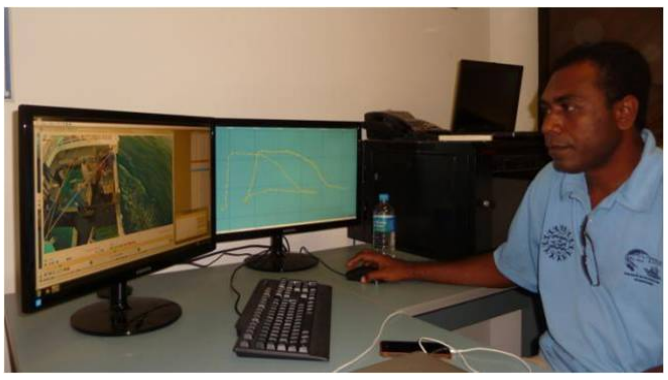
Report on the 2014 Solomon Islands Longline E-Monitoring Project



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EXECUTIVE SUMMARY

This report summarises the results of a Video Electronic Monitoring project conducted on tuna longline fishing vessels operating in Solomon Islands waters during 2014.

- The main objective of the project was to investigate the extent which Video Electronic Monitoring system (E-Monitoring) can record 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).
- The project partners were Tri Marine, National Fisheries Developments (NFD), Yi Man Fishing Company, Satlink (the service provider), Pacific Islands Forum Fisheries Agency (FFA), Oceanic Fisheries Programme of the Secretariat of the Pacific Community (SPC-OFP) and the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR). The International Seafood Sustainability Foundation (ISSF) is also a major contributor through support of the Regional Electronic Reporting Coordinator position contracted by SPC.
- Two CT-4 freezer longline tuna vessels were equipped with a video E-Monitoring system and each undertook two trips under this project. The E-Monitoring system (Satlink Sea Tube) installed on-board consisted of high-definition video cameras, GPS and a central computer to record all events and video footage.
- The E-Monitoring data collected from these trips was analysed by experienced longline fisheries observers using the Satlink View Manager (SVM) analysis software. These office observers recorded all aspects of the fishing activity, including setting and hauling parameters, identifying fishing locations, the catch and size composition, and the fate of any bycatch taken. An independent fisheries observer was also assigned to each vessel to carry out the regular task of observing and recording the catch.
- A comparative analysis between the on-board observer data and the E-Monitoring data is presented in this report and shows which of the required Regional Observer Programme (ROP) minimum standard data fields are adequately collected using E-Monitoring.
- In the scope of implementing E-Monitoring technology in all or parts of the Western and Central Pacific Ocean fisheries, logistical and legal frameworks will be required at national and regional levels. The Pacific Community's (SPC) knowledge and experience in managing observer data and the Pacific Islands Forum Fisheries Agency's (FFA) expertise in fisheries legislative mechanisms mean that an SPC/FFA partnership will be paramount if the decision is made to advance E-Monitoring in the region.

Eighteen (18) points constituting the MAIN OUTCOMES and fourteen (14) RECOMMENDATIONS are provided in this report.

RECOMMENDATIONS

RECOMMENDATION 1. Future trials of E-Monitoring should be established through an 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. **[ACTION: All stakeholders]**

RECOMMENDATION 2. Any future E-Monitoring trials should consider a review of how each of the WCPFC ROP minimum data fields can be collected before the trial starts. **[ACTION: SPC-OFP and technical service provider]**

RECOMMENDATION 3. SPC-OFP should consider the design of a systematic and quantifiable audit of the data generated by any E-Monitoring system against each of the WCFPC ROP minimum data field standards. This audit would be conducted after future trials. **[ACTION: SPC-OFP]**

RECOMMENDATION 4. The technical services provider should consider updating their system to support the entry of data using formatting and data quality control equivalent to the TUBS system. The data can then be exported and easily distributed to authorised recipients of the data. The data exported to the WCPFC should satisfy the relevant standards. **[ACTION: Technical service provider]**

RECOMMENDATION 5. SPC-OFP and the technical service provider should develop detailed protocol and procedures for undertaking the E-Monitoring video analysis to ensure the analysis and data generated are as consistent and accurate as possible. **[ACTION: SPC-OFP and technical service provider]**

RECOMMENDATION 6. SATLINK should investigate a range of potential enhancements to reduce the time by the office observer in viewing long periods of uneventful video footage. For example, consider the possibility for enhancing their VM software to programmatically 'tag' each instance where catch comes on-board. **[ACTION: Technical service provider]**

RECOMMENDATION 7. The amount of time and resources for data preparation and analyses for future trials should be better planned, including gains in efficiency, given that this work was clearly underestimated for this trial. **[ACTION: SPC-OFP]**

RECOMMENDATION 8. To ensure the onboard and office observers 'data can be analysed in future trials, investigate how to efficiently align the times and catch of the office and on-board observer to avoid the time-consuming manual work. For example, consider using UTC date/time for both and which basket number the catch comes from in both sources of data, if at all possible.**[ACTION: SPC-OFP and technical service provider]**

RECOMMENDATION 9. SPC should consider updating their regional observer database structures to support the storage of positional information at the individual catch level, since this is readily available from E-Monitoring generated data. **[ACTION: SPC-OFP]**

RECOMMENDATION 10. SPC-OFP and the services provider should consider developing standard procedures and materials for training and auditing to familiarise the new office observer to the video analysis tool. The auditing materials should include consideration of a third person (e.g. a debriefer) used to assess the differences between the office observers data and the on-board observers data. These materials should eventually be considered under PIRFO. **[ACTION: SPC-OFP and technical service provider]**

RECOMMENDATION 11. Future E-Monitoring trials should consider how to collect the FLOAT and HOOK count data more efficiently as this information is important to scientists and was the most difficult to compile based on issues identified in the comparison between the data collected by the on-board and office observers. For example, the technical service provider should investigate the possibility if electronic tagging of floats and hooks which are integrated into their software which, if successful, would ensure accurate data and save time during the E-Monitoring video analysis. **[ACTION: Technical service provider]**

RECOMMENDATION 12. Future E-Monitoring trials should consider the issues raised in the generation of the LENGTH data using the digital measuring tool, including assurance that the office observer is correctly using the tool. Future trials should continue to collect and compare 'partner' data (i.e. lengths of fish from both on-board observations and from E-Monitoring video observations) until such time as the data generated from the E-Monitoring tool reconciles with the data collected by the on-board observer, with clear procedures for ensuring accurate data are generated from the E-Monitoring tool in the future. If time and resources are available, a dedicated review of the digital length measuring tool against the video from these trials should be undertaken. **[ACTION: SPC-OFP and technical service provider]**

RECOMMENDATION 13. Future E-Monitoring trials should investigate how to improve the consistency in the collection of condition (life status) information and how to improve the coverage of sex information, if possible. If coverage of sex information is deemed not possible then some alternative data collection outside of E-Monitoring should be proposed to ensure this information can be made available to scientists. **[ACTION: SPC-OFP and technical service provider]**

RECOMMENDATION 14. The WCPFC ROP minimum data fields that are not possible to complete using E-Monitoring will need further investigation to assess which will or will not be possible to collect through E-Monitoring video analysis. For those fields that cannot be collected electronically, this investigation should suggest alternative sampling means (e.g. sampling elsewhere) to ensure the requirements are met. **[ACTION: SPC-OFP and technical service provider]**

Table of Contents

1. INTRODUCTION

The Western and Central Pacific Ocean is the world's largest tuna fishing ground, with over 3000 registered longline vessels fishing in this region. Economic losses from Illegal Unreported and Unregulated fishing in the region are estimated to amount to up to 46% of the reported catch, equivalent to approximately US$1.5 billion a year. This carries important implications for many Pacific Island Countries and Territories who rely on fisheries resources for their livelihood and economic development.

The Western and Central Pacific Fisheries Commission (WCPFC) requires five percent observer coverage on longline vessels operating in the region. However, challenges such as limited space on-board smaller vessels, logistics, and costs have limited human observer coverage to around two percent for some fleets. Observer data is therefore lacking on most longline fleets in the region. Catch, effort and fisheries operation data are necessary to improve the scientific understanding of these fisheries, strengthen management tools, and promote better enforcement of existing national and regional conservation measures. Use of Video Electronic Monitoring (E-Monitoring) technology to supplement human observer monitoring offers real opportunities to overcome these challenges in tuna longline fisheries, making this an important and pioneering project.

The **main objective of the project** was to investigate the extent to which 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) (see http://www.wcpfc.int/doc/table-rop-data-fields-including-instructions).

This collaborative project was developed under a Memorandum of Understanding (see APPENDIX 1) between key stakeholders: Tri Marine, National Fisheries Developments (NFD), Yi Man Fishery Company, Satlink, Pacific Islands Forum Fisheries Agency (FFA), Oceanic Fisheries Programme of the Pacific Community (SPC-OFP) and the Solomon Islands Ministry of Fisheries and Marine Resources (MFMR). Tri Marine and NFD contributed to project management, installation, maintenance, and costs of the systems. FFA, via the EU funded DevFish 2 project, shared the equipment costs. Satlink provided and covered partial costs of the system, while also designating staff to installation, data monitoring and review. Yi Man Fishery Company volunteered two vessels, allocating valuable time to facilitate installation along with some vessel space and resources to accommodate the equipment and human observers. MFMR has provided human observers, while SPC assigned a project coordinator to assist with observer placement, data review and project evaluation and reporting.

The Memorandum of Understanding (MOU) was signed between the project parties in February 2014. It was planned for both vessels to conduct two paired trips each carrying the E-Monitoring system and an independent fisheries observer. This project was the first foray into this type of work for most of the stakeholders and while the MOU was as specific as possible, the nature of the work, being innovative and evolving rapidly, meant that the approach taken was flexible and adaptive.

> **RECOMMENDATION 1.** Future trials of E-Monitoring should be established through an 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.

2. OPERATIONAL ASPECTS

2.1 Introduction

The project partners were in Noro in the Solomon Islands from the 10th to 14th March 2014, to install the E-Monitoring system on two tuna longline fishing vessels the Yi Man 2 and Yi Man 3 and to place an MFMR observer on-board each vessel. Both vessels fished in the Solomon Islands EEZ and unloaded their catch in Suva (Fiji).

2.2 On-board equipment

On Yi Man 2, four High-Definition wide angle, water and shock proof cameras were installed. On Yi Man 3, three similar cameras were installed. On both vessels, a central unit housing a computer and eight hard drives was installed. The cameras were linked to the central unit via internet protocol cables. The E-Monitoring system on each vessel also included a GPS antenna which was used to track the vessels' positions every 10 minutes. Satlink also installed on both vessels a fleet broadband communication unit to allow remote maintenance of the systems. After discussion with the vessels' owner, it was decided that the cameras would record the vessels' activities 24 hours a day. Satlink would have been able to install hydraulic sensors that would have triggered the cameras to record only when fishing activities started (setting and hauling the line). However, the hydraulic systems on both vessels were already fine-tuned and time constraints prevented installing these sensors. The E-Monitoring systems were checked and tested before the vessels departed from Noro.

After the vessels' first trips, they returned to Suva for unloading. In Suva port, after the unloading of the catch was completed, a technician from Satlink removed the hard drives containing the E-Monitoring data and replaced them with blank ones. Minor adjustments were made to the E-Monitoring equipment, including changing one camera position and changing some camera angles.

On Yi Man 3: one camera was flooded and was replaced. The mount on which the fleet broad band antenna was fixed was damaged (due to lightning strike) and was also replaced.

The fleet broad band allowed receiving a photo snapshot from each camera every 10 minutes. While this feature allowed determining if the camera lenses were clean enough, the high cost (beared by the service provider) of the unit itself and the airtime for transmitting the photos meant that a fleet broadband unit would not be necessary for future trials.

2.3 On-board Observers

The two MFMR observers were contracted by FFA to carry out a regular monitoring trip. The FFA observer programme funded all costs of the observers' travels. A placement meeting was conducted with all parties to the project in Noro. FFA provided the two observers with a two way satellite communication device (Delorme InReach) with which shore parties were able to communicate with the observers at sea and vice versa. These devices were very useful to communicate with the observers and had positive effects on their morale. The observers also used the InReach devices for obtaining position and time information while on deck, instead of having to get this information from the wheel house instruments.

The first two observers disembarked in Suva and were replaced by two other observers (also each equipped with a Delorme Inreach unit). Another placement meeting was conducted with all project parties in Suva.

The on-board observers collected data using the regional SPC/FFA standard observer data collection forms[1]. The observers' data debriefing were conducted in Honiara by the FFA observer coordinator. Their data were subsequently entered using the Regional Observer (TUBS) database System at SPC, New Caledonia.

2.4 Vessel trip summary

Figure 1 provides an outline of the spatial extent of activities for each of the four trips and Table 1 provides summary catch and effort information from each trip by the on-board and office observers, respectively. All trips fished in the Solomon Islands EEZ and landed the catch in Suva, Fiji. The trips were, 84, 81, 51 and 66 days long.

3. GENERATING E-MONITORING DATA

3.1 Methodology

3.1.1 Pre-trial planning

As the main objective of the project was to capture the required minimum WCPFC ROP data fields, the first step was to review how the analysis of E-Monitoring footage could capture these data. This review was then used for planning both the equipment installation and the video analysis. The initial review was essentially a 'brainstorming' exercise amongst the partners in this project and produced a guideline (APPENDIX 2) for proceeding with the field work, acknowledging that as time went on, more enhanced equipment, software and protocols would make the E-Monitoring system more efficient.

> **RECOMMENDATION 2.** Any future E-Monitoring trials should consider a review of how each of the WCPFC ROP minimum data fields can be collected before the trial starts.

Nevertheless, the initial review of the main requirements against the proposed system was fundamental and should be undertaken for any E-Monitoring trials in the future. With further improvements expected, we recommend that a systematic and quantifiable audit of the data generated by any E-Monitoring system against each of the WCFPC ROP minimum data field standards should be conducted after any future trials. For example, a second review of E-Monitoring analysis could be undertaken to check on each of the differences between the on-board observer's record and the original E-Monitoring analysis record to determine the level of error from each source of data.

> **RECOMMENDATION 3.** SPC-OFP should consider the design of a systematic and quantifiable audit of the data generated by any E-Monitoring system against each of the WCFPC ROP minimum data field standards. This audit would be conducted after future trials.

3.1.2 Video analysis equipment and software

The analysis of the E-Monitoring data was conducted at FFA headquarters in Honiara, Solomon Islands. Satlink was provided an office room and set up a control centre consisting of a central unit with a computer and racks to read the hard drives and two 24 inch screens.

[1] http://www.spc.int/oceanfish/en/data-collection/241-data-collection-forms

E-Monitoring data analyses for the four trips were conducted by two senior MFMR observers who received training and supervision from Satlink technicians.

At the start of the analyses, only one review unit was available, with the office observers alternating one week on, one week off. After trip 1 was analysed, a second review unit was installed at FFA which allowed both office observers to work full time on the analyses of trips 2, 3 and 4. Note that time constraints did not allow both office observers to analyse the same trip to compare inter-observer variability.

The analysis of the E-Monitoring data was undertaken using a specific reviewing software (the Satlink View Manager, SVM hereafter) developed by Satlink. The data consisted of GPS data monitoring the vessels position every 10 minutes and high resolution video footage recorded from each camera. The SVM allowed reviewing of the video footage at the same speed it was recorded. The footage could also be reviewed at half, two times, five- or ten times the normal recording speed. Finally the software allowed zooming into the footage without losing definition quality.

Accessing the raw data, the office observer first isolated the sections where the vessel was engaged in fishing activities (setting and hauling the longline). This process took about 15 minutes.

Once the section had been isolated, the office observer began reviewing the setting operations. This allowed determining the: the set positions, start and end dates and times of the set, the bait species used, the amount of bait used and the branchline interval time. This process took around 15 minutes.

The office observer then moved on to reviewing the hauling operation. This allowed determining the: the set positions, dates and times of the start and end of the haul, the average number of hooks between each floats, the species for each animal landed or discarded, its size (see next section 3.1.3), fate and the hook number on which it was caught. The office observer attempted to record the condition of the individual catch on landing (and discard, if relevant) and also attempted to record the sex of the individual catch but this was only deemed possible for the elasmobranchs (sharks and rays). On average, for a 3000 hooks set, this process took between four and six working hours, depending on how many individuals were caught (compared to an average of about 12 hours of actual hauling).

The SVM featured an input system which allowed the office observer to record data for each event. Each time a species was landed, the office observer inputted a coded text line which recorded the hook number, the species, caught condition code, discard condition code, length, length code, fate code and sex. Where a field couldn’t be recorded, a dash (-) was inputted instead. The time for each species landed was obtained directly from the GPS. Each time the footage was stopped and a note was inputted, a still thumbnail image from the footage was associated with that note. Illustrations 1, 2 and 3 show the analysis process and report.

At the end of the set’s analysis, the SVM produced a detailed report. The report’s format was similar to the observer’s data entered into regional observer database system at SPC and both data sets were compared.

For the latter two trips, it became evident that entering the data from the office observer directly into the TUBS database system was more efficient (given the data quality control tools built in this system). Although this meant that the catch was not directly linked to any positional information. After further consideration, it was recommended that the same level of data field formatting and data quality control in the SVM software should be established.

RECOMMENDATION 4. The technical services provider should consider updating their system to support the entry of data using formatting and data quality control equivalent to the TUBS system. The data can then be exported and easily distributed to authorised recipients of the data. The data exported to the WCPFC should satisfy the relevant standards.

The main issue for the office observer was the monotony of reviewing video for hours at a time on consecutive days and after consideration, it was deemed that a maximum of four hours video viewing per day (approximately one set) was probably the optimum that could be achieved. Taking in the weekends, this meant that the actual duration of the work by the office observer to review the hauls for the entire trip, from the first day of [video] observation until the last day, would make it longer than the vessel trip itself. This issue was identified as the most detrimental to the success of the trials and therefore the most important to address in the future. Ideally, the best solution would be for the SVM software to make an initial pass of the video in an attempt to programmatically 'tag' each instance where catch comes on-board and so the office observer need only advance the video to each catch event rather than review long periods of uneventful video footage. The process of counting hooks and floats would not be possible under this approach but suggestions for how this could be achieved have been described in Section 2.2.

RECOMMENDATION 5. SPC-OFP and the technical service provider should develop detailed protocol and procedures for undertaking the E-Monitoring video analysis to ensure the analysis and data generated are as consistent and accurate as possible.

RECOMMENDATION 6. The technical services provider should investigate a range of potential enhancements to reduce the time by the office observer in viewing long periods of uneventful video footage. For example, consider the possibility for enhancing their SVM software to programmatically 'tag' each instance where catch comes on-board.

