitoring employment. E-Monitoring may also resolve some the significant OH&S issues associated with observer coverage of a large proportion of this fleet.

The concept of 100% "information coverage" will be explored further in the project report.

Perceptions of cost

There is a perception that the costs of implementing E-Reporting and E-Monitoring will be prohibitive in the WCP tuna fisheries. Evidence from other fisheries contradicts this perception. In the WCP tuna fisheries however, the situation is complicated by the significant range and disparity in funding, cost recovery, and subsidy arrangements whereby cost burdens are not felt in a uniform way. This makes quantitative analysis and comparison difficult.

Whilst one comment was to the effect of "the question is not so much whether we can afford to implement this, but whether we can afford not to", the fact is that implementation will be expensive. Technology solutions do, however, offer the potential for significant long term efficiencies with associated savings and benefits. An initial scan of data suggests a positive cost benefit is likely to be demonstrated in the final report. Some very preliminary comparative financial data is attached at Appendix 3, and further cost benefit discussion will be included in the project report.

Project Timeliness

This project is timely. Everywhere we have looked there are further E-Reporting and E-Monitoring trials either being planned, underway or near completed. There is a risk that these will continue to roll out in an ad hoc manner and undermine the potential for coordinated, effective and efficient systems.

Noting this, it is a reasonable assumption that within five years the implementation challenge will be greater than it is today, because so many jurisdictions will have developed and introduced their own systems with potentially incompatible or inappropriate technologies, differing data standards, and incompatible information management systems. As a result, change to meet common standards will be resisted and achievement of data efficiencies and desired management outcomes will likely be more difficult and expensive.

Within 10 years, emerging technology will have revolutionised how we collect and manage fisheries information.

Multiple trials and implementation

Within the WCPFC, some of the E-Reporting and E-Monitoring projects are highlighted below (this list may be expanded once all consultation has been completed):

- PNG National Fisheries Authority (NFA) has implemented E-Reporting of port sampling using customised tablet interface, and trials of electronic observer reports are ongoing.
- All vessels fishing in the vessel day scheme (VDS) have the option of submitting E-reports claims for non-fishing days through a web-based portal.
- A subset of observers are trialling the use of handheld satellite communicators for daily real time transmissions, focussed largely on safety at sea issues, but moving towards event reporting.
- SPC is conducting trials of PDF logsheet data entry by both vessel skippers, and observers.
- There have been several trials using video cameras and equipment sensors to record fishing activity in the WCPFC area but it currently appears to be mandatory in only one fishery (the Australian east coast tuna longline fishery) where it is currently being implemented.
- This project has identified a significant number of larger fishing vessels already using video monitoring equipment for their own reasons – to monitor fishing and other vessel operations, safety, and crew activities.

Critical next steps

Available technology is not the limiting factor in the implementation of E-Reporting and E-Monitoring in WCP tuna fisheries. Whilst this project will analyse the limited data available on current costs, and provide a high level cost-benefit analysis, critical next steps will include:

- What, why, when analysis - agreement about how much of which data is required and whether it is needed in real time or at trip completion.
- Development of a policy and legislative foundation.
- Development of data standards and formats.
- Hardware and software certification and type-approvals.
- Resolution of data ownership, confidentiality and privacy issues.
- Resolution of technical and logistic challenges in the context of such a massive and remote geographic area.

Electronic data options

Prior to the implementation of E-Reporting or E-Monitoring systems, managers, compliance officers, and researchers must agree on which information sources they are going to be applied to, and within each, what data is required in real time or otherwise. Once this decision is made, implementation of E-Reporting and E-Monitoring can proceed to the next phase – the development of data and reporting standards. There is a need for a fundamental process to establish what data is needed, why and when, taking into account all the opportunities for data to be collected.

Data standards

To be both effective and efficient, implementation of an E-Reporting system requires an explicit statement of: what data fields are required; when it is required; whether they are mandatory or optional; what is the format of the data; and, what is the acceptable data range. Otherwise, the risk is that data will arrive at the relevant agency's database as such poor quality and in such disarray that there will be more effort required in sorting through and fixing the information than if it was just sent through manually in paper format and keypunched in the first place.

Certification

Finally, once the above steps have been completed, there is a need for "certification" of the E-Reporting system to ensure that the created data reports meet the agreed data reporting standards. Such certification is usually done by the agency in control of the database into which the data is being transferred.