3.1.3 Enhancements to video analysis equipment and software

As the trials and the video analysis proceeded, it became evident that better solutions were necessary in several areas and the team was able to adapt and improve the way the required data were generated as the project progressed. The major changes to the E-Monitoring analysis equipment/software and protocols that were originally perceived before the trial started (i.e. in APPENDIX 2) include:

- Length measuring tool: Satlink developed a digital length measuring tool which was incorporated into the SVM. This tool was used by the office observers during the analyses of the last two trips. While this tool was useful, the following limitations must be noted. The calibration of the measuring tool could not optimal because when the tool was introduced the E-Monitoring systems had already been removed from the vessels. Also, the office observers were finding it difficult to use this new tool which was in essentially still in a trial phase during the analyses.

- During the analysis of trips 2 and 4, the TUBS system was installed on both review computers. This allowed the office observers to produce data with greater quality as TUBS features data checking tools. This also allowed having the E-Monitoring data formatted in the same way as the on-board observer data, which made the comparative analysis a simple process.

4. ANALYSES OF E-MONITORING DATA

4.1 Data preparation

The overall objective of this project was to ensure that all required WCPFC ROP data fields normally collected by an on-board observer can be collected through E-Monitoring and made available in the regional observer database and thereby used for both regional and national scientific and related work. The images and data entered by the office observer were exported by the SVM software into XPS or TXT files (basically the XPS files without the images) for event recorded in the software – the following levels of resolution were recorded during these trials for each set (i.e. date/time and position for each of these events):

- Start of set;
- Branchline set interval ;
- Records for each bait box used and the weight of each;
- End of set;
- Pollution report for the setting duration;
- Start of Haul;
- Time of each FLOAT hauled on-board, the number of that FLOAT in the haul and the number of hooks between this FLOAT and the preceding FLOAT (i.e. the 'BASKET').
- Each catch event.
- End of Haul;
- Pollution report for the hauling duration.

The 'free-format' entry of the individual fish information into the notes field of the SVM software meant that there were some data entry errors, but surprisingly only a few obvious errors. The addition of the new module in the SVM software that provides an interface and online data validation for each field should resolve any issues in the future. The text files generated have a relatively standard format and so a data loader was developed to import the TXT files into a database that is compatible with the regional standard observer database (TUBS) developed and maintained by the SPC, which is used by WCPFC, FFA and the national fisheries offices of FSM, RMI, PNG, Fiji and Tonga. The data loader supports the generation of data into the database format for the CATCH MONITORING data and the gear information (number of baskets, hooks and hooks between floats). The conversion of the data output from the SVM software into the regional standard observer database format facilitated the comparison of data collected by the on-board observers and the data generated through the E-Monitoring video analysis by the office observers (see Section 4.2).

As mentioned, for the latter two trips, the data entered by the office observers directly into the TUBS database system was more efficient (given the data quality control tools in this system), but it meant that the catch was not directly linked to any positional information. This led to further consideration (see RECOMMENDATION 4 and RECOMMENDATION 6 above).

In order to undertake a fine-scale comparison of the data collected by the two observers, a second stage of data preparation was required whereby each individual catch event recorded by the on-board observer needed to be aligned next to the corresponding event recorded by the office observer. This painstaking task took several weeks to complete for the four trips but enabled the detailed comparative analysis that is presented in Section 4.2 below. It should be noted, however, that this comparison is not necessarily highlighting the differences between E-Monitoring and an on-board observer, but also the differences between how two observers' record data.

RECOMMENDATION 7. The amount of time and resources for data preparation and analyses for future trials should be better planned, including gains in efficiency, given that this work was clearly underestimated for this trial.

RECOMMENDATION 8. To ensure the onboard and office observers 'data can be analysed in future trials, investigate how to efficiently align the times and catch of the office and on-board observer to avoid the time-consuming manual work. For example, consider using UTC date/time for both and which basket number the catch comes from in both sources of data, if at all possible.

4.2 E-Monitoring versus on-board observer data

A comparison of data gathered by E-Monitoring and those collected by the on-board observers was undertaken. The analysis focused on the catch and effort data, with some basic comparison provided for the other data types.

There were gaps in both the on-board and office observer data for one reason or another including:

- No data collected by the on-board observer during periods of rough weather when it was dangerous for the observer to be on-deck;
- No data collected by the on-board observer during a scheduled day off after the observer had been working for three consecutive days;
- No data collected by the on-board observer during scheduled breaks;
- No data collected by the office observer when the E-Monitoring was not operational (4.58% of the time).

Table 1 shows some descriptive statistics on the comparison of the data from the on-board office observer. These are discussed in more detail below.

4.2.1 Trip-level gear and effort data

The data normally collected by the on-board observer on the Regional SPC/FFA Observer LL-1 form and some of the LL-2/3 form are static during the trip, so this information was collected by the office observer through a pre-trip port inspection before the vessel departed.

There were several instances where the on-board observer was not able to collect data mainly due to rough conditions. The lack of data from the on-board observer in these situations is understandable and unavoidable, and highlights the potential benefit of E-Monitoring to capture information from ALL sets, even in situations that make it difficult for an observer to operate at sea. On-board the vessel, the duration of the haul is long (at least 10-12 hours per haul) and it is normal for the on-board observer to take breaks and this information is stipulated by the data collection protocol and in the database so estimates of observer effort and catch can be determined (i.e. the baskets set and baskets observed are recorded).

The comparison of summary effort and catch information (Table 1) shows generally close correlation. Reasons why the video analysis did not produce 100% coverage include (i) certain faults with the loss of video (4.58% of the time); and (ii) potential reporting errors by both observers (e.g. recording hooks between floats at the basket level).

4.2.2 Positional data

The data normally collected by the on-board observer on the Regional SPC/FFA Observer LL-2/3 form represents the positions collected during the setting and hauling. The positional data from the SVM software was generated automatically through the GPS data so there was no need for the office observer to record these data. The positional data from the SVM software was a higher resolution than the positional data recorded by hand by the on-board observer.

A benefit of E-Monitoring is the automatic tagging of each fish landed (or discarded) with accurate date/time and position; this level of data would be beneficial to any fine-scale analyses looking at any relationships between spatial aggregations of the catch in association with oceanographic features (e.g. seamounts).

> **RECOMMENDATION 9.** SPC should consider updating their regional observer database structures to support the storage of positional information at the individual catch level, since this is readily available from E-Monitoring generated data.

4.2.3 Species composition – broad comparisons

Table 2 and Figure 2 show the summarised comparison of species composition for each trip.

The following are some comments and observations on the broad comparison of species composition between the on-board and office observer.

- In general, the composition of the most common species encountered in each trip was consistent between the on-board and office observer's data. There were a few exceptions which may need further investigation that may have resulted from: (i) differences in coverage of the hauls by the observers; (ii) issues with data recording and compilation in the initial stages of the trials; and (iii) potential differences in species identification between the two observers. It was clear that the data for trips #3 and #4 were better than trips #1 and #2 and this was due to be better tools, experience and procedures for compiling the data as the trials progressed.
- In the first two trips, there was clearly more albacore tuna (%) in the on-board observer's records than the E-Monitoring video analysis and significantly less yellowfin tuna (%) in the E-Monitoring video analysis. This difference would normally suggest a species identification problem but appears unusual with two experienced observers, particularly when the composition for these species in Trips #3 and #4 were much closer aligned. Further investigation may be required.
- The species compositions comparisons of the main tuna between the observers for Trip #3 (ALB:YFT:BET – 53%:31%:22% to 56%:32%:21%) and for Trip #4 (ALB:YFT:BET – 47%:44%:10% to 49%:44%:8%), taking into account the different levels of coverage (74-77% for the on-board observer versus near complete for the office observer), was encouraging in that despite the lower coverage of on-board observer, it was consistent with the data recorded from the E-Monitoring video analysis.
- For the rare species, there was more variance in the data and the explanations in the first point above are equally valid for these cases. In particular, the explanation (iii) (in the first point above) above is probably more relevant for these species.
- For both on-board and office observers', albacore, yellowfin and bigeye tuna were the dominant species in the catch of all trips, followed by pelagic stingray, lancetfish, skipjack tuna, barracuda spp., escolar, wahoo and mahi mahi. Sailfish was the most predominant billfish species in the first two trips and short-billed spearfish was the predominant species for the last two trips.
- Silky shark was clearly the predominant shark species in all trips; in general, very few sharks were taken compared to the tuna and billfish species. Overall, sharks represented only 1-2% of the total catch by number for both the on-board and office observers in all trips.
- The discarding of target tuna species (albacore, bigeye and yellowfin tuna) was generally consistent amongst the trips and observers. Albacore tuna were rarely discarded, with discard rates of 0.6-2.1% (mainly due to toothed whale and shark damage). Yellowfin tuna had a higher discard rate of 3.6-6%, again mostly due to

depredation damage but also some small fish were discarded. Bigeye tuna had a discard rate of 0.6-1.9% for all but the Trip #3 which had a relatively high discard rate reported by both observers (22-23% discarded); the high discard rate in this trip was due the discarding of small fish. Most skipjack tuna were retained for crew consumption, with a discard rate of 2-10%, except for Trip #3, where the discard rate was 23-28% due to shark damage and what the observer reported as discard due to 'undesirable species'.

- In regards to the discard of the more prevalent bycatch species, both types of observers reported consistently that pelagic stingrays and lancetfishes were almost always discarded. Escolar species were generally retained, presumably for crew consumption (or kept for later use), although for Trip #3, most were discarded as an undesirable species, possibly reflecting difference in crew preferences for this species. Barracuda, mahi mahi and wahoo were mostly retained, presumably for crew consumption (or kept for later use, etc.). The billfish were also mostly retained presumably for commercial sale; the discarding of the billfish was mainly due depredation damage.
- Several other interesting observations that may need further review include:
    - Both observer types reported high catch of lancetfish but there were several instances when the lancetfish comparison at the species level within the trip did not align. For example, in Trip #4, the office observer appeared to only observe longsnouted lancetfish [ALX] while the on-board observer, observed both of longsnouted and shortsnouted lancetfish [ALO]. A similar trend also appears in Trip #1. In general, the office observer appears to have recorded a higher number of lancetfish catch than the on-board observer which highlights that E-Monitoring analysis can clearly identify the commercially unimportant bycatch species which are mostly discarded, but that they may need additional species identification training to separate these species on a video.
    - There are several species with minor catches mentioned in one source of data (for example, see the lower half of the Table 2/Trip #4 for E-Monitoring-video/office observer data) that do not appear in the other source of data, and vice-a-versa. This will require further investigation, although considering the higher coverage by the office observer, these catches may have been taken in sets not covered by the on-board observer, again highlighting the benefit of E-Monitoring over an on-board observer on long trips.
    - The on-board observer reported consistent catch of Roudi escolar [PRP] for Trip#4 which wasn't reported at all by the office observer with the matching process showing that the office observer tended to report this catch under 'Snake Mackerels and Escolars" [GEP]. Interestingly, this was the opposite in Trip #3, where the office observer reported 19 Roudi Escolar [PRP] which was reported as Gemfish [GEM], Escolar [LEC], Omosudid [OMW] and snake mackerel [GES] by the on-board observer. This highlights potential species identification issues amongst the observers which is not a factor related to whether the data were recorded on-board the vessel or from the E-Monitoring video.
    - There were eleven (11) blue sharks reported by the E-Monitoring in Trip #3 which were not reported as blue shark by the on-board observer; the matching process showed that the on-board observer reported two of these as small-finned Mako Shark (SMA) and one of these as Silky shark (FAL). As with the escolar and lancetfish noted above further investigation of the E-Monitoring video is required to identify where the issues lie.

Very few differences were noted between the overall species composition of the main tuna species between the two observer types indicating that the E-Monitoring footage is providing sufficient information for identification to the species level. There are several examples described above where it is evident that the species identification and catch coverage from the E-Monitoring video analysis is better than the on-board observer data. One benefit of E-Monitoring is that it provides a means of reviewing footage of the video repetitively and by a number of people (e.g. including experts in species identification). With more time, further review of the data compiled for these trials could be undertaken to resolve differences between the on-board observer's record and the original E-Monitoring video analysis record to determine where the problem lies, for example.

RECOMMENDATION 10. SPC-OFP and the services provider should consider developing standard procedures and materials for training and auditing to familiarise the new office observer to the video analysis tool. The auditing materials should include consideration of a third person (e.g. a debriefer) used to assess the differences between the office observers data and the on-board observers data. These materials should eventually be considered under PIRFO.

4.2.4 Species composition – detailed comparisons

A more detailed review of species composition is provided in APPENDIX 3 ("Comparison of catch composition data recorded by on-board observers and by office based observers reviewing video footage"). The key findings from these analyses are:

- The Sorensen method suggested a **high correlation** (S_{mean} = 0.88; see Table A3) between the number of fish recorded by the office and the on-board observer, meaning that neither of the two methods is significantly better than the other to record total fish caught (in number), and that this E-Monitoring trial was therefore a viable method for generating total fish number at the set level which was at least as accurate as the on–board observer.
- The identification of fish based on the matching of the office and on-board observers' data showed **high correlation** (13 219 fish [94%] had the same identification).

The points raised in the last paragraph of the previous section are relevant to the findings of this review.

4.2.5 Species hook number

Scientists require observers to collect information on the individual fish catch that includes the corresponding hook number between successive floats, which provides an indication of relative depth at which the species was caught. Analyses have shown that some species tend to be caught on the shallowest hooks in the basket while other species tend to be taken on the deepest hooks in the basket.

An attempt was made to compare the hook number (between successive floats) of the individual catch of albacore tuna recorded by the on-board observer and the office observer (see Figure 3). The instances where the records from the two sources of data correspond exactly are apparent when the circles are on the diagonal line in Figure 3. Most of the records that do not fall on the diagonal line are generally within 4 hooks of the diagonal line and of these records, there was a tendency for the office observer to record a slightly higher hook-number than the on-board observer. There was also a tendency for the office observer to record a default of hook number equal to '1' where it appears he has lost count of the hook number (these records were ignored in the analysis but further investigation will be required to resolve this issue). A further observation is that most of the available data for valid 'hook numbers' are for records with less than 10 hooks, suggesting the difficulties for observers in maintaining a count of hooks between successive floats as the count gets higher; this would no doubt be more difficult for the on-board observers.

An attempt was also made to compare the hook number (between successive floats) of the individual catch of albacore tuna recorded by the on-board observer and an estimated hook number, determined from information on the time of landing with respect to the time for retrieving the floats immediately before and after that catch; this estimation process also used the hooks set between these successive floats. The estimated hook number for an individual fish catch was determined as follows:

$$HkNo \quad = \quad HBF \times \frac{(T_{f+1}-T_c)}{(T_{f+1}-T_f)}$$

where

- HBF = Hooks between floats
- T_c = Time of landing of individual fish catch
- T_{f+1} = Time when immediate next float (after this catch) comes on-board
- T_f = Time when immediate previous float (before this catch) comes on-board

This simplistic estimation assumes a constant rate of retrieving branch-lines (with catch) between successive floats and could be considered to provide a coarse indication of relative depth of the catch in situations when it is difficult for the observer to record the hook number of the catch. Figure 4 shows the comparison between the on-board observer's record of hook number for albacore tuna and the estimated hook number using the times for landed catch and float retrieval. There is some trend in the matches although this could only be considered as producing broad indications of relative depth with further refinements. For example, the estimation of hook number is generally higher than the on-board observer's version and so the formula needs to be reviewed. The other issue is that the time between the retrieval of successive floats was generally in the range of only 5-7 minutes and since the landed catch and float retrieval times are recorded to the nearest minute, this is not of sufficient resolution (for units of time) to produce a precise estimate of hook number.

It is clear there are unresolvable issues with the 'hook number' data collected by both the on-board and office observer and future trials should attempt to resolve these issues to ensure accurate data are generated and there are efficiencies gained in the time spent on the E-Monitoring video analysis.

RECOMMENDATION 11. Future E-Monitoring trials should consider how to collect the FLOAT and HOOK count data more efficiently as this information is important to scientists and was the most difficult to compile based issues identified in the comparison between the data collected by the on-board and office observers. For example, the technical service provider should investigate the possibility if electronic tagging of floats and hooks which are integrated into their software which, if successful, would ensure accurate data and save time during the E-Monitoring video analysis.

4.2.6 Length measurements

Scientists require observers to collect information on the individual fish length and at the start of this project, this requirement was deemed too ambitious to undertake. However, mid-way through the project, the technical service provider introduced a new digital measuring tool in the SVM analysis software for use with the footage obtained from Trips #3 and #4 (see ILLUSTRATION 4). This tool was successfully tested, although there were some initial (minor) issues reported by the office observers in the familiarisation process with the tool.

A review of the length measurements taken by the office and on-board observer is provided in APPENDIX 3. The key finding from this review was that, the correlation between fish length estimates varied according to species. For instance, more differences on length estimates were observed for albacore tuna (ρ = 0.41) and skipjack tuna (ρ = 0.35) than for yellowfin tuna (ρ = 0.81) and bigeye tuna (ρ = 0.87) (see table A5, figures A3, A4 and A5 for details of each species), possibly because the latter species were larger than the former species. In general, the data generated from the digital measuring tool were deemed to be not unusable unless further investigation into the extent of the differences with the on-board observer's length data could be explained.

The unplanned implementation of the digital measuring tool at the mid-way point in the project probably meant that insufficient attention was directed towards its use and this may have resulted in the extent of the differences with the on-board observer's length data. The digital measuring tool has great potential and since size data are required under the ROP minimum data standards, priority work should focus more attention to its use in future trials in addition to further analyses to demonstrate that this tool can be a viable method of obtaining size data.

RECOMMENDATION 12. Future E-Monitoring trials should consider the issues raised in the generation of the LENGTH data using the digital measuring tool, including assurance that the office observer is correctly using the tool. Future trials should continue to collect and compare 'partner' data (i.e. lengths of fish from both on-board observations and from E-Monitoring video observations) until such time as the data generated from the E-Monitoring tool reconciles with the data collected by the on-board observer, with clear procedures for ensuring accurate data are generated from the E-Monitoring tool in the future. If time and resources are available, a dedicated review of the digital length measuring tool against the video from these trials should be undertaken.

4.2.7 Fate, Condition and Gender codes

Scientists require observers to collect information on the life status (fate, condition) and sex of the individual fish interacting with the longline gear. Tables 3, 4–5 and 6–7 provide a summary of the comparison of fate, condition and sex data collected by the observers. The following are some comments and observations on a broad comparison of these codes.

- The comparison of fate code recordings in Table 3 is only for the main tuna species, which represents around 70-80% of the catch (by number). The most common (~ 95%) fate codes recorded for the target tuna (RWW-retained whole weight and RGT–Retained gilled, gutted and tailed) matched between 93-99% over the four trips. One would expect that there should be few differences in how different observers record the fate code, especially with the target tuna species, for which the processing and retention are very consistent. For the non-target species, there may be differences in how observers' may interpret some of the fates of the individual catch. On review of the fish-by-fish comparison of the data collected by the on-board observer and the office observer, it appears that more than one fate code could be used to describe what happened to the fish (e.g. "Discarded, struck off" / "Discarded, cut free" and "Retained, shark damage"/"Retained, Partial") and so in cases where fate are similar, these differences could be considered acceptable under these circumstances.
- The comparison of condition codes was only possible for Trips #3 and #4, and is provided in Tables 4 and 5. The different levels of 'Alive' categories in the condition codes (A1, A2 and A3) may sometimes be difficult to interpret from one observer to another (regardless of whether it is recorded from E-Monitoring video or not). For the target tuna comparisons there was 54% agreement for condition category 'A1' between the on-board observer and office observer for Trip #3 and 45% for condition category 'A2', but a poor comparison for 'A3' (only 7%). The matching of the comparisons for Trip #4 in the 'Alive' categories was, in general, lower than for Trip #3. In contrast, the matching of the 'D–dead' category was very high for both trips (at 97% and 96%, respectively), which would be expected. The low-level of matches for the condition codes in the 'Alive' categories is perhaps disappointing and requires further investigation to find a solution prior to any future trials.

- The comparison of sex codes was restricted to Trips #3 and #4 and is provided in Tables 6 and 7 for the shark species only (acknowledging that the recording of sex for other species from the E-Monitoring video was rarely attempted). Due to the low number of shark taken (compared to tuna), the sample size for this comparison is small. The match of sex codes was better for Trip #3 (Table 6) where 53% of the FEMALE sharks recorded by the on-board observer were matched by the office observer and 76% of MALE sharks.

In summary, the nature of the E-Monitoring video analysis means that the recording of the fate code would be more accurate than the recording of the condition (life status), the latter with a potential issue that relates to the potential different interpretations by observers which is not necessarily related to the E-Monitoring analysis. The recording of accurate information on sex codes is difficult as the E-Monitoring analysis would require to have high resolution viewing of internal organs (where relevant) and these images may not be possible with E-Monitoring video and so the data may only be possible to collect for shark and related species.

> **RECOMMENDATION 13.** Future E-Monitoring trials should investigate how to improve the consistency in the collection of condition (life status) information and how to improve the coverage of sex information, if possible. If coverage of sex information is deemed not possible then some alternative data collection outside of E-Monitoring should be proposed to ensure this information can be made available to scientists.

5. MAIN OUTCOMES

5.1 General

The following are the main outcomes of the project:

1. The management of the project, considering it was the first time this type of initiative was attempted by the stakeholders involved, was deemed successful. There were several lessons learnt from the exercise and the ability to adapt to resolve issues and improve efficiency during the trials was one of the strengths of the project. The recommendations from this project should ensure further improvements with future trials leading to implementation.
2. In general, the amount of time and resources for data preparation and analyses was clearly underestimated and future trials should take this into account during the planning phase.
3. Consideration of what data fields (i.e. WCPFC ROP minimum standard data fields) were required to be generated from the trial in the planning phase was fundamental to this (and future) trials of E-Monitoring in the WCPO.
4. The installation of equipment was successful and in most cases, according to the plan. Perhaps the only major area in the original plan that was not possible was the intention to use sensors on the gear; instead, the office observer was required to undertake manual counts of floats/hooks and to visually determine when catch was taken on the gear. The uses of sensors is recommended as it would (i) allow to augment the amount of space available on the hard drive for long trips and (ii) allow the office observer to rapidly resume the analysis of the hauling footage in cases where the mainline has been cut (in this trial, in such events, the office observers had to spend several minutes reviewing the footage until the mainline was found by the crew).
5. The on-board E-Monitoring equipment performed exceptionally well, including periods of rough conditions. The system was installed between 15/03/2014 and 15/10/2015 and during this time the system was not operational 4.58% of the operational hours at sea.
6. The collection of vessel, gear and equipment information required under the ROP minimum data fields was achieved using a pre-departure at port inspection.

7. The length of time for the office observers to undertake the E-Monitoring video analysis was much longer than originally envisaged but a strong attention to detail in the video review is fundamental to generating accurate and complete data (including identifying the hook number on which species where caught on). The current methodology, which requires the office observer to review all video footage (even if some of the footage is in fast-forward mode), has no clear advantages with respect to availability of processed data to users over the data from the on-board observer. Reducing the time that the office observer spends reviewing video footage is therefore a primary area to focus research in the future – if this can be made more efficient, it will provide a competitive advantage for E-Monitoring video over the on-board observer. A recommendation and suggestions have been proposed, such as, better methods for the observer to identify catch on the video under fast-forward mode, e-tagging floats and hooks, programmatic interrogation of the digital video to determine and tag in the video when each catch is highlighted.
8. The trials demonstrated that, in general, the data collected by E-Monitoring was at least as good as the data recorded by the on-board observer, and the coverage of the data by the office observer was higher than the on-board observer, as would be expected.
9. The essential longline positional data collected from E-Monitoring was inherently more accurate and higher resolution than the data collected by the on-board observer.
10. The essential longline effort data collected from E-Monitoring was in general more detailed than the data collected by the on-board observer.
11. The target tuna catch data from E-Monitoring was consistent with the data collected by the on-board observer.
12. Most of the essential individual catch fields required under the WCPFC ROP minimum data standards can be captured from E-Monitoring; the main exception was the sex field which was not possible to collect for most species during this trial.
13. There was a high correspondence of fate of the individual target tuna catch generated from video E-Monitoring analysis with the data recorded by the on-board observer.
14. There were issues with correspondence of condition (life status) of the individual catch generated from video E-Monitoring analysis with the data recorded by the on-board observer. Resolving these issues will require further investigation; it is possible that differences in observers' interpretation (independent of the E-Monitoring trial) could be attributed to some of these differences.
15. The comparative analysis of the on-board and office observers' data was fundamental to evaluating the success of the trial. The data preparation involved is time-consuming and recommendations from this report are provided to ensure this process is more efficient for future trials
16. One benefit of E-Monitoring is the ability to go back and scrutinise the video if there are issues/doubts on what has been recorded. It also provides a means of highlighting any issues with related to the capabilities and knowledge of observers and in this way, can be used as a training tool
17. The digital length measuring tool was introduced late in the trials and in some cases, appeared to be successful, but there was insufficient time and availability of resources to properly evaluate this tool. A strong recommendation has been provided to continue the work in evaluating this tool, including the development of protocols for using it.
18. Those fields (e.g. the sex field) that are not possible to generate from the E-Monitoring video analysis and will need further assessment to determine whether it will be possible to collect through E-Monitoring; otherwise, there should be some consideration whether there are alternative means (e.g. sampling elsewhere) to ensure the sample size requirements for science are met.

In the scope of implementing E-Monitoring technology in all or parts of the Western and Central Pacific Ocean fisheries, logistical and legal frameworks will be required at national and regional levels. The Pacific Community's (SPC) knowledge and experience in managing observer data and the Pacific Islands Forum Fisheries Agency's (FFA) expertise in fisheries legislative mechanisms mean that an SPC/FFA partnership will be paramount if the decision is made to advance E-Monitoring in the region.

5.2 Compliance with WCPFC ROP minimum data fields

The main aim of this project was to investigate the extent with which video E-Monitoring could capture the required minimum WCPFC ROP data fields and in most cases, this requirement was achieved. The following list identifies where the video E-Monitoring analysis in this project did **not** capture, or **did not sufficiently satisfy** the requirements for minimum standard WCFPC ROP data (see APPENDIX 2), and therefore highlighting areas where further work is required:

1. Some of the ROP "SPECIAL GEAR ATTRIBUTES" were potentially available both before the trip (in the pre-departure inspection) and from the analysis of the E-Monitoring during the setting phase, for example, the use of wire trace and hook type/size, but this was not attempted. Future trials should consider the reviewing and recording of these data by the office observer where relevant.
2. The monitoring of marine pollution was possible with E-Monitoring and highlighted issues with throwing the plastic bait wrapping and straps around the bait box for example, the office observer also recorded discarding of gear (branchlines) in certain circumstances. However, it is not certain where other forms of marine pollution could be recorded since it was only possible to identify an event if it was in the viewing range of the cameras and so this may need further investigation.
3. The hook number within the basket for the catch was attempted by the office observer, but there was evidence that the information generated may not be accurate. This is one area for further research as noted in the previous section.
4. As noted in the previous section, the sex and condition data fields determined from E-Monitoring is limited and requires further investigation (see RECOMMENDATION 13 in the previous section).
5. The ratio of weight of shark fin-to-carcass is an ROP data field requirement but this is a challenge for the on-board observer, let alone the office observer. The digital measuring tool may provide an opportunity to collect morphometric information on the shark species catch, if this proves to the useful.
6. E-Monitoring is useful for collecting information on the landings of Species of Special Interest (SSIs), but the equipment may not be appropriately placed to collect information on the sightings of SSIs. However, the requirements of sightings of SSIs (i.e. SSIs not interacting with the gear) may be deemed as secondary priority for E-Monitoring, although the assessment of the mitigation gear will be very important in some cases (e.g. the assessment of tori lines to mitigate seabird interaction on vessels fishing south of 25°S).

RECOMMENDATION 14. The WCPFC ROP minimum data fields that are not possible to complete using E-Monitoring will need further investigation to assess which will or will not be possible to collect through E-Monitoring video analysis. For those fields that cannot be collected electronically, this investigation should suggest alternative sampling means (e.g. sampling elsewhere) to ensure the requirements are met.

TABLES

Table 1. Summary information for each trip under this project

TRIP #1		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)[1]
VESSEL	YI MANN #2	
OBSERVER	HAV	JA
Start Observation	15/03/2014	
End Observation	6/06/2014	
Duration of Observation (days)	84	41
Total sets	54	54
Total Baskets set	7,004	7,004
Total Baskets observed	6,806	6,946
% Baskets observed	*97%*	*99%*
Total Hooks sets	189,108	189,108
Total Hooks observed	183,762	154,475
% hooks observed	*97%*	*82%*
Range of Hooks between Floats (HBF)	27	11-43
Average HBF	27	22.4
Total Observed Yellowfin tuna	1324	922
Total Observed Bigeye tuna	169	114
Total Observed Albacore tuna	1470	1513
Total Estimated Yellowfin tuna	*1363*	*1129*
Total Estimated Bigeye tuna	*174*	*140*
Total Estimated Albacore tuna	*1513*	*1852*
TRIP #2		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)
VESSEL	YI MANN #3	
OBSERVER	JA	HAV
Start Observation	15/03/2014	
End Observation	3/06/2014	
Duration of Observation (days)	81	39
Total sets	60	60
Total Baskets set	6,000	6,000
Total Baskets observed	5,751	5,397
% Baskets observed	*96%*	*90%*
Total Hooks sets	160,082	160,082
Total Hooks observed	153,442	136,490
% hooks observed	*96%*	*85%*
Range of Hooks between Floats (HBF)	25-27	11-44
Average HBF	26	25.3
Total Observed Yellowfin tuna	877	662
Total Observed Bigeye tuna	225	212
Total Observed Albacore tuna	1024	1030
Total Estimated Yellowfin tuna	*915*	*776*
Total Estimated Bigeye tuna	*235*	*249*
Total Estimated Albacore tuna	*1068*	*1208*

1. The duration of the E-M video analysis (days) only reflects the days when work was undertaken and not the duration from the start to the end of the E-M analysis which would include weekend days and days when no E-M video analysis was conducted, for example.

Table 1. Summary information for each trip under this project (continued)

TRIP #3		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)
VESSEL	YI MANN #3	
OBSERVER	LEA	HAV
Start Observation	10/06/2014	
End Observation	30/07/2014	
Duration of Observation (days)	51	23
Total sets	38	38
Total Baskets set	4,722	4,722
Total Baskets observed	3,610	4,600
% Baskets observed	*76%*	*97%*
Total Hooks sets	126,494	126,494
Total Hooks observed	97,470	121,307
% hooks observed	*77%*	*96%*
Range of Hooks between Floats (HBF)	27	25-26
Average HBF	27	25
Total Observed Yellowfin tuna	1073	1360
Total Observed Bigeye tuna	699	851
Total Observed Albacore tuna	1988	2580
Total Estimated Yellowfin tuna	*1393*	*1418*
Total Estimated Bigeye tuna	*907*	*887*
Total Estimated Albacore tuna	*2580*	*2690*

TRIP #4		
Data item	On-board Observer	E-M Video Analysis ("Office" observer)
VESSEL	YI MANN #2	
OBSERVER	PHK	JA
Start Observation	14/06/2014	
End Observation	18/08/2014	
Duration of Observation (days)	66	29
Total sets	47	47
Total Baskets set	6,005	6,005
Total Baskets observed	4,439	6,005
% Baskets observed	*74%*	*100%*
Total Hooks sets	140,607	140,607
Total Hooks observed	103,728	140,607
% hooks observed	*74%*	*100%*
Range of Hooks between Floats (HBF)	23-25	20-30
Average HBF	23	23
Total Observed Yellowfin tuna	1438	2100
Total Observed Bigeye tuna	286	353
Total Observed Albacore tuna	1331	1864
Total Estimated Yellowfin tuna	*1949*	*2100*
Total Estimated Bigeye tuna	*388*	*353*
Total Estimated Albacore tuna	*1804*	*1864*

Table 2. Summary comparison of catch by species on each TRIP under this project

TRIP #1													
SPECIES		Species composition (%)		RETAINED		DISCARDED		On-board			EM Video		
		On-board	EM Video	On-board	EM Video	On-board	EM Video	N	Ret	Disc	N	Ret	Disc
ALB	ALBACORE	30.75%	35.04%	99.25%	98.61%	0.75%	1.39%	1470	1459	11	1513	1492	21
YFT	YELLOWFIN	27.70%	21.35%	95.32%	95.99%	4.68%	4.01%	1324	1262	62	922	885	37
ALX	LONGSNOUTED LANCETFISH	8.79%	12.46%	0.00%	0.19%	100.00%	99.81%	420	0	420	538	1	537
PLS	PELAGIC STING-RAY	6.40%	6.83%	0.33%	0.00%	99.67%	100.00%	306	1	305	295	0	295
SKJ	SKIPJACK	4.31%	4.05%	92.72%	97.71%	7.28%	2.29%	206	191	15	175	171	4
BET	BIGEYE	3.54%	2.64%	99.41%	100.00%	0.59%	0.00%	169	168	1	114	114	0
GBA	GREAT BARRACUDA	2.74%	2.89%	91.60%	99.20%	8.40%	0.80%	131	120	11	125	124	1
LEC	ESCOLAR	2.64%	2.34%	80.95%	93.07%	19.05%	6.93%	126	102	24	101	94	7
ALO	SHORTSNOUTED LANCETFISH	1.92%	0.58%	1.09%	0.00%	98.91%	100.00%	92	1	91	25	0	25
WAH	WAHOO	1.67%	1.67%	91.25%	91.67%	8.75%	8.33%	80	73	7	72	66	6
SHK	SHARKS (UNIDENTIFIED)	1.40%	0.25%	0.00%	0.00%	100.00%	100.00%	67	0	67	11	0	11
GES	SNAKE MACKEREL	0.98%	0.88%	6.38%	2.63%	93.62%	97.37%	47	3	44	38	1	37
SFA	SAILFISH (INDO-PACIFIC)	0.92%	0.93%	97.73%	100.00%	2.27%	0.00%	44	43	1	40	40	0
DOL	MAHI MAHI / DOLPHINFISH / DORADO	0.84%	0.93%	95.00%	95.00%	5.00%	5.00%	40	38	2	40	38	2
SSP	SHORT-BILLED SPEARFISH	0.79%	0.76%	86.84%	87.88%	13.16%	12.12%	38	33	5	33	29	4
BUM	BLUE MARLIN	0.69%	0.74%	93.94%	93.75%	3.03%	6.25%	33	31	1	32	30	2
TST	SICKLE POMFRET	0.67%	0.65%	3.13%	3.57%	96.88%	96.43%	32	1	31	28	1	27
LAG	OPAH (MOONFISH)	0.56%	0.79%	100.00%	97.06%	0.00%	2.94%	27	27	0	34	33	1
SXH	BLACK MACKEREL	0.42%	0.05%	0.00%	0.00%	100.00%	100.00%	20	0	20	2	0	2
PRP	ROUDI ESCOLAR	0.38%	0.12%	0.00%	0.00%	100.00%	100.00%	18	0	18	5	0	5
BLM	BLACK MARLIN	0.29%	0.35%	100.00%	100.00%	0.00%	0.00%	14	14	0	15	15	0
FAL	SILKY SHARK	0.27%	0.63%	0.00%	0.00%	100.00%	100.00%	13	0	13	27	0	27
POA	RAY'S BREAM / ATLANTIC POMFRET	0.21%	0.19%	30.00%	25.00%	70.00%	75.00%	10	3	7	8	2	6
BSH	BLUE SHARK	0.15%	1.02%	0.00%	0.00%	100.00%	100.00%	7	0	7	44	0	44
EBS	BRILLIANT POMFRET	0.15%	0.19%	42.86%	0.00%	57.14%	100.00%	7	3	4	8	0	8
MLS	STRIPED MARLIN	0.10%	0.28%	100.00%	100.00%	0.00%	0.00%	5	5	0	12	12	0
SWO	SWORDFISH	0.10%	0.12%	100.00%	100.00%	0.00%	0.00%	5	5	0	5	5	0
OIL	OILFISH	0.06%	0.05%	0.00%	0.00%	100.00%	100.00%	3	0	3	2	0	2
RMV	MOBULA (A.K.A. DEVIL RAY)	0.06%	0.05%	0.00%	0.00%	100.00%	100.00%	3	0	3	2	0	2
ALG	GLAUERT'S ANGLERFISH	0.04%	0.00%	100.00%	0.00%	0.00%	0.00%	2	2	0	0	0	0
LGH	PELAGIC PUFFER	0.04%	0.09%	0.00%	0.00%	100.00%	100.00%	2	0	2	4	0	4
LKV	OLIVE RIDLEY TURTLE (NEW FAO)	0.04%	0.05%	0.00%	0.00%	100.00%	100.00%	2	0	2	2	0	2
LOP	CRESTFISH/UNICORNFISH	0.04%	0.05%	0.00%	0.00%	100.00%	100.00%	2	0	2	2	0	2
MAN	MANTA RAYS (UNIDENTIFIED)	0.04%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
RRU	RAINBOW RUNNER	0.04%	0.05%	50.00%	100.00%	0.00%	0.00%	2	1	0	2	2	0
UNS	UNSPECIFIED	0.04%	0.42%	0.00%	5.56%	100.00%	94.44%	2	0	2	18	1	17
ASZ	RAZORBACK SCABBARDFISH	0.02%	0.02%	0.00%	0.00%	100.00%	100.00%	1	0	1	1	0	1
CBG	DRIFT FISH	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
GSE	SOAPFISH	0.02%	0.05%	0.00%	0.00%	100.00%	100.00%	1	0	1	2	0	2
LXE	ORANGE-SPOTTED EMPEROR	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
PLC	FLATHEAD CHUB	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
RZV	SLENDER SUNFISH	0.02%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
SKA	RAJA RAYS NEI	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
TUG	GREEN TURTLE	0.02%	0.02%	0.00%	0.00%	100.00%	100.00%	1	0	1	1	0	1
YTC	AMBERJACK / GIANT YELLOWTAIL	0.02%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
BAB	BLACKFIN BARRACUDA	0.00%	0.07%	0.00%	100.00%	0.00%	0.00%	0	0	0	3	3	0
BRZ	POMFRETS AND OCEAN BREAMS	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
BTH	BIGEYE THRESHER	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
GEP	SNAKE MACKERELS AND ESCOLARS	0.00%	0.14%	0.00%	0.00%	0.00%	100.00%	0	0	0	6	0	6
LLL	CRESTFISH	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
LMA	LONG FINNED MAKO	0.00%	0.05%	0.00%	0.00%	0.00%	100.00%	0	0	0	2	0	2
OCS	OCEANIC WHITETIP SHARK	0.00%	0.05%	0.00%	0.00%	0.00%	100.00%	0	0	0	2	0	2
SMA	SHORT FINNED MAKO	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
SNK	BARRACOUTA (SNOEK)	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
THR	THRESHER SHARKS NEI	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
TRX	DEALFISHES	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1