With the above decisions made and processes established, there is abundant opportunity to establish E-Reporting and E-monitoring in the WCP tuna fisheries. Regardless of the extent or complexity of E-Reporting system envisaged for the WCP tuna fisheries, based on systems already operational elsewhere around the world, it is most unlikely that technology will be the limiting factor in its implementation.

Vision

Well proven technology already exists to enable the following open system and closed system monitoring scenario:

> *The master of a vessel makes a single button push (SBP) entry in his E-log as he leaves port. The observer makes a similar entry in his O-log. Both entries automatically record date, time and location via GPS. Any changes to the data are recorded for audit purposes. The vessel's VMS transmits real time position data at required intervals. The start of fishing operations is SBP recorded by Master and Observer. As the vessel slows video recording automatically starts to capture items of interest around the vessel (other vessels, FADs, marine mammals). Winch sensors automatically trigger video recording of the fishing operation areas, and a real time event report occurs using a short burst data (SBD) transmission (the satellite equivalent of SMS). In accordance with CMM requirements, reportable events are reported by the master and observer through real time, SBP entry, via SBD. As fish are brought on board the observer samples the catch and records species composition, length, and weight estimates. Completion of fishing operations is recorded, and E-logs and O-logs are completed with full details of catch and fishing operations. The winch sensor times out video monitoring and triggers a real time event report. At any stage either at sea or in port, compliance officers can come onboard with*

digitally encoded USB flash drives that automatically download up to date summary information from the E-logs.

Each day, both the vessel and observer separately transmit small packets of pre-determined data, in near real time, through SBD. Approval to tranship is sought and given via SBD requests. Zone entry and exit are detected and reports sent automatically via SBD notification.

At the end of a trip all the video and other data recorded on board is recovered, downloaded or transmitted, validated, and loaded into the respective country and RFMO fisheries information systems, in line with ownership, confidentiality, privacy, and chain of custody requirements (for potential evidence). Much of the data checking and validation can be done automatically before it is analysed in accordance with established protocols to provide scientific information, validate observer reports, and to investigate compliance with CMMs.

Carrier vessels fitted with video cameras and sensors automatically record every transhipment event, with automated real time activity reports by SBD transmission.

Every FAD is fitted with a locator beacon visible to both the owner, and the RFMO.

Real time and near real time log sheet and observer position data is automatically overlaid and compared, and anomalous data flagged for further analysis. Information from E-logs is automatically cross referenced with O-logs, VMS track, FAD tracks, entry, exit, and transhipment E-reports. Conflicting or divergent catch or position information can be automatically flagged as anomalies for further investigation by compliance, research or management staff accordingly.

Significant steps towards this vision are already visible in Papua New Guinea with the development of their iFIMS system, as well as through the early work being done by FFA to compare AIS and VMS tracks, trial FAD monitoring undertaken by the PNA office, and the analysis of observer and catch log position reports against VMS track by SPC.

Further Project Work

Global technology review - request for information

As part of this project, a review is being conducted of the current status of E-Reporting and E-Monitoring including various trials, projects and companies operating across some of the world's fisheries. The huge range of such operations prevents an exhaustive review but some of the major fisheries E-Reporting and E-Monitoring work will be captured. To this end, we request that Commission members provide details of any particular trial, project or company they are involved with so they can be included in the final report

Continued liaison with WCPFC member countries

At the time of preparing this preliminary report, the consultants have spoken to fishery agencies and industry members in the Solomon Islands, Philippines, Micronesia, Marshall Islands, Hawaii, New Caledonia and Australia. During the remainder of the project, the consultants will speak with officials and industry in Papua New Guinea, New Zealand, and Fiji.

Recommendations

1. TCC notes this interim project report and project progress.
2. TCC supports the final report progressing to the 10th Regular Session of the Commission for consideration and appropriate action.
3. TCC provides the project consultants with details of any particular E-Monitoring or E-Reporting trial, project or company they wish to be considered as part of this project.

Appendix 1 - Objectives and Terms of Reference

OBJECTIVE #1 – Develop a common understanding and language of what E-Reporting and E-Monitoring will mean in the WCPFC tuna fisheries

A report covering this work should include, but not be restricted to, the following:

Terms of Reference

1. Provide a clear definition and distinction between E-Reporting and E-Monitoring, drawing on relevant examples in the WCFPC Tuna Fisheries wherever possible
2. Describe the potential uses of E-Reporting and E-Monitoring data for MCS, science, and broader fisheries management and policy.
3. Provide an overview of current obligations for collecting and managing scientific and other data in the WCPFC tuna fisheries, highlighting OBSERVER and LOGSHEET DATA (E-Reporting) – i.e. clearly state what the current data requirements and deliverables are.
4. Summarise current WCPFC CMM obligations and other regulatory requirements that could potentially be covered by E-Monitoring and E Reporting
5. Provide an overview of the stakeholders in the WCFPC area and their current and perceived roles in:
    a. **Data** collection/management, highlighting OBSERVER and LOGSHEET DATA (**E-Reporting)**, and
    b. Management and Compliance (**E-Monitoring)**.
    c. And identify whether their respective roles may be expected to change with implementation of **E-Reporting** and **E-Monitoring**?

Key stakeholders to include SPC, WCPFC, FFA, PNA, National Fisheries Authorities/Govt. (coastal-state and flag-state), TVM, and the fishing industry.

OBJECTIVE #2 – Document and evaluate current and future E-Reporting technologies that are potentially suitable for collecting information in the WCPFC tuna fisheries, and recommend the best potential options for WCPFC tuna fisheries

A report covering this work should include, but not be restricted to, the following:

Terms of Reference

1. Evaluation of each type of **E-Reporting** product/initiative, including sections on each of the following:
    a. A brief description of the product/initiative, the product provider contact details, cost, availability, existence of training/documentation, etc. This section should be concise but refer the reader to any web links and/or publications that elaborate on the technical and non-technical aspects of the product.
    b. A description of where the product/initiative has been implemented/trialled, including scale of implementation, duration of implementation, etc.
    c. A summary of any evaluations of the product/initiative (indicating whether the evaluation was independent or not). This should include --
        i. Specific reference to any opinions of stakeholder(s), particularly noting their opinions on the success or otherwise of the product/initiative.
        ii. Technical Issues/constraints encountered
        iii. Non-technical issues/constraints encountered, specifically including but not restricted to legal, logistical, socio-economic issues
    d. An appraisal of the identified products by the consultant with respect to suitability for large-scale implementation in the WCPFC Tuna Fisheries, including PROS/CONS from both the technical perspective, and the non-technical perspective
2. A table ranking each product/initiative including a descriptive narrative of pros and cons according to the consultant's evaluation which should include: fit with identified requirements; proven track record of implementation; reliability of technology; flexibility to adapt and improve; potential for delivery through PICs.

OBJECTIVE #3 - Document and evaluate current and future E-Monitoring technologies that are potentially suitable for WCPFC tuna fisheries

A report covering this work should include, but not be restricted to, the following:

Terms of Reference

1. Evaluation of each type of **E-Monitoring** product/initiative, including sections on each of the following --
    a. A brief description of the product/initiative, the product provider contact details, cost, availability, existence of training/documentation, etc. This section should be concise but refer the reader to any web links and/or publications that elaborate on the technical and non-technical aspects of the product.
    b. A description of where the product/initiative has been implemented/trialed, including scale of implementation, duration of implementation, etc.
    c. A summary of any evaluations of the product/initiative (indicating whether the evaluation was independent or not). This should include:
        i. Specific reference to any opinions of stakeholder(s), particularly noting their opinions on the success or otherwise of the product/initiative.
        ii. Technical Issues/constraints encountered
        iii. Non-technical issues/constraints encountered, specifically including but not restricted to – Legal, Logistical, Economic issues
        iv. Could this product also be used for E-Reporting?
    d. An appraisal of the product by the consultant with respect to suitability for large-scale implementation in the WCPFC Tuna Fisheries, including PROS/CONS from both the technical perspective, and the non-technical perspective (see above)
2. A table ranking each product/initiative including a descriptive narrative of pros and cons according to the consultant's evaluation which should include: fit with identified requirements; proven track record of implementation; reliability of technology; flexibility to adapt and improve; potential for delivery through PICs.