Table 2. Summary comparison of catch by species on each TRIP under this project (continued)

TRIP #2													
SPECIES		Species composition (%)		RETAINED		DISCARDED		On-board			EM Video		
		On-board	EM Video	On-board	EM Video	On-board	EM Video	N	Ret	Disc	N	Ret	Disc
ALB	ALBACORE	31.53%	32.95%	99.12%	97.28%	0.88%	1.94%	1024	1015	9	1030	1002	20
YFT	YELLOWFIN	27.00%	21.18%	94.30%	93.05%	5.70%	6.50%	877	827	50	662	616	43
PLS	PELAGIC STING-RAY	10.90%	10.56%	0.00%	3.64%	100.00%	96.06%	354	0	354	330	12	317
BET	BIGEYE	6.93%	6.78%	98.22%	98.11%	1.78%	1.89%	225	221	4	212	208	4
ALX	LONGSNOUTED LANCETFISH	6.10%	11.00%	0.00%	2.33%	100.00%	97.38%	198	0	198	344	8	335
SKJ	SKIPJACK	3.33%	1.95%	90.74%	95.08%	9.26%	4.92%	108	98	10	61	58	3
LEC	ESCOLAR	1.51%	1.12%	83.67%	77.14%	16.33%	20.00%	49	41	8	35	27	7
GBA	GREAT BARRACUDA	1.48%	2.14%	100.00%	97.01%	0.00%	2.99%	48	48	0	67	65	2
LAG	OPAH (MOONFISH)	1.20%	1.73%	100.00%	98.15%	0.00%	1.85%	39	39	0	54	53	1
WAH	WAHOO	1.17%	1.09%	94.74%	94.12%	5.26%	5.88%	38	36	2	34	32	2
SFA	SAILFISH (INDO-PACIFIC)	0.99%	0.99%	100.00%	100.00%	0.00%	0.00%	32	32	0	31	31	0
DOL	MAHI MAHI / DOLPHINFISH / DORADO	0.92%	0.67%	96.67%	95.24%	3.33%	4.76%	30	29	1	21	20	1
FAL	SILKY SHARK	0.89%	0.96%	3.45%	0.00%	96.55%	100.00%	29	1	28	30	0	30
GES	SNAKE MACKEREL	0.89%	1.12%	6.90%	5.71%	93.10%	94.29%	29	2	27	35	2	33
ALO	SHORTSNOUTED LANCETFISH	0.86%	0.90%	0.00%	0.00%	100.00%	100.00%	28	0	28	28	0	28
MLS	STRIPED MARLIN	0.58%	0.22%	100.00%	71.43%	0.00%	28.57%	19	19	0	7	5	2
BUM	BLUE MARLIN	0.49%	0.61%	100.00%	100.00%	0.00%	0.00%	16	16	0	19	19	0
SSP	SHORT-BILLED SPEARFISH	0.49%	0.61%	100.00%	84.21%	0.00%	15.79%	16	16	0	19	16	3
TST	SICKLE POMFRET	0.49%	0.67%	43.75%	28.57%	56.25%	71.43%	16	7	9	21	6	15
GEP	SNAKE MACKERELS AND ESCOLARS	0.31%	0.10%	0.00%	33.33%	100.00%	66.67%	10	0	10	3	1	2
BAB	BLACKFIN BARRACUDA	0.25%	0.06%	100.00%	50.00%	0.00%	50.00%	8	8	0	2	1	1
SWO	SWORDFISH	0.25%	0.16%	75.00%	100.00%	25.00%	0.00%	8	6	2	5	5	0
BRZ	POMFRETS AND OCEAN BREAMS	0.12%	0.06%	0.00%	0.00%	100.00%	100.00%	4	0	4	2	0	2
BTH	BIGEYE THRESHER	0.12%	0.10%	0.00%	0.00%	100.00%	100.00%	4	0	4	3	0	3
EBS	BRILLIANT POMFRET	0.12%	0.26%	0.00%	0.00%	100.00%	100.00%	4	0	4	8	0	8
LKV	OLIVE RIDLEY TURTLE (NEW FAO)	0.12%	0.00%	0.00%	0.00%	100.00%	0.00%	4	0	4	0	0	0
BSH	BLUE SHARK	0.09%	0.16%	33.33%	0.00%	66.67%	80.00%	3	1	2	5	0	4
BRO	BRONZE WHALER SHARK	0.06%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
LGH	PELAGIC PUFFER	0.06%	0.06%	0.00%	0.00%	100.00%	100.00%	2	0	2	2	0	2
LOP	CRESTFISH/UNICORNFISH	0.06%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
NEN	BLACK GEMFISH	0.06%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
RMB	GIANT MANTA	0.06%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
RRU	RAINBOW RUNNER	0.06%	0.03%	100.00%	100.00%	0.00%	0.00%	2	2	0	1	1	0
SMA	SHORT FINNED MAKO	0.06%	0.03%	50.00%	100.00%	50.00%	0.00%	2	1	1	1	1	0
ALV	THRESHER	0.03%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
AMB	GREATER AMBERJACK	0.03%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
AML	GREY REEF SHARK	0.03%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
BLM	BLACK MARLIN	0.03%	0.42%	100.00%	100.00%	0.00%	0.00%	1	1	0	13	13	0
GSE	SOAPFISH	0.03%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
LXE	ORANGE-SPOTTED EMPEROR	0.03%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
OIL	OILFISH	0.03%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
PRP	ROUDI ESCOLAR	0.03%	0.10%	0.00%	0.00%	100.00%	100.00%	1	0	1	3	0	3
PSK	CROCODILE SHARK	0.03%	0.03%	0.00%	100.00%	100.00%	0.00%	1	0	1	1	1	0
PTH	PELAGIC THRESHER	0.03%	0.06%	0.00%	0.00%	100.00%	100.00%	1	0	1	2	0	2
SNK	BARRACOUTA (SNOEK)	0.03%	0.06%	0.00%	0.00%	100.00%	100.00%	1	0	1	2	0	2
TAK	Jackass Morwong	0.03%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
TTL	LOGGERHEAD TURTLE	0.03%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
UNS	UNSPECIFIED	0.03%	0.64%	0.00%	0.00%	100.00%	100.00%	1	0	1	20	0	20
BIZ	BIRD (UNIDENTIFIED)	0.00%	0.03%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
LMA	LONG FINNED MAKO	0.00%	0.03%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
POA	RAY'S BREAM / ATLANTIC POMFRET	0.00%	0.10%	0.00%	0.00%	0.00%	100.00%	0	0	0	3	0	3
RMV	MOBULA (A.K.A. DEVIL RAY)	0.00%	0.06%	0.00%	0.00%	0.00%	100.00%	0	0	0	2	0	2
SHK	SHARKS (UNIDENTIFIED)	0.00%	0.03%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
SXH	BLACK MACKEREL	0.00%	0.16%	0.00%	20.00%	0.00%	80.00%	0	0	0	5	1	4

Table 2. Summary comparison of catch by species on each TRIP under this project (continued)

TRIP #3													
SPECIES		Species composition (%)		RETAINED		DISCARDED		On-board			EM Video		
		On-board	EM Video	On-board	EM Video	On-board	EM Video	N	Ret	Disc	N	Ret	Disc
ALB	ALBACORE	41.36%	40.27%	99.40%	98.60%	0.60%	1.40%	1988	1976	12	2580	2544	36
YFT	YELLOWFIN	22.33%	21.23%	96.37%	94.71%	3.63%	5.29%	1073	1034	39	1360	1288	72
BET	BIGEYE	14.54%	13.28%	76.39%	78.03%	23.61%	21.97%	699	534	165	851	664	187
SKJ	SKIPJACK	7.70%	7.27%	77.30%	71.67%	22.70%	28.33%	370	286	84	466	334	132
PLS	PELAGIC STING-RAY	3.66%	5.18%	0.00%	0.00%	100.00%	100.00%	176	0	176	332	0	332
LEC	ESCOLAR	1.81%	2.59%	35.63%	17.47%	64.37%	82.53%	87	31	56	166	29	137
WAH	WAHOO	1.73%	2.01%	91.57%	87.60%	8.43%	12.40%	83	76	7	129	113	16
DOL	MAHI MAHI / DOLPHINFISH / DORADO	1.39%	1.42%	92.54%	80.22%	7.46%	19.78%	67	62	5	91	73	18
FAL	SILKY SHARK	0.79%	1.06%	0.00%	0.00%	100.00%	100.00%	38	0	38	68	0	68
TST	SICKLE POMFRET	0.67%	0.45%	9.38%	0.00%	90.63%	100.00%	32	3	29	29	0	29
RZV	SLENDER SUNFISH	0.44%	0.36%	0.00%	0.00%	100.00%	100.00%	21	0	21	23	0	23
OMW	OMOSUDID	0.42%	0.00%	0.00%	0.00%	100.00%	0.00%	20	0	20	0	0	0
BEC	RED SEA CATFISH	0.40%	0.00%	84.21%	0.00%	15.79%	0.00%	19	16	3	0	0	0
GES	SNAKE MACKEREL	0.40%	0.56%	0.00%	0.00%	100.00%	100.00%	19	0	19	36	0	36
SSP	SHORT-BILLED SPEARFISH	0.37%	0.33%	33.33%	52.38%	66.67%	47.62%	18	6	12	21	11	10
LAG	OPAH (MOONFISH)	0.33%	0.55%	0.00%	2.86%	100.00%	97.14%	16	0	16	35	1	34
BUM	BLUE MARLIN	0.29%	0.20%	92.86%	76.92%	7.14%	23.08%	14	13	1	13	10	3
SFA	SAILFISH (INDO-PACIFIC)	0.23%	0.19%	90.91%	100.00%	9.09%	0.00%	11	10	1	12	12	0
SWO	SWORDFISH	0.21%	0.16%	30.00%	30.00%	70.00%	70.00%	10	3	7	10	3	7
EBS	BRILLIANT POMFRET	0.12%	0.22%	33.33%	0.00%	66.67%	100.00%	6	2	4	14	0	14
GBA	GREAT BARRACUDA	0.10%	0.09%	100.00%	83.33%	0.00%	16.67%	5	5	0	6	5	1
BTH	BIGEYE THRESHER	0.06%	0.05%	0.00%	0.00%	100.00%	100.00%	3	0	3	3	0	3
ABU	SARGENT MAJOR	0.04%	0.00%	100.00%	0.00%	0.00%	0.00%	2	2	0	0	0	0
ALV	THRESHER	0.04%	0.00%	100.00%	0.00%	0.00%	0.00%	2	2	0	0	0	0
ALX	LONGSNOUTED LANCETFISH	0.04%	1.45%	0.00%	0.00%	100.00%	100.00%	2	0	2	93	0	93
ASZ	RAZORBACK SCABBARDFISH	0.04%	0.02%	0.00%	0.00%	100.00%	100.00%	2	0	2	1	0	1
ETA	DEEP-WATER RED SNAPPER	0.04%	0.00%	100.00%	0.00%	0.00%	0.00%	2	2	0	0	0	0
GEM	GEMFISH (SOUTHERN OR SILVER KINGFISH)	0.04%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
OCS	OCEANIC WHITETIP SHARK	0.04%	0.08%	0.00%	0.00%	100.00%	100.00%	2	0	2	5	0	5
PRP	ROUDI ESCOLAR	0.04%	0.30%	0.00%	0.00%	100.00%	100.00%	2	0	2	19	0	19
RMB	GIANT MANTA	0.04%	0.02%	0.00%	0.00%	100.00%	100.00%	2	0	2	1	0	1
SMA	SHORT FINNED MAKO	0.04%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
ALN	FILEFISH (SCRIBBLED LEATHERJACKET)	0.02%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
ALO	SHORTSNOUTED LANCETFISH	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
BLM	BLACK MARLIN	0.02%	0.11%	100.00%	100.00%	0.00%	0.00%	1	1	0	7	7	0
CUT	HAIRTAILS - CUTLASSFISHES	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
LKV	OLIVE RIDLEY TURTLE (NEW FAO)	0.02%	0.05%	0.00%	0.00%	100.00%	100.00%	1	0	1	3	0	3
LLL	CRESTFISH	0.02%	0.08%	0.00%	0.00%	100.00%	100.00%	1	0	1	5	0	5
LMA	LONG FINNED MAKO	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
LOP	CRESTFISH/UNICORNFISH	0.02%	0.02%	0.00%	0.00%	100.00%	100.00%	1	0	1	1	0	1
MLS	STRIPED MARLIN	0.02%	0.03%	100.00%	50.00%	0.00%	50.00%	1	1	0	2	1	1
RMV	MOBULA (A.K.A. DEVIL RAY)	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
TUG	GREEN TURTLE	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
BSH	BLUE SHARK	0.00%	0.17%	0.00%	0.00%	0.00%	100.00%	0	0	0	11	0	11
CBG	DRIFT FISH	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
OIL	OILFISH	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
POA	RAY'S BREAM / ATLANTIC POMFRET	0.00%	0.09%	0.00%	0.00%	0.00%	100.00%	0	0	0	6	0	6
PTH	PELAGIC THRESHER	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
SHK	SHARKS (UNIDENTIFIED)	0.00%	0.03%	0.00%	0.00%	0.00%	100.00%	0	0	0	2	0	2
TTL	LOGGERHEAD TURTLE	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
TUN	TUNA (UNIDENTIFIED)	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
UNS	UNSPECIFIED	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1

Table 2. Summary comparison of catch by species on each TRIP under this project (continued)

TRIP #4													
SPECIES		Species composition (%)		RETAINED		DISCARDED		On-board			EM Video		
		On-board	EM Video	On-board	EM Video	On-board	EM Video	N	Ret	Disc	N	Ret	Disc
YFT	YELLOWFIN	33.45%	35.11%	94.37%	94.90%	5.63%	5.10%	1438	1357	81	2100	1993	107
ALB	ALBACORE	30.96%	31.17%	97.90%	99.09%	2.10%	0.91%	1331	1303	28	1864	1847	17
BET	BIGEYE	6.65%	5.90%	98.25%	98.58%	1.75%	1.42%	286	281	5	353	348	5
SKJ	SKIPJACK	6.21%	5.99%	96.25%	98.32%	3.75%	1.68%	267	257	10	358	352	6
LEC	ESCOLAR	4.56%	3.34%	69.39%	94.00%	30.61%	6.00%	196	136	60	200	188	12
PLS	PELAGIC STING-RAY	4.30%	4.78%	0.54%	0.00%	99.46%	100.00%	185	1	184	286	0	286
WAH	WAHOO	4.09%	3.81%	95.45%	92.98%	4.55%	7.02%	176	168	8	228	212	16
DOL	MAHI MAHI / DOLPHINFISH / DORADO	2.21%	1.97%	93.68%	94.92%	6.32%	5.08%	95	89	6	118	112	6
GES	SNAKE MACKEREL	0.88%	0.54%	0.00%	0.00%	100.00%	100.00%	38	0	38	32	0	32
FAL	SILKY SHARK	0.86%	1.22%	2.70%	0.00%	97.30%	100.00%	37	1	36	73	0	73
GBA	GREAT BARRACUDA	0.70%	0.69%	86.67%	97.56%	13.33%	2.44%	30	26	4	41	40	1
ALO	SHORTSNOUTED LANCETFISH	0.67%	0.00%	0.00%	0.00%	100.00%	0.00%	29	0	29	0	0	0
ALX	LONGSNOUTED LANCETFISH	0.63%	1.02%	0.00%	0.00%	100.00%	100.00%	27	0	27	61	0	61
SSP	SHORT-BILLED SPEARFISH	0.60%	0.57%	96.15%	97.06%	3.85%	2.94%	26	25	1	34	33	1
TST	SICKLE POMFRET	0.51%	0.38%	0.00%	0.00%	100.00%	100.00%	22	0	22	23	0	23
PRP	ROUDI ESCOLAR	0.44%	0.00%	0.00%	0.00%	100.00%	0.00%	19	0	19	0	0	0
RZV	SLENDER SUNFISH	0.26%	0.27%	0.00%	0.00%	100.00%	100.00%	11	0	11	16	0	16
BUM	BLUE MARLIN	0.23%	0.37%	70.00%	100.00%	30.00%	0.00%	10	7	3	22	22	0
MLS	STRIPED MARLIN	0.21%	0.15%	100.00%	88.89%	0.00%	11.11%	9	9	0	9	8	1
SFA	SAILFISH (INDO-PACIFIC)	0.21%	0.20%	77.78%	83.33%	22.22%	16.67%	9	7	2	12	10	2
EBS	BRILLIANT POMFRET	0.19%	0.13%	0.00%	0.00%	100.00%	100.00%	8	0	8	8	0	8
LAG	OPAH (MOONFISH)	0.19%	0.27%	50.00%	56.25%	50.00%	43.75%	8	4	4	16	9	7
BLM	BLACK MARLIN	0.16%	0.08%	100.00%	100.00%	0.00%	0.00%	7	7	0	5	5	0
SWO	SWORDFISH	0.14%	0.12%	100.00%	100.00%	0.00%	0.00%	6	6	0	7	7	0
GEP	SNAKE MACKERELS AND ESCOLARS	0.12%	0.57%	0.00%	0.00%	100.00%	100.00%	5	0	5	34	0	34
LKV	OLIVE RIDLEY TURTLE (NEW FAO)	0.12%	0.08%	0.00%	0.00%	100.00%	100.00%	5	0	5	5	0	5
NEN	BLACK GEMFISH	0.12%	0.00%	0.00%	0.00%	100.00%	0.00%	5	0	5	0	0	0
BRZ	POMFRETS AND OCEAN BREAMS	0.09%	0.03%	0.00%	0.00%	100.00%	100.00%	4	0	4	2	0	2
ASZ	RAZORBACK SCABBARDFISH	0.05%	0.00%	100.00%	0.00%	0.00%	0.00%	2	2	0	0	0	0
LLL	CRESTFISH	0.05%	0.00%	0.00%	0.00%	100.00%	0.00%	2	0	2	0	0	0
GSE	SOAPFISH	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
OCS	OCEANIC WHITETIP SHARK	0.02%	0.10%	0.00%	0.00%	100.00%	100.00%	1	0	1	6	0	6
RMV	MOBULA (A.K.A. DEVIL RAY)	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
SKA	RAJA RAYS NEI	0.02%	0.00%	100.00%	0.00%	0.00%	0.00%	1	1	0	0	0	0
TUG	GREEN TURTLE	0.02%	0.00%	0.00%	0.00%	100.00%	0.00%	1	0	1	0	0	0
UNS	UNSPECIFIED	0.02%	0.52%	0.00%	0.00%	100.00%	100.00%	1	0	1	31	0	31
ABU	SARGENT MAJOR	0.00%	0.02%	0.00%	100.00%	0.00%	0.00%	0	0	0	1	1	0
AKB	Black Bream	0.00%	0.02%	0.00%	100.00%	0.00%	0.00%	0	0	0	1	1	0
BRO	BRONZE WHALER SHARK	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
BSH	BLUE SHARK	0.00%	0.05%	0.00%	0.00%	0.00%	100.00%	0	0	0	3	0	3
BTH	BIGEYE THRESHER	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
COM	SPANISH MACKEREL (NARROW-BARRED)	0.00%	0.07%	0.00%	100.00%	0.00%	0.00%	0	0	0	4	4	0
CUT	HAIRTAILS - CUTLASSFISHES	0.00%	0.02%	0.00%	100.00%	0.00%	0.00%	0	0	0	1	1	0
DOD	GIZZARD SHAD (KONOSHIRO)	0.00%	0.02%	0.00%	100.00%	0.00%	0.00%	0	0	0	1	1	0
LMA	LONG FINNED MAKO	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
OIL	OILFISH	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
POA	RAY'S BREAM / ATLANTIC POMFRET	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
RMB	GIANT MANTA	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
RRG	OARFISHES NEI	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
SHK	SHARKS (UNIDENTIFIED)	0.00%	0.28%	0.00%	0.00%	0.00%	100.00%	0	0	0	17	0	17
SMA	SHORT FINNED MAKO	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1
TTH	HAWKSBILL TURTLE	0.00%	0.02%	0.00%	0.00%	0.00%	100.00%	0	0	0	1	0	1

Table 3. The percentage of matching fate codes between the on-board and office observers.

			% of matches of FATE code for each target tuna catch			
FATE		N	TRIP #1	TRIP #2	TRIP #3	TRIP #4
RWW	Retained - whole	5,497	98%	94%	94%	93%
RGT	Retained - gilled gutted and tailed	3,709	99%	94%	98%	98%
DTS	Discarded - too small	159	0%	78%	85%	63%
DWD	Discarded - Whale damage	83	91%	73%	50%	46%
RSD	Retained - Shark damage	67	29%	3%	0%	100%
DSD	Discarded - Shark damage	52	63%	100%	92%	63%
RCC	Retained - Crew Consumption	27	8%	0%	20%	0%
RWD	Retained - Whale Damage	18	0%	0%	0%	0%
	[Other FATE codes combined]	38	0%	50%	0%	0%

Table 4. Comparison of CONDITION codes reported for each matching target tuna catch for trip #3.

TRIP #3 - Number of CONDITION CODE matches					
		"Office" Observer			
	Condition Code	A1	A2	A3	D
On-board Observer	A1	490	230	43	149
	A2	18	43	6	29
	A3	7	22	4	23
	D	34	38	8	2466

TRIP #3 - % of CONDITION CODE matches					
		"Office" Observer			
	Condition Code	A1	A2	A3	D
On-board Observer	A1	54%	25%	5%	16%
	A2	19%	45%	6%	30%
	A3	13%	39%	7%	41%
	D	1%	1%	0%	97%

Table 5. Comparison of CONDITION codes reported for each matching target tuna catch for trip #4.

TRIP #4 - Number of CONDITION CODE matches					
		"Office" Observer			
	Condition Code	A1	A2	A3	D
On-board Observer	A1	52	120	47	44
	A2	49	138	142	138
	A3	2	7	26	112
	D	7	24	26	1541

TRIP #4 - % of CONDITION CODE matches					
		"Office" Observer			
	Condition Code	A1	A2	A3	D
On-board Observer	A1	20%	46%	18%	17%
	A2	10%	30%	30%	30%
	A3	1%	5%	18%	76%
	D	0%	2%	2%	96%

Table 6. Comparison of GENDER codes reported for each matching individual SHARK species catch for trip #3.

TRIP #3 - Number of SEX CODE matches				
		"Office" Observer		
	Sex Code	F	M	U
On-board Observer	F	32	7	21
	M	9	51	7
	U	46	19	

TRIP #3 - Number of SEX CODE matches				
		"Office" Observer		
	Sex Code	F	M	U
On-board Observer	F	*53%*	12%	35%
	M	13%	*76%*	10%
	U	71%	29%	

Table 7. Comparison of GENDER codes reported for each matching individual SHARK species catch for trip #4.

TRIP #4 - Number of SEX CODE matches				
		"Office" Observer		
	Sex Code	F	M	U
On-board Observer	F	6		
	M	6		2
	U	44	19	

TRIP #4 - Number of SEX CODE matches				
		"Office" Observer		
	Sex Code	F	M	U
On-board Observer	F	*100%*	0%	0%
	M	75%	*0%*	25%
	U	70%	30%	

FIGURES

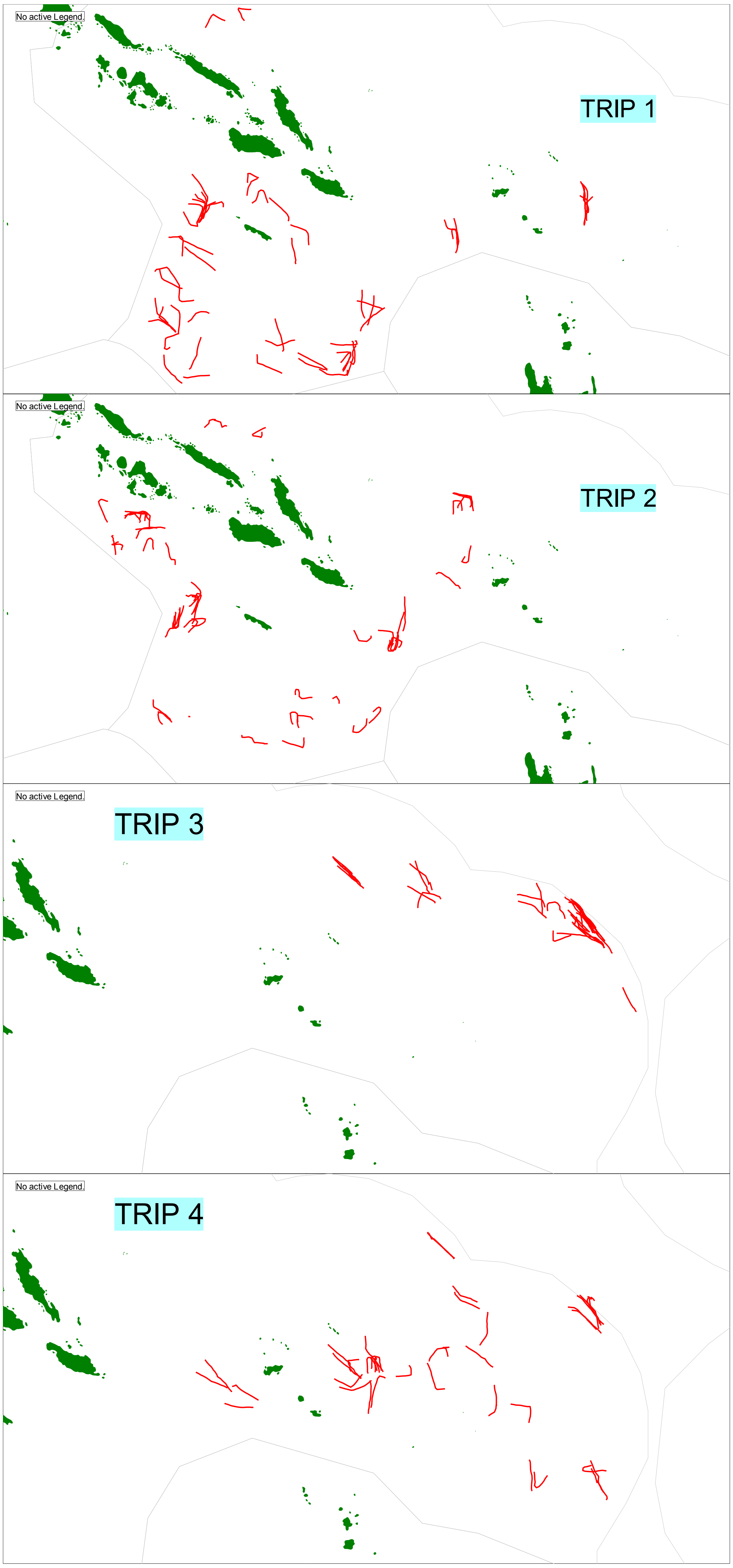

Figure 1. Longline 'haul' tracks for each TRIP under this project

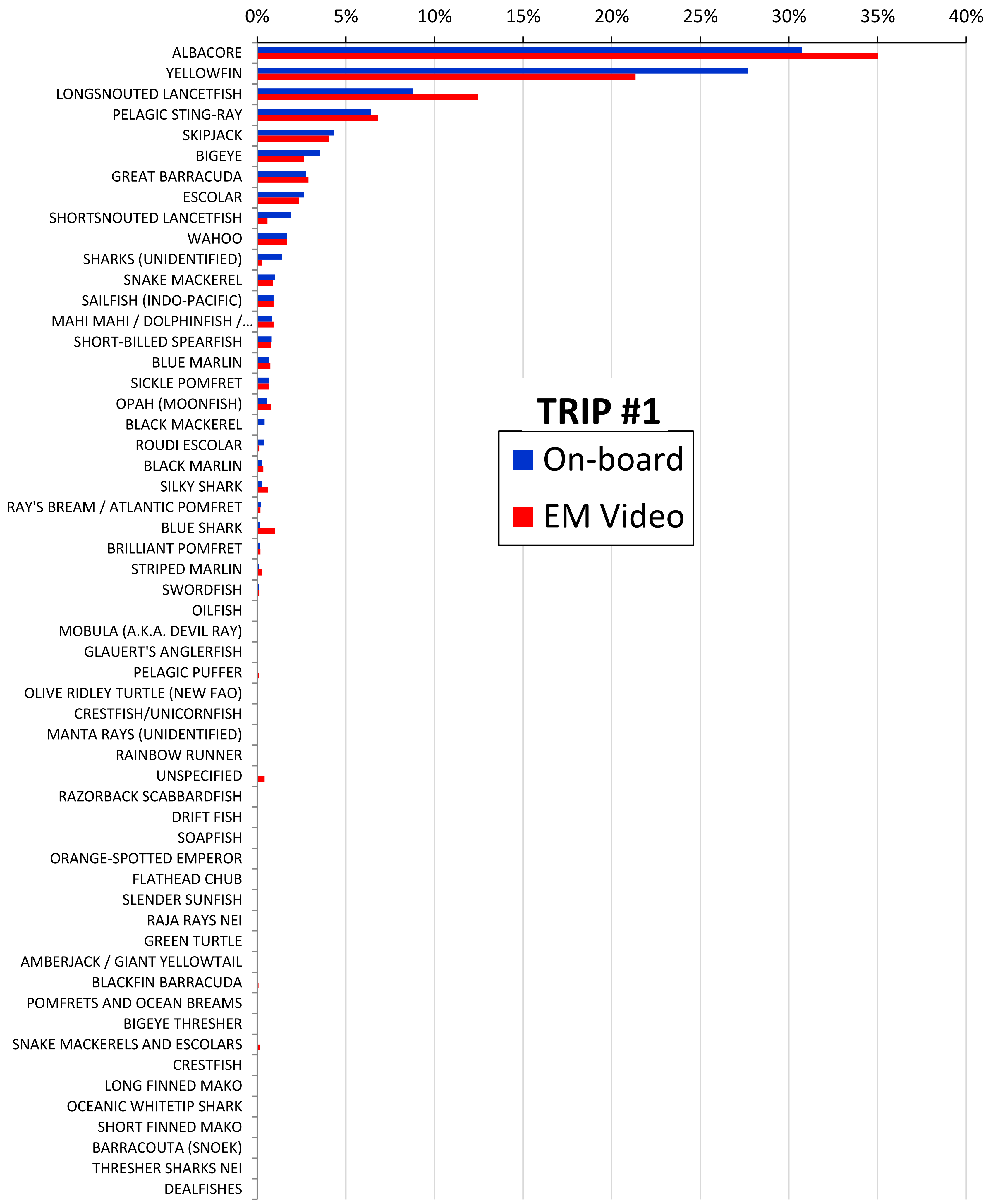

Figure 2. Summary comparison of catch (in number) by species for each TRIP under this project

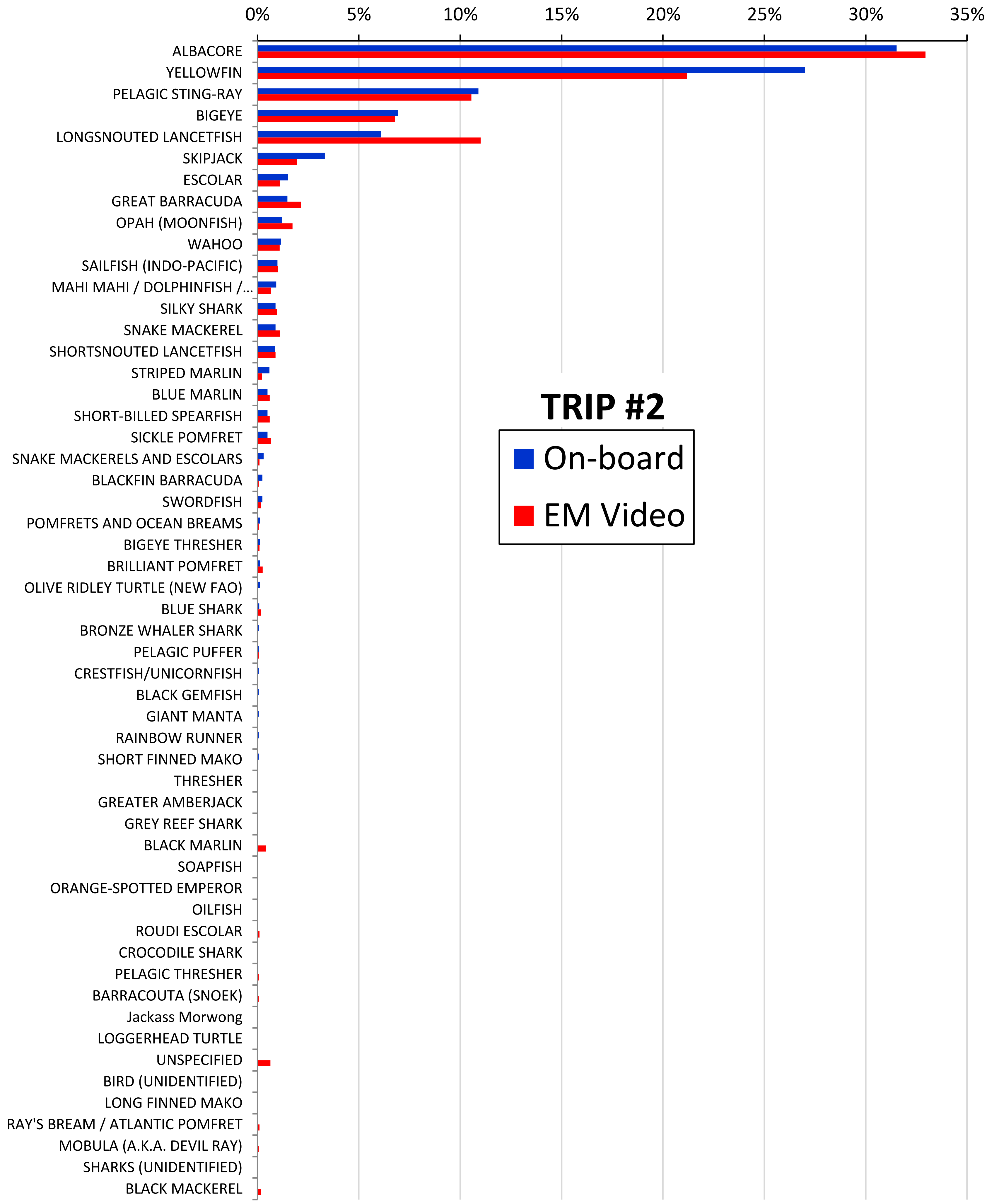

Figure 2. Summary comparison of catch (in number) by species for each TRIP under this project
(continued)