OBJECTIVE #4 – Propose recommendations for the most practical and efficient framework of E-Reporting and E-Monitoring in the WCFPC Fisheries to guide discussions of a dedicated small working group

A report covering this work should include, but not restricted to, the following:

Terms of Reference

1. A summary review of the outputs of OBJECTIVES #1 thru OBJECTIVE #3
2. Describe the current system and recommendations for the most practical and efficient FRAMEWORK for OBSERVER and LOGSHEET data **E-Reporting** and **E-Monitoring** in the WCPFC Fisheries in the future. For the future framework, include a description of:
    a. Processes including data acquisition, data management and data dissemination
    b. Expected roles of each stakeholder
    c. The potential conflicts
    d. What legislation is required to accommodate this framework at both the national and regional level.
    e. Anticipated technical support requirements (e.g. equipment and human resources)
    f. Cost implications
3. Present a SWOT analysis of current arrangements and the potential future framework, including consideration of a hybrid approach which might best satisfy WCPFC requirements. If applicable, the analysis should include a general discussion of alternatives considered and why they were not recommended.
4. Identify the critical factors to be considered in the decision making process including:
    a. Describing the interrelationships between **E-Reporting** and **E-Monitoring** and how they might be integrated, or where they might operate exclusively
    b. Describing the decision making factors to be considered, for example, costs and benefits to identified stakeholder groups, timely access to data, quality of data, etc.
    c. Identifying which factors are likely to be more important to different stakeholders and how this can be presented and potential conflicts resolved.
5. For the most practical and efficient future FRAMEWORK identified, list the steps involved and the perceived stakeholder(s) responsibilities in order to proceed with large-scale **E-Reporting** and **E-Monitoring** implementation in the WCPFC Tuna Fisheries, highlighting important issues that can be documented now or will need specific attention, such as a detailed breakdown of resource needs, cost recovery, changes to legislation, etc.
6. A short discussion and recommendations section, which should include:
    a. Reviewing the information at hand, the pros and cons of current approaches, the potential Framework, and including consideration of a hybrid approach
    b. Listing the steps involved and the responsibilities of key stakeholders in order to proceed with large-scale **E-Reporting** and **E-Monitoring** implementation in the WCPFC Tuna Fisheries, highlighting important issues that can be documented now or will need specific attention, such as a detailed breakdown of resource needs, cost recovery, changes to legislation, etc.
    c. Providing a summary (with explanation) of what the consultant recommends would be the best way to **progress** towards the most practical and efficient framework for **E-Reporting** and **E-Monitoring, including a clear recommendation** for a preferred approach if it is clear there is one.
    d. Describing a potential process for decision making to move **E-Reporting** and **E-Monitoring** implementation forward through regional meetings/workshops

Appendix 2 – Consultation to date

Honiara, Solomon Islands	**4, 5 and 6 June 2013**	
Organisation	**Name**	**Position**
Forum Fisheries Agency (FFA)	Mr James Movick	Director General
	Mr Wez Norris	Deputy Director General
	Ms Alice McDonald	Fisheries Management Adviser
	Ms Pamela Maru	Fisheries Management Adviser
	Mr Fraser McEachan	MCS Policy analyst
	Mr Mark Young	Director Fisheries Operations
	Mr Filimoni Lutunaika	System Analyst
	Mr Henry Salonica	Network Administrator
	Mr Kenneth Katafono	Database Administrator
	Mr Nicholas Reese	IT Manager
	Mr William Edeson	Legal Adviser
	Mr Dennis Yehilomo	MCS Analyst
	Mr Timothy Park	Observer Manager
	Ms Agnes Arahauta	MCS Officer
	Mr Daniel Koroi	VMS Liaison Officer
	Mr Fred Aleziru	MCS Officer
	Mr Mike Pounder	Surveillance Operations Officer 2
	Mr Peter Graham	Surveillance Operations Officer 1
	Mr Steve Masika	VMS Officer
SolTuna, Trimarine	Mr Adrian Wickham	Managing Director

Manilla, Philippines	**15 and 16 July 2013**	
Organisation	**Name**	**Position**
Bureau of Fisheries and Aquatic Resources (BFAR)	Atty Asis G. Perez	***National Director***
	Atty Benjamin F.S. Tabios	Assistant Director for Administrative Services
	Dr Noel Barut	Chief Aquaculturist, NFDRI Deputy Executive Director
	Dr Alma C. Dickson	BFAR Agriculture Center Chief IV
	Mr Rafael Raminascal	Chief Aquaculturist, Chief Scientist MV/DA
	Mr Marlo Demo-os	Project Assistant. National Fisheries Observer Assistant Coordinator
CLS ARGOS	M. Phillipe Courrouyan	Director ASEAN