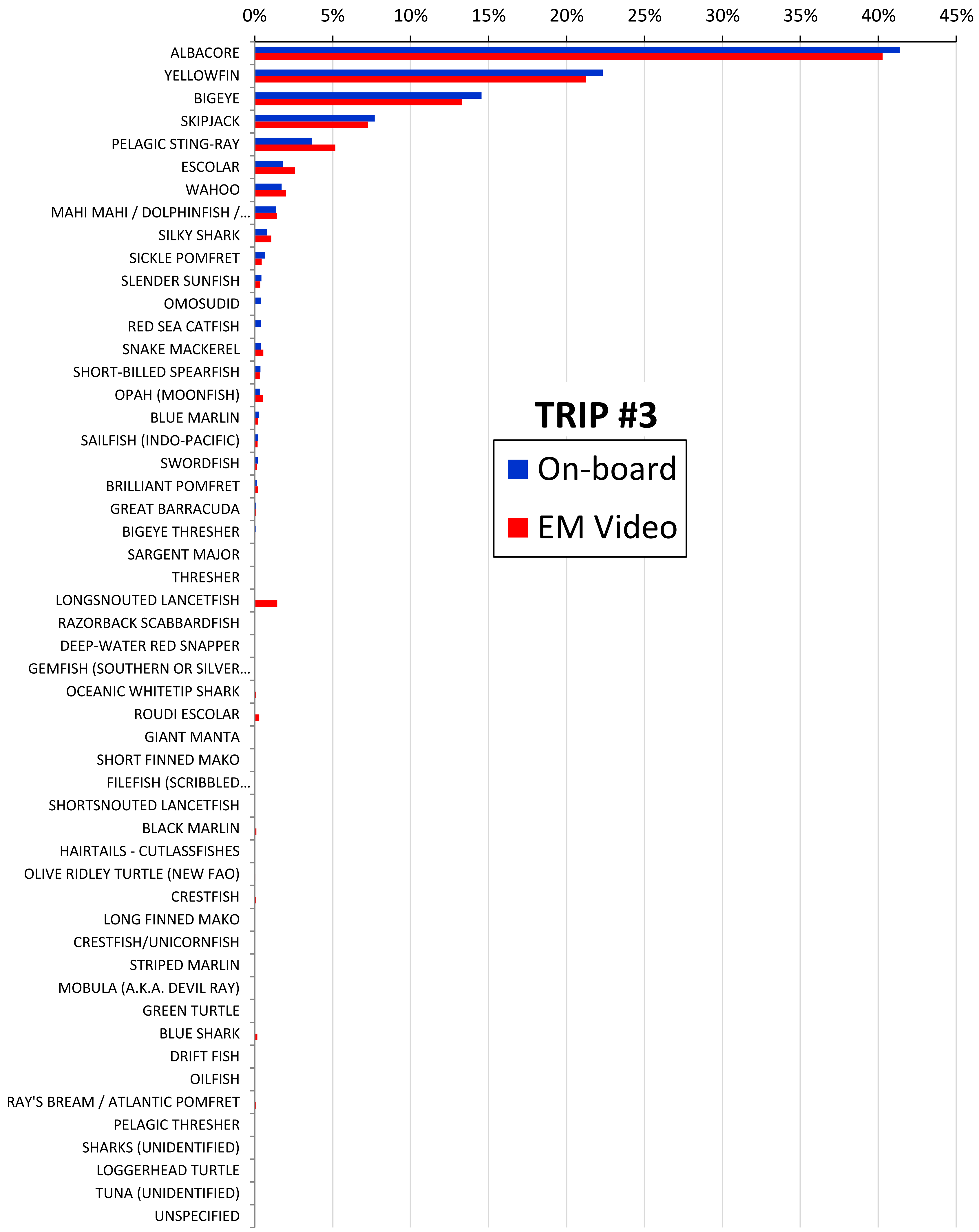

Figure 2. Summary comparison of catch (in number) by species for each TRIP under this project
(continued)

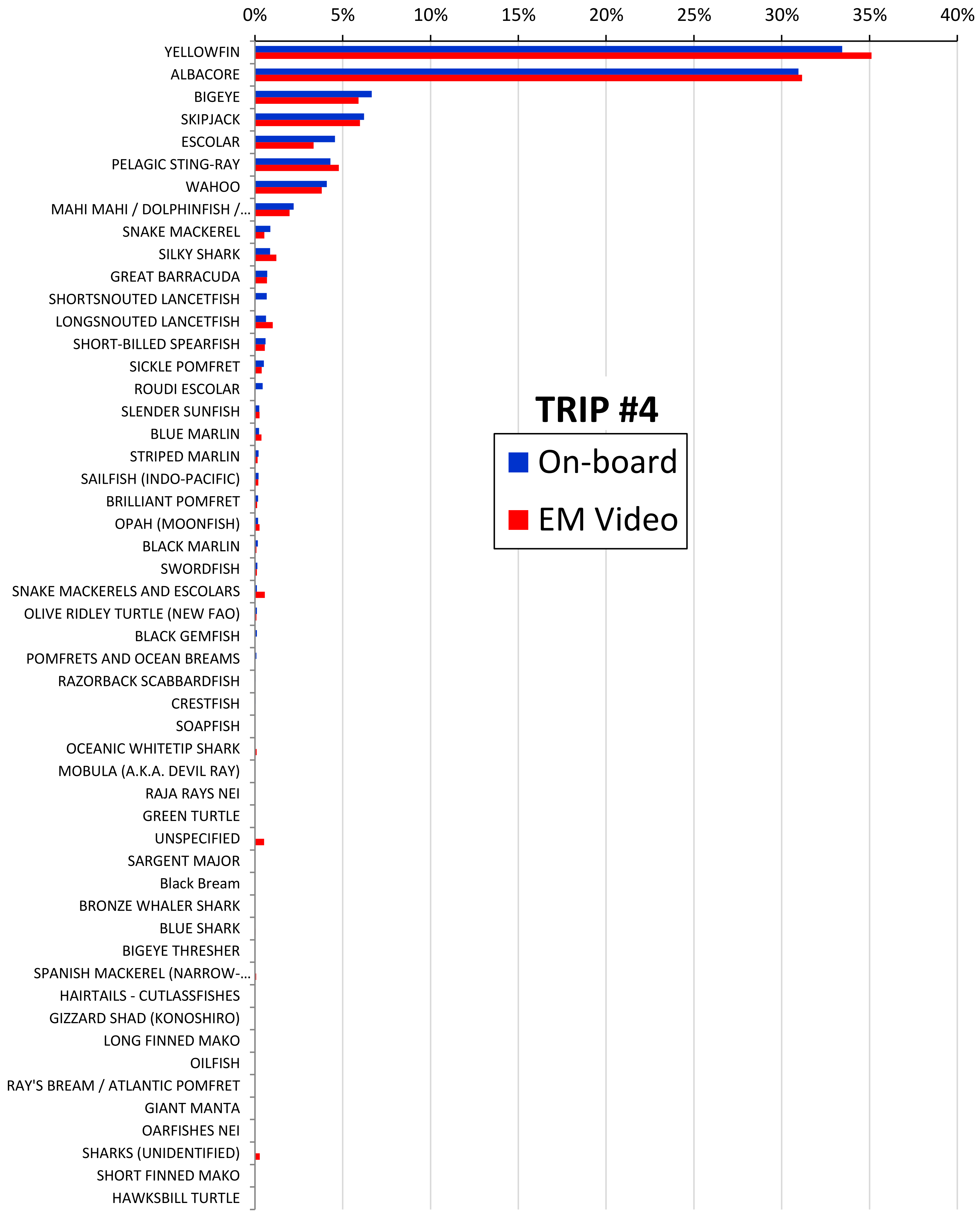

Figure 2. Summary comparison of catch (in number) by species for each TRIP under this project (continued)

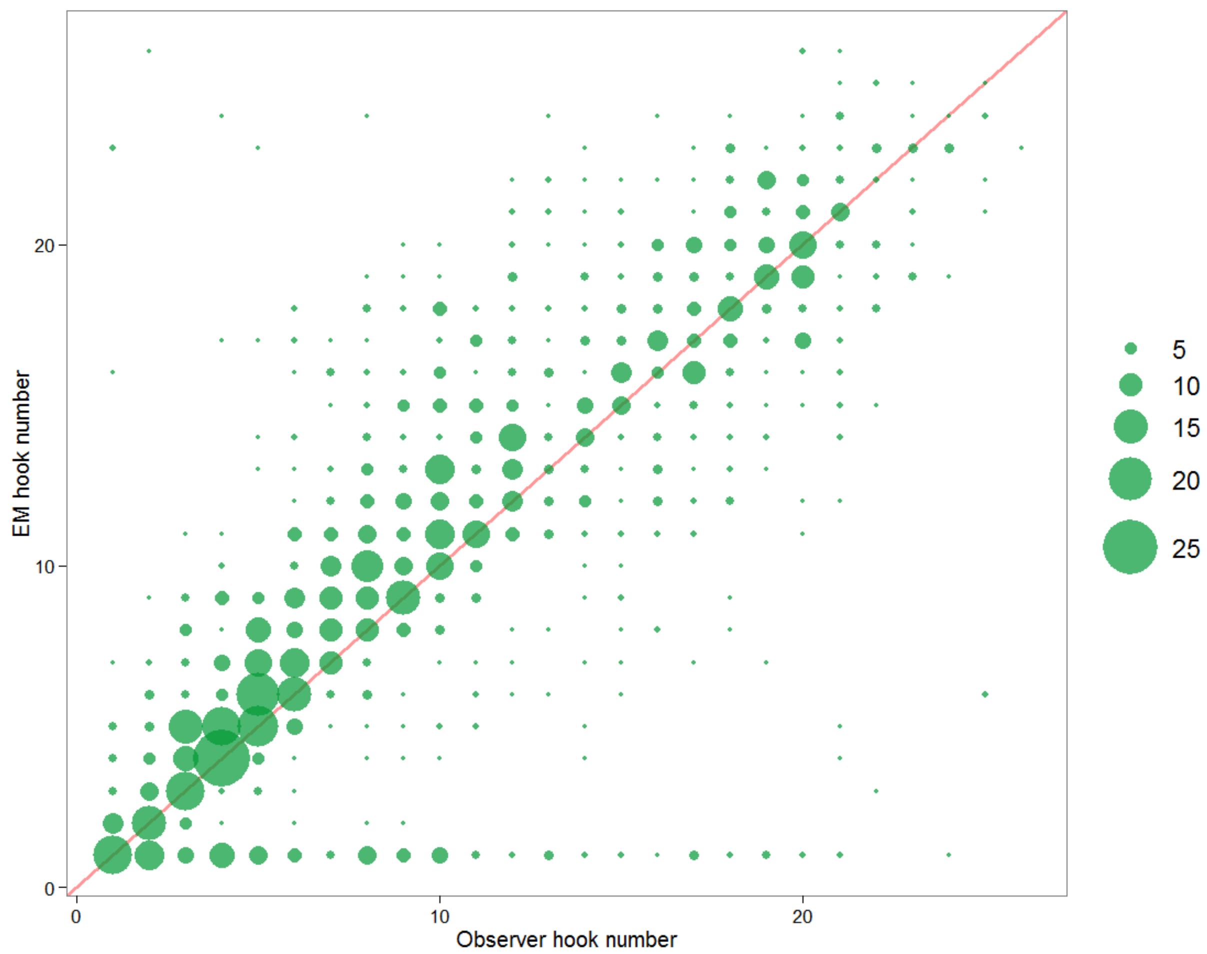

Figure 3. Comparison of the hook number an albacore was caught on recorded by (i) the on-board observer (Observer hook number), and (ii) the office observer (EM hook number)

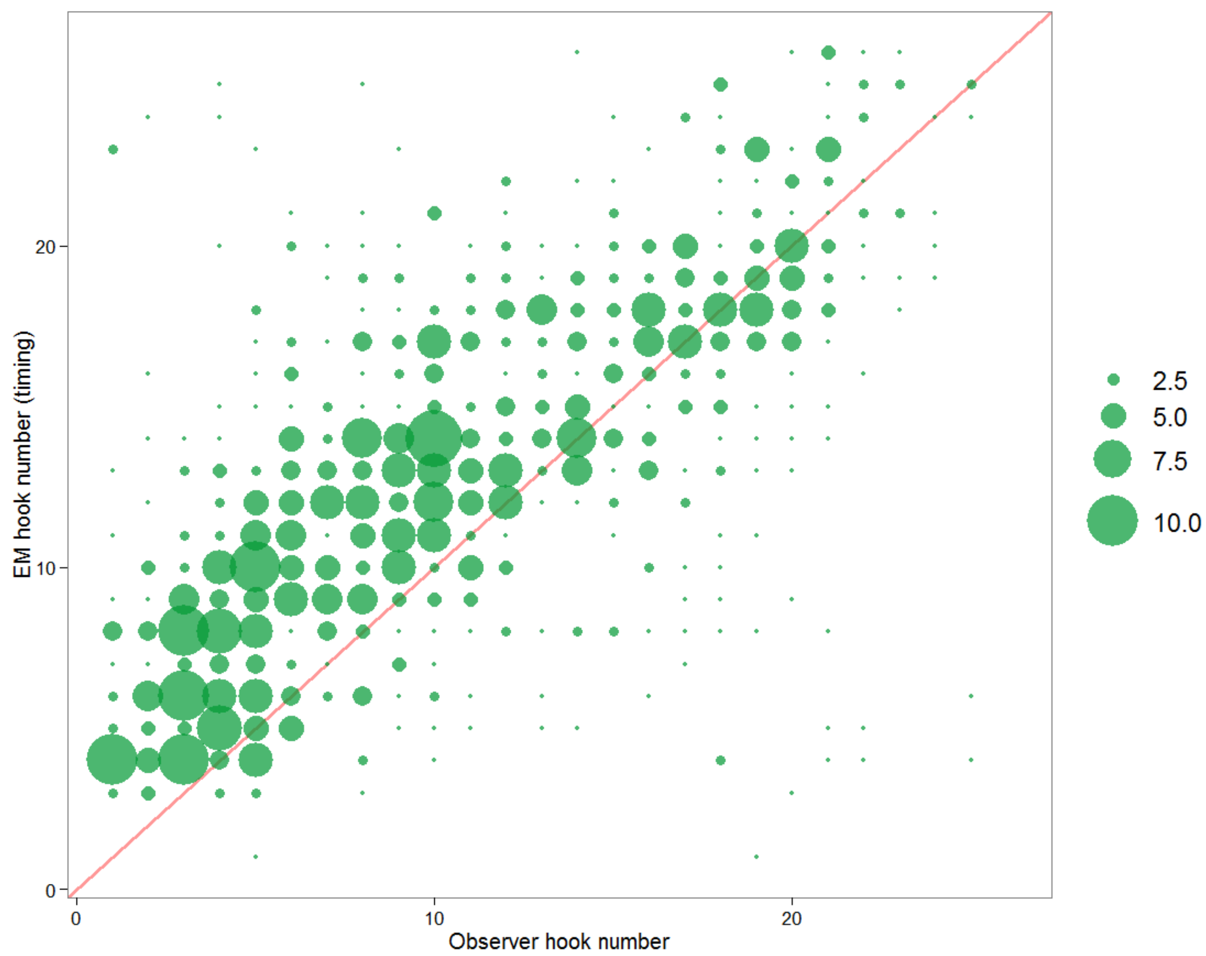

Figure 4. Comparison of hook-number-between float for albacore tuna, (i) recorded by the on-board observer (Observer hook number), and (ii) the estimated hook number determined from time of landing with respect to time for retrieving floats before and after, and the number of hooks between these floats (EM hook number - timing).

ILLUSTRATIONS

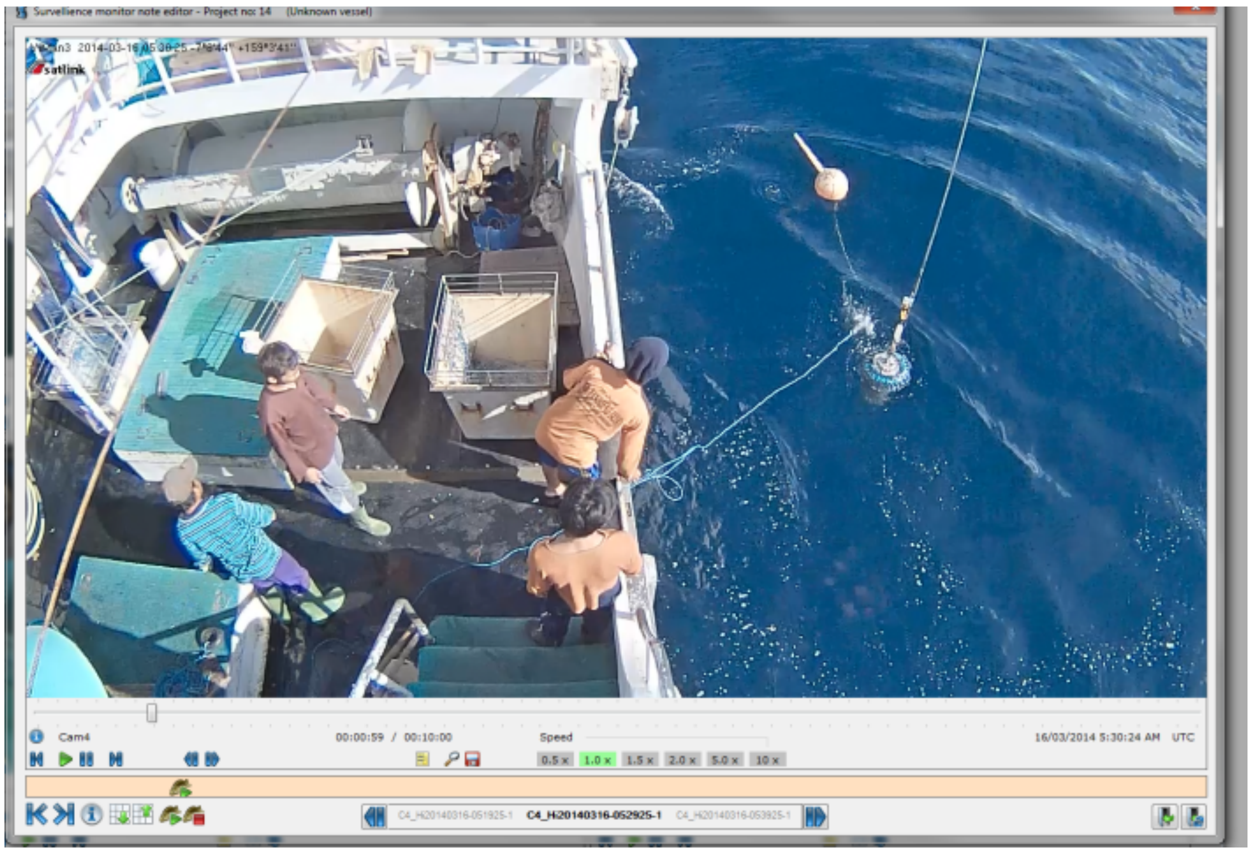

Illustration 1: Screen shot from the Satlink View Manager. This is the moment when the crew of the Yi Man 3 retrieved the first radio buy attached to the longline. This marks the start of the hauling. The pink timeline bar at the bottom of the screen includes note functions to allow the office observer to record data for each new event.

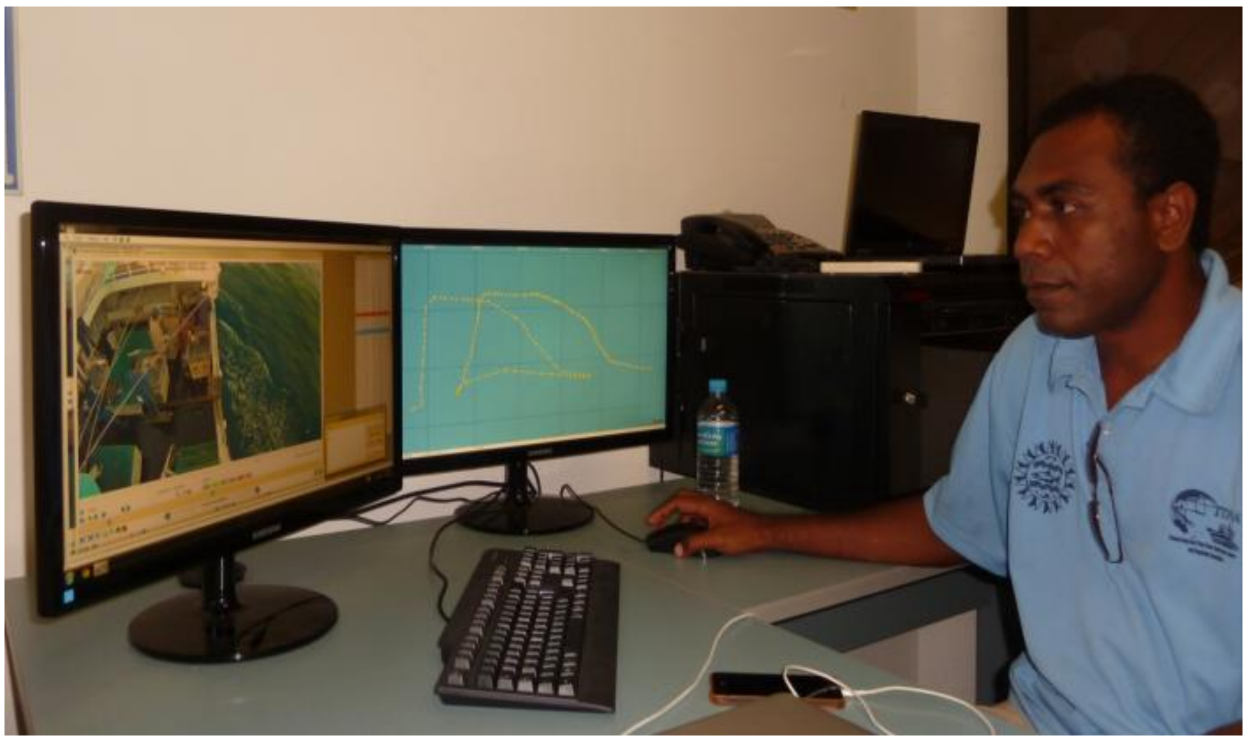

Illustration 2: MFMR office observer Harold Vilia analyzing the haul. The screen at right is used to display the vessel's track for the setting and hauling period while the screen at left displays the camera footage. The central unit housing the computer and the hard drive racks is at the far right.

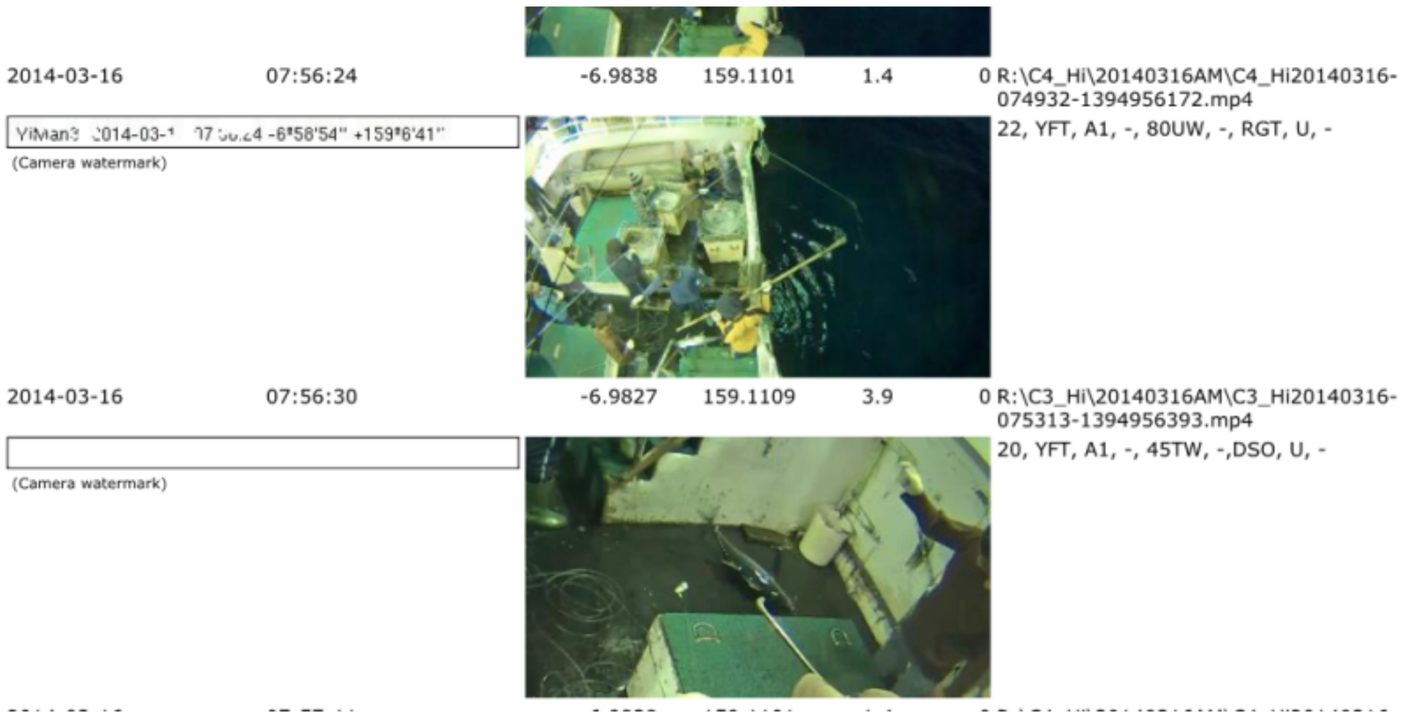

Illustration 3: Example of the report produced by the VM after a set has been analysed. The GMT date and date and position for each event is displayed at left, a thumbnail picture can also be included in the report (it can also be rE-Monitoringoved), and finally at right the coded data regarding the species.

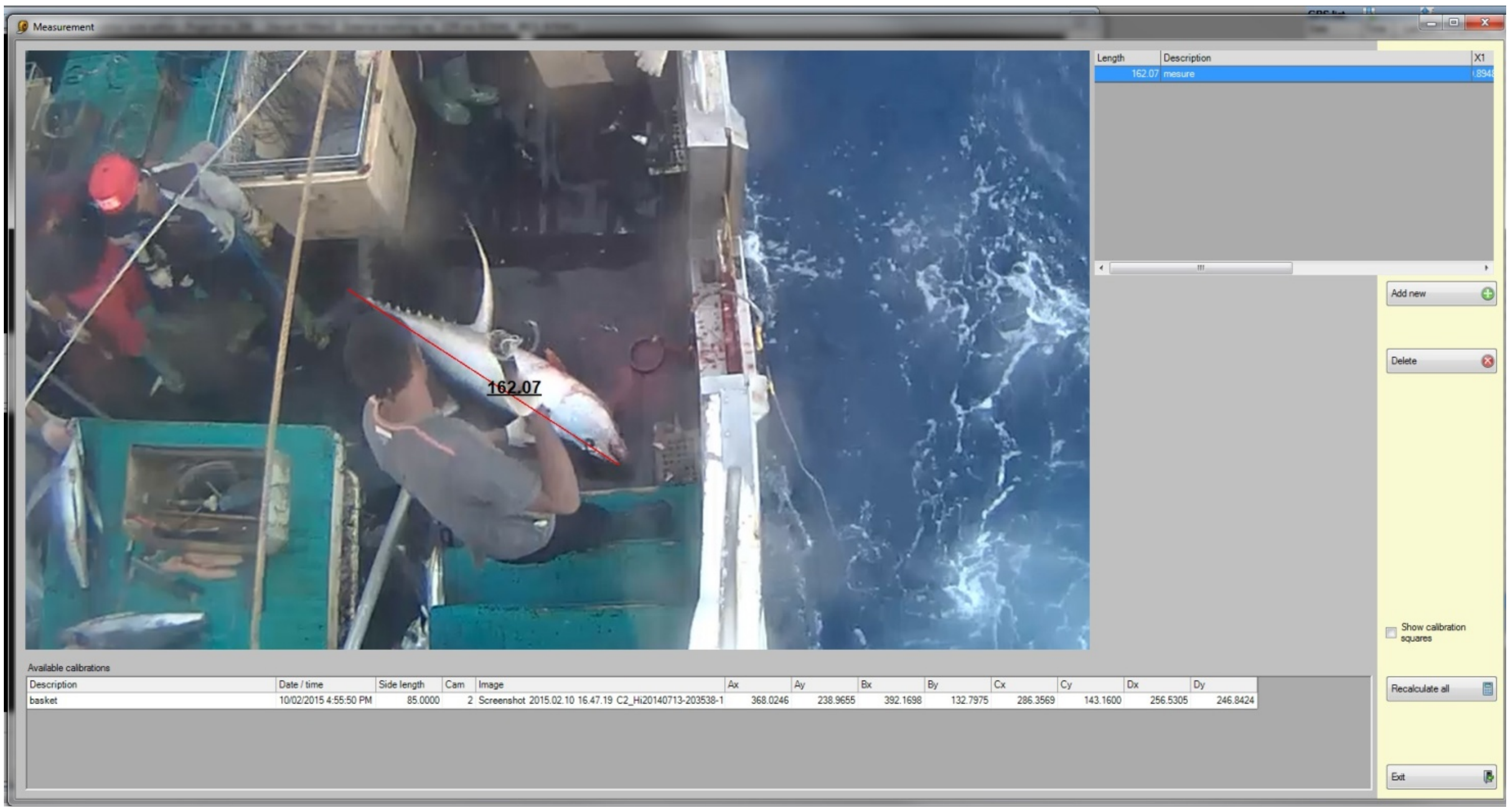

Illustration 4: Example of the length measurement tool being used to measure a large yellowfin tuna.

APPENDIX 1 – PROJECT ME-MONITORINGORANDUM OF UNDERSTANDING (MOU)

Memorandum of Understanding

Between: Tri Marine Management Company, LLC (TMMC), National Fisheries Developments, LTD (NFD),

And: Yi Man Fishery Co., Ltd. (YMFC), Forum Fisheries Agency (FFA), Solomon Islands Ministry of Fisheries and Marine Affairs (MFMR), and Secretariat of the Pacific Community (SPC)

This Memorandum of Understanding ("MOU") summarizes previous discussions, email exchanges, and general thinking among TMMC, NFD, the YMFC, FFA, MFMR, and SPC ("the Parties") regarding the development and implementation of an electronic monitoring (EM) trial ("the Project") in the Solomon Islands.

The Project will have the objective of assessing whether EM, using video and other equipment, can accurately collect at-sea fishing activity and catch data onboard tuna longliners. In addition, the goal is to see if, when combined with information from at-port vessel inspections by fisheries agents, this data will fulfill the requirements of the Western and Central Pacific Fisheries Commission (WCPFC) Regional Observer Program (ROP) minimum data fields. If successful and deemed cost effective, the Project could be expanded to help increase the level of observer coverage onboard tuna longliners operating in the region to, or beyond, the 5% requirement of the WCPFC.

The Project, as currently envisioned, will trial EM onboard two Taiwanese flagged, CT4 class, tuna longliners operating out of Noro, Solomon Islands, and/or Suva, Fiji, on two fishing trips for a total of four trips. For all four trips, both human observers and EM equipment will be placed onboard the vessels. Human observers will conduct normal observation activities, but also assist with many aspects of the EM trial. Ultimately, the trial will generate 8 observer data sets using the ROP minimum data fields, 4 human, and 4 electronic (combined with human at-port data as indicated above). These will be compared, and a report generated that summarizes the results, including a cost-benefit analysis and recommendations.

The project will commence in Q1 2014 and be completed around mid-year. This would allow adequate time for the project report to be completed ahead of, and presented at, the WCPFC Scientific Committee meeting scheduled for early August, 2014.

The project will be managed by a Project Management Committee, comprised of key representatives from FFA, SPC, MFMR, NFD and TMMC. The Project Management Committee will be responsible for planning and oversight of the trial design, implementation and evaluation. A field coordinator will receive direction and report to the Project Management Committee during the implementation phase.

Each of Parties will have an important role to play in the Project, and agree to the following roles and responsibilities:

TMMC and NFD:

1. General coordination amongst the Parties.
2. Participate in planning sessions, via conference call, or in-person, with the other Parties.

3. Be a member of the Project Management Committee, which will be responsible for the development and implementation of the project workplan.
4. 50% financial contribution toward the cost of EM equipment and services and oversight of EM equipment procurement.
5. Assistance with EM equipment installation and removal onboard the vessels.
6. Assistance with observer placement while they are in Noro.
7. Contribute to the trial evaluation.

YMFC:

1. Participate in planning sessions, via conference call, or in-person, with the other Parties.
2. Communicate the project plan to the vessel captains and crews (e.g. objectives, roles and responsibilities, trip timing).
3. Ensure captains and crews, and/or other designated staff, assist in the installation, maintenance, and removal of EM equipment.
4. Ensure vessels have adequate bunk space and food to house the human observers, and that they be given good treatment while onboard.
5. Contribute to the trial evaluation.

FFA:

1. Participate in planning sessions, via conference call, or in-person, with the other Parties.
2. Be a member of the Project Management Committee, which will be responsible for the development and implementation of the project workplan.
3. 50% financial contribution toward the cost of EM equipment and services.
4. Assist with observer placement and training. Overall coordination and contribution to the evaluation of the trial (with input from other project partners)
5. Preparation of the project report to Scientific Committee (in conjunction with SPC, with input from other project partners).

MFMR:

1. Participate in planning sessions, via conference call, or in-person, with the other Parties.
2. Provide 4 trained observers to participate in the trial. Observers will:
   a. Conduct regular longline observer duties on one vessel trip each. Submit the observer report to MFMR, SPC and FFA following the trip.
   b. Take ownership of the EM data collected onboard the vessel following the trip. Submit the EM data to MFMR, SPC and FFA.
   c. With FFA and SPC oversight and EM service provider assistance, review the EM data from a vessel different than that which they conducted observation on. Generate an observer report based on the review and submit it to MFMR, SPC and FFA.
3. Communicate the project plan to the selected observers. Ensure that observers are ready and willing to participate in the trial, and available in Noro on time for vessel departure.
4. Contribute to the trial evaluation.

SPC:

1. Participate in planning sessions, via conference call, or in-person, with the other Parties.
2. Be a member of the Project Management Committee, which will be responsible for the development and implementation of the project workplan.
3. Provide a Field Coordinator for the project who will add on-site technical support and draft the final project report in liaison with the Project Managememt Committee (if not done by the EM service provider). The Field Coordinator will report to the Project Management Committee.
4. Help ensure the trial is designed to best meet minimum observer requirements.
5. Assist with observer placement and training.
6. Audit observer reports to compare results and provide suggestions for refinements.
7. Contribute to the trial evaluation.
8. Preparation of the project report to Scientific Committee (in conjunction with FFA, with input from other project partners).

Additional responsibilities, or changes to these responsibilities, may be generated and agreed to by the Parties as part of the planning process.

By signing below, authorized signatories of the Parties agree to work together as this document indicates.

APPENDIX 2 – PRE-TRIAL REVIEW OF DATA STANDARDS FOR REGIONAL OBSERVER PROGRAMME

Pre-trial review of WCPFC ROP Minimum Standard Data Fields to be collected during the E-Monitoring trial

The following tables provide information on the pre-trial review of the how the E-Monitoring trial was perceived to generate the required WCPFC Regional Observer Programme (ROP). **Please note that since the trials, the protocols for generating the required fields suggested below have changed in several areas.**

- The right-hand column provides information on the perceived source/methodology for collecting the respective ROP data field information during the E-Monitoring trial on-board a LONGLINE vessel as a guide for establishing protocols for generating data from the E-Monitoring trials. For example, it was envisaged that the trials of E-Monitoring should consider that a pre-trip port inspection will be required to collect a range of data usually collected by the observer but which will not be efficiently collected by E-Monitoring video.
- Columns #2 and #3 represent the technical service providers responses to collecting each data field with respective versions of their analysis software.

GENERAL VESSEL AND TRIP INFORMATION FOR ALL VESSEL TYPES - VESSEL IDENTIFICATION				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Initial proposal for E-M**
Name of vessel	Yes – we have Fishing vessel Name field, included in metadata as configured during installation	Yes –shown on inspection report	Name must be clearly written, make sure any numbers connected with the name are included. i.e. "Moonlight No 6"	This information is available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This should include taking photos where relevant.
Flag State Registration Number	Yes – we have EU Fleet Reg Number (CFR) field, that can be used for this included in metadata as configured during installation.	Yes – shown on inspection report	This number will be sourced from the vessel papers. You can normally get this information during the briefing.	
International Radio Call Sign	Yes – we have Radio Call Sign field, included in metadata as configured during installation.	Yes – shown on inspection report. Size is 7-char	The vessel call sign is usually issued to the vessel by the flag State in accordance with IMO regulations and procedures. This can become the WCPFC identification number of the vessel	
Vessel Owner/Company	No – not available for configuration on the vessel	Yes- can be configured in the program	Name and contact if possible of the owner of the vessel, if it is owned by a company, then use the company name.	
Hull markings consistent with CMM 2004-03	Yes – we have External reg field, that can be used for this included in metadata as configured during installation.	Yes – shown on inspection report. Size is 14-char	The hull markings should be consistent with CMM 2004-03; these are virtually the same as the FAO standards on vessel markings except that a few letters disallowed in the FAO standards are permitted in CMM 2004- 03 standards.	
WIN markings consistent with CMM 2004-03	No – not available in metadata. Could IRCS field be used ?		If the vessel does not have an IRCS number, the flag State must create and issue a "WCPFC Identification number" or WIN number and use this as the vessel identifier. In the majority of cases, the IRCS number and WIN would be the same number.	
WIN format for markings consistent with CMM 2004-03	No – not available in metadata. Could External reg field be used ?		WIN as specified shall be the only other vessel identification mark consisting of letters and numbers to be painted on the hull or super structure.	