Pohnpei, Federated States of Micronesia	**17, 18 and 19 July 2013**	
Organisation	**Name**	**Position**
Western and Central Pacific Fisheries Commission (WCFPC)	Prof Glenn Hurry	Executive Director
	Mr Donald David	Data Quality Officer
	Mr Albert Carlot	VMS Manager
	Dr Lara Manarangi-Trott	Compliance manager
	Dr Sung Kwon Soh	Science Manager
	Mr Sam Taufao	ICT Manager
National Oceanic Resource Management Authority (NORMA)	Mr Patrick Mackenzie	Executive Director
	Mr Eugene Pangelinan	Deputy Director
Dongwon Industries Co. Ltd.	Mr Park Taeson	General Manager
	Mr Gu-hyun Kang	Pohnpei Office Manager
Caroline Fisheries Corporation Inc.	Mr Marko Kamber	Operations/Fleet Manager

Majuro, Marshall Islands	**20, 21 & 22 July 2013**	
Organisation	**Name**	**Position**
Office of the Parties to the Nauru Agreement (PNA Office)	Transform Aquorau	Chief Executive Officer
	Maurice Brownjohn	Commercial Manager
	Herman Kisokau	VDS/VMS Data Officer
	Patricia Jack-Jossien	VDS Manager
Marshall Islands Marine Resources Authority (MIMRA)	Samuel K. Lanwi, Jr	Deputy Director
	Bernard Fiubala	Observer Program Manager
	Dike Poznanski	Information Management Specialist
	Ron Allan V. Doloroso	IT Personnel
Marshall Islands Fishing Venture Inc.	Jin Liang	Base Manager
Pan Pacific Foods (RMI) Inc.	WanJun Yang	Fleet Coordinator

Honolulu, Hawaii	**23, 24 & 25 July 2013**	
Organisation	**Name**	**Position**
National Oceanic and Atmospheric Administration (NOAA)	Dr Charles Karnella	WCPFC Chair / International Fisheries Coordinator
	Mr Raymond Clarke	Fisheries Biologist
	Ms Valerie Chan	Fishery Policy Analyst
	Mr Terry Boone	VMS Program Manager
	Mr Larry Li	Information Technology Specialist
	Mr John D. Kelly	Program Manager Observer Program
Western Pacific Regional Fisheries Management Council (WPFMC)	Mr Eric Kingma	NEPA Coordinator
	Dr Paul Dalzell	Senior Scientist/Pelagics Coordinator
POP Fishing and Marine	Mr Jim Cook	Co-owner

Noumea, New Caledonia	**28, 29 & 30 July 2013**	
Organisation	**Name**	**Position**
Secretariat of the Pacific Community (SPC)	Peter Williams	Principal Fisheries Scientist
	Simon Hoyle	Senior Fisheries Scientist
	Dr Graham Pilling	Fisheries Scientist
	Mr Joel Rice	Senior Fisheries Scientist
	Tim Adams	Fisheries Scientist
	Tim Lawson	Principal Fisheries Scientist
	Peter Sharples	Observer Support and Development Coordinator
	Deirdre Brogan	Fisheries Monitoring Supervisor
	Siosifa Fukofuka	Observer Training and Support Officer
	Ferral Lasi	Data Collection Officer
	Dr Simon Nicol	Principal Fisheries Scientist
	Mme Valerie Alain	Fisheries Research Scientist
	Bruno Leroy	Fisheries Scientist
	Sylvain Caillot	Tagging Database Developer
	Manu Schneiter	Fisheries Database Analyst/Developer
	Corey Cole	Observer Data Manager
	Colin Millar	Fisheries Database Analyst/Developer
	Mr. Bryan Scott	Fisheries IUU Liaison Officer
	Bruno Deprez	Fisheries Data Audit Officer
	Colley Falasi	Observer Data Audit Officer
	Malo Hosken	Consultant E-Monitoring Trial
Service de la marine marchande et des pêches maritimes, New Caledonia	M. Regis Etaix-Bonin	
	M. Hugues Gossuin	Tuna Coordinator

Adelaide, Australia	**6 August 2013**	
Organisation	Name	Position
Southern Sea Eagles Pty Ltd	Mr Kyri Toumazos	Director
The Fish Factory Pty LtdSPC)	Mr Len Toumazos	Managing Director
	Mr Yioto Toumazos	Production – Domestic Sales
	Mr Philios Toumazos	Fishing Operations Manager