GENERAL VESSEL AND TRIP INFORMATION FOR ALL VESSEL TYPES - VESSEL IDENTIFICATION

VESSEL TRIP INFORMATION

Data field	Satlink SeaTube	Satlink View Manager version 1.2.0.16	Instructions	Proposal for E-M
Date and time of departure from port	No - not available in metadata.	No - not available in SVM 1.2.0.16 as a dedicated field. We suggest that when reviewing video that a NOTE tag is added to the first video with the information required. The NOTE tag will be on the inspection report as well. See SATLINK NOTE 1)	The day and time the vessel leaves the port to start its fishing campaign. I.e. pulls up its anchor, or throws the ropes free from the wharf.	This information is available prior to departing and on return to the port and should be compiled by the port data collection officer liaising with the relevant port authority using the usual OBSERVER DATA COLLECTION FORMS.
Port of departure	No - not available in metadata.	See above	Name of the port of departure - as a help also include the country	
Date and time of return to port	No - not available in metadata.	See above	The day and time the vessel returns to a port (usually taken when vessel either drops the anchor or ties up to a wharf or another vessel in port; at the completion of its trip.	
Port of return	No - not available in metadata.	See above	Name of the port where the vessel returns- as a help also include the country.	

OBSERVER INFORMATION

Data field	Satlink SeaTube	Satlink View Manager version 1.2.0.16	Instructions	Proposal for E-M
Observer name	No – not available for configuration on the vessel	No – not as proposed We suggest using the *Menu > Project Property > Edited By* field that is a 5 char ID field to make reference to the observer. This ID is written on the Inspection Report as well. Another suggestion is to use the *Menu > Project Property > Project Tile / Project Description* field, which is written on the inspection report as well. This field is 50 char and could be used with the format: "Observer name // Nationality of observer // Observer provider -country and or organization // Date, time and location of E-Monitoringbarkation // Date, time and location of disE-Monitoringbarkation" Yet another option is to use the NOTE tag on a video to add information about the observers. This is also printed on the Inspection Report	Your name clearly printed using the format - First name First - Last name Last (Do not use initials) an observer with the first name John last name Smith would write John Smith (Not JS - J Smith or Smith John)	Not applicable for E-Monitoring Video, although this information might be substituted with the person responsible for reviewing the video information and compiling the ROP data fields from video. This information should be recorded on using the usual OBSERVER DATA COLLECTION FORMS.
Nationality of observer			Country where the observers passport is issued	
Observer provider -country and or organization			Organisation that E-Monitoringploys the observer and has organised the provision of the observer to the vessel. In the case of the Philippine it most likely would be "BFAR National Observer Programme" Philippines It was suggested that port data collection officer should enter their details, as well as those of the electronics for observation.	
Date, time and location of E-Monitoringbarkation			The day and time the observer leaves the port, to start their observer trip. (Note in most cases this will be the same as the vessel start dates and times)	
Date, time and location of disE-Monitoringbarkation			The day and time the observer returns to a port at the completion of their trip. (Note in most cases this will be the same as the vessel return dates and times)	

CREW INFORMATION				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Name of captain	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	The captains name clearly printed in the format - First name First - Last names Last (Do not use initials) - This may be difficult to determine particularly with some Asian vessels, therefore write the name the way the captain is named on paperwork or from identification he/she shows you.	This information is available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This should include taking photos/scans where relevant.
Nationality of captain			Passport nationality of the captain, Note - in your written notes if you wish you can record the captain's birth country, if this is available, i.e. Capt is Korean born and speaks in Korean but holds a NZ Passport.	
Identification document			Document that confirms nationality i.e. passport "field not on form"	
Name of fishing master			The fishing master name clearly printed in the format - First name First - Last names Last (Do not use initials) This may be difficult to determine particularly with some Asian vessels so write the name the way the fishing master is named on paperwork or from identification he/she shows you.	
Nationality of fishing master			Passport nationality of the fishing master, if the vessel has one that is separate from the captain. Note - in your written notes if you wish you can record the fishing master birth country, if this is available, i.e. Fishing master is Japanese born but holds an Australian Passport.	
Identification document			Document that confirms nationality i.e. passport "field not on form"	
Other crew			Total the number of the other crew on board and if possible indicate the numbers of each nationality i.e. 8 Philippines 6 Samoans 4 Taiwanese	
Total number of Crew			Add the total number of persons on the vessel including all the officers captain etc, (Do not count yourself in this number, even if you are on the crew list for insurance purposes.)	

VESSEL ATTRIBUTES				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Vessel cruising speed	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	Cruising speed of the vessel is the speed the vessel travel, which allows it to optimize its fuel usage, but also gets the vessel along at a good speed. It is not the top speed of the vessel.	This information is available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This information can also be collected from the Port Inspection officers. This should include taking photos/scans where relevant.
Vessel fish hold capacity			The total maximum amounts in metric Tons (mT.) that the vessel freezers, wells and	
Freezer type			Indicate by answering Yes/ No to all the different types of refrigeration methods the vessel has on board, many vessels may have	
Length (specify unit)			The "LOA" Length Over All can be taken from the vessel plans or from other paper work	
Tonnage (specify unit)			The vessel may be registered using Gross Tonnage (GT) or in (GRT) this will be indicated on the vessel	
Engine power (Specify unit			The engine power and the power units used on board can usually be found in the vessel plans or from other paper work of the vessel. If not sure where to look, ask the engineer.	

VESSEL ELECTRONICS

Indicate "Yes or No" if on board. In your written notes you may like to indicate the numbers of each on board as well as the special uses some of this equipment may be used for.

Data field	Satlink SeaTube	Satlink View Manager version 1.2.0.16	Instructions	Proposal for E-M
Radars	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	Indicate Yes if on board No if not sighted	The information on the existence of these vessel electronics components is available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This information can also be collected from the Port Inspection officers. This should include taking photos/scans where relevant. **However, information on the 'USES' of these equipment can only be collected during the trip and so could only be potentially collected by mounting video cameras in the bridge to monitor all of this equipment in operation.** **However, these data can be collected during the pre-trip inspection.**
Depth Sounder			Indicate Yes if on board No if not sighted	
Global Positioning SystE-Monitoring (GPS)			Indicate Yes if on board No if not sighted	
Track Plotter			Indicate Yes if on board No if not sighted	
Weather Facsimile			Indicate Yes if on board No if not sighted	
Sea Surface TE-Monitoringperature (SST) gauge			Indicate Yes if on board No if not sighted	
Sonar			Indicate Yes if on board No if not sighted	
Radio/ Satellite Buoys			Indicate Yes if on board No if not sighted	
Doppler Current Meter			Indicate Yes if on board No if not sighted	
Expendable Bathythermograph (XBT)			Indicate Yes if on board No if not sighted	
Satellite Communications Services (Phone/Fax/E-Monitoringail numbers)			Indicate all the vessel Satellite numbers if the vessel has Satellite communications on board	
Fishery information services			Indicate Yes if used by the Vessel board - No if not sighted	
Vessel Monitoring SystE-Monitoring	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report By the way Satlink Seatube includes its own VMS Terminal from where it gets the position.	Indicate the type of systE-Monitorings used on a vessel- The most popular and widely used systE-Monitoring is the INMARSAT systE-Monitoring, however some vessels may use the ARGOS systE-Monitoring- some vessels may have both. There are also other systE-Monitorings if these are being used please record the information.	

LONGLINE INFORMATION				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
VESSEL ATTRIBUTES				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Refrigeration Method	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	Indicate by answering Yes/No to all the different types of refrigeration methods the vessel has on board as indicated on the RLL-1 Form - many vessels may have more than one type of freezer.	The information on the existence of this attribute should be available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This information can also be collected from the Port Inspection officers.
GENERAL GEAR ATTRIBUTES				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Mainline material	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	The materials used in the mainline of the vessel some examples are Kuralon- Braided nylon, - Monofilament Nylon there are many more.	The information on the existence of these attributes should be available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This information can also be collected from the Port Inspection officers. This should include taking photos/scans where relevant.
Mainline length			What is the total length of the mainline when it is fully set usually recorded in miles or kilometres (make sure the unit is clearly	
Mainline diameter			What is the diameter of the mainline; you can measure this with small callipers if you have thE-Monitoring or just ask the Engineer or Bosun. MeasurE-Monitoringent is usually recorded in Millimetres	
Branch line material(s)			A branch line can consist of one type of material like monofilament or it can be made up of many different materials like braided nylon wire trace and mono filament, etc	

SPECIAL GEAR ATTRIBUTES

Data field	Satlink SeaTube	Satlink View Manager version 1.2.0.16	Instructions	Proposal for E-M
Wire trace	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	Indicate Y or No - if the vessel uses wire traces on all their lines or only on certain lines i.e. lines close to the buoys etc if no traces are used at all then record N	**This information can only be collected on-board the fishing vessel during the trip.** **It would require the video to adequately identify wire traces on the branchlines during the haul.**
Mainline hauler			Indicate Y or No - Most long line vessel will have an instrument that hauls the lines in after it has been set- some very small vessels may haul line by hand.	The information on the existence of these attributes should be available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This information can also be collected from the Port Inspection officers. **However, information on the 'USES' of these equipment can only be collected during the trip potentially with the use of a wide-angle camera, or the use of multiple cameras that capture a wide area to cover the collection of this information.** **Consider a dedicated video camera at the baiting area during the setting phase.**
Branch line hauler			Indicate Y or No - Some long line vessels may use special haulers to coil the branch	
Line shooter			Indicate Y or No - Some vessels allow the long line to drag over the side and regulate depth-of setting by the speed of the vessels, many long liners have a special piece of equipment that regulates the speed of the line going into the water and therefore along with a constant setting speed of the vessel allow the line to be set at uniform depth along the length of the line	
Automatic bait thrower			Indicate Y or No -Most vessels manually throw the branch lines with the bait away from the wash, especially if the bait is vulnerable to bird strikes. However there are a number of vessels that use automatic bait throwers so the bait is constantly thrown away from the wash at a determined distance.	
Automatic branch line attached			Indicate Y or No - Most lines are attached manually at a regular distance along the mainline by a crewman, however some vessels may have an automatic branch line attacher that also attaches the branch at regular intervals.	
Hook type			What type of hook or hooks is used Examples are J hooks - Circle hooks- offset circle etc, the vessel usually uses one type,	

SPECIAL GEAR ATTRIBUTES				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Hook size	Yes – The idea is that Satlink SeaTube records when there is fishing activity	Satlink View Manager includes "tags" that can be added to a video when reviewed. As default the tags are added to the video with the texts: • Report start • Report end • Fishing start • Fishing end • Set gear • Retrieve gear The text of each of these tags can be changed to reflect other actions. One "tag" could be given the name "Underwater setting shoot" if its an action that is normally done.	Size of the hooks used, if not sure ask the Bosun,	
Tori pole			Indicate Y or No - whether the vessel uses a Tori pole when setting, this is mandatory in some areas. A Tori pole can have a number of different designs but is basically a pole with lines ribbons and other attachments to scare birds away from the branch line baits.	The information on the existence of these attributes should be available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using the usual OBSERVER DATA COLLECTION FORMS. This information can also be collected from the Port Inspection officers. **However, information on the 'USES' of these equipment can only be collected during the trip potentially with the use of a wide-angle camera, or the use of multiple cameras that capture a wide area to cover the collection of this information .** **This is particularly the case when the pre-trip data collection might identify the existence of a mitigation measure where its use needs to be verified during the trip, for example :** • **Tori Poles** • **Weighted branch-lines** • **Blue-dyed bait**
Bird curtain			Bird curtain is usually extended from the side of the vessel and is placed in the flight path of the birds swooping in to steal the	
Weighted branch lines			Do the branch lines have weighted attachments usually lead on the hook, or near the end of the leader of the branch lines?	
Blue dyed bait			Bait that has been dyed especially to look blue This has shown to reduce bird strikes in some trials.	
Underwater setting shoot			Some vessels may have special shutes or arms that protect the bait and take the line down to a depth before releasing the branch-line this makes it harder for birds to attack the bait.	
Disposal method for offal managE-Monitoringent			Most vessels discard their offal from processed fish by different methods, describe what the vessel does- example the vessel may just throw it over the side as they process the fish, they may accumulate offal in baskets and throw it over in one go, they may have machines that blends the offal and it is sprayed over the side.	**This information can only be collected on-board the fishing vessel during the trip.** **It would require the video to adequately identify the vessel's practice with respect to disposal of offal.**

SPECIAL GEAR ATTRIBUTES				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Date and time of start of set	Doubt – The idea is that Satlink SeaTube records when there is fishing activity i.e. when activated by sensor This means that there is only video when sensor indicated fishing activity If we need sensor information to be recorded apart from starting stopping recording then we need to make some changes Please see SATLINK NOTE 2) at the end of this document	Yes – "Fishing start" could be changed to "Start of set". Every time the tag is added to the video, the recording time and date as the last know GPS time and date is registered and is displayed on the inspection Report. Note - In 1.2.0.16 there is no support for reading for sensor information for automatic tagging of video	Date and time the first buoy is thrown into the water to start the setting of the line.	**This information would need to be collected from relevant sensor information on the gear or review of the video both of which is used in conjunction with GPS equipment. This would identify and store the date/time and position representing the start and end of the setting.** **The sensor might be best placed on the line shooter for example.**
Latitude and Longitude of start of set		Yes –Every time the "Start of set" tag is added to the video, the last know GPS latitude, longitude, speed and course registered and is displayed on the inspection Report. Note - In 1.2.0.16 there is no support for reading for sensor information for automatic tagging of video	Take the GPS reading at the time the first buoy is thrown into the water	
Date and Time of end of set		Yes – "Fishing end" could be changed to "End of set". Every time the tag is added to the video, the recording time and date as the last know GPS time and date is registered and is displayed on the inspection Report.	Date and time the last buoy (usually has radio beacon attached) at the end of the mainline thrown into the water	
Latitude and Longitude of end of set		Yes –Every time the "End of set" tag is added to the video, the last know GPS latitude, longitude, speed and course registered and is displayed on the inspection Report.	Take the GPS reading at the time the last buoy is thrown into the water	
Total number of baskets or floats	Not sure if the cameras can detect this ?	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report Note - In 1.2.0.16 there is no support for reading for sensor information for automatic tagging of video	A basket is the sum of all the hooks set between two buoys on a longline; usually it is the same as the number of floats set minus one.	**These data fields can only be collected on-board the vessel during the trip. They represent what gear has been deployed and are collected for each set. Some of this information can be collected during the pre-trip inspection, for example, "Distance between branchlines" is a factor of shooter speed and baskets since it may be difficult to collect during the trip.** **These fields could be obtained from video/sensor equipment if it was feasible**
Number of hooks per basket, or number of hooks between floats			How many hooks set from one buoy to another, the number is usually constant along the line, but can vary in some cases, also if the vessel also sets a branch line on the buoy count this as a hook between floats as well.	

SPECIAL GEAR ATTRIBUTES				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Total number of hooks used in a set			How many hooks used, usually calculated by multiplying number of baskets by the number of hooks between the baskets.	**to do one or several of the following:** • **Video monitoring of the entire set** • **Video monitoring of the entire haul** • **Sensor equipment on relevant gear/equipment to quantify usage** **The existence of TDRs and light-sticks can be checked prior to the trip and so it is not necessary to attE-Monitoringpt to obtain information for these fields on a set by set basis (but the pre-trip inspection would need to identify this). If there is only one bait species on-board at the start of the trip, then it is not necessary to attE-Monitoringpt to obtain information for these fields on a set by set basis (but the pre-trip inspection would need to identify this). However, this might also require confirmation that no bait species had been taken on-board and used during the trip. Consider a dedicated video camera at the baiting area during the setting phase.** **"Target species" at the set level should be determined from a combination of setting attributes (e.g. gear configuration and bait). Otherwise, the main target species should be known prior to and after the trip (e.g. examination of species composition of the catch).**
Line shooter speed			If the vessel has a line shooter, it will normally have an indicator to show its running speed, as well as a sound indicator or light, that beeps at a regular interval, when it is time to attach a branch line.	
Distance between branch-lines			Distance the branch lines are attached to the mainline can be determined easily if vessel has a line shooter with	
Time-depth recorders (TDRs)			Does the vessel use TDRs on its line, record the number it may use and where along the mainline they attach thE-Monitoring to the	
Number of light-sticks			Does the vessel use light sticks on its line, record the number it may use, and where along the mainline they attach thE-Monitoring to the branch lines	
Target species	No – not available for configuration on the vessel	No – not as proposed. We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	What species does the vessel target - Tuna (BET YFT) Swordfish, Sharks. Etc.	
Bait species			Name the bait species used Pilchards, Sardine, Squid, etc.	
Length of float-line	No – not available for configuration on the vessel	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	Length of the line that is attached to the floats, get a coil and measure the length. It usually rE-Monitoringains the same throughout the trip.	This information should be available prior to departing the port and should be compiled by the port data collection officer responsible for the onshore coordination of retrieving the E-Monitoring equipment/data using
Length of branch-lines			Measure the length of a sample of the majority of branch lines used, some may vary slightly due to repairs.	

SPECIAL GEAR ATTRIBUTES				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Date and time of start of haul	Yes – The idea is that Satlink SeaTube records when there is fishing activity	Satlink View Manager includes "tags" that can be added to a video when reviewed. As default the tags are added to the video with the texts: • Report start • Report end • Fishing start • Fishing end • Set gear • Retrieve gear The text of each of these tags can be changed to reflect other actions. One "tag" could be given the name "Underwater setting shoot" if its an action that is normally done.	Date and time the first buoy of the mainline is hauled from the water to start the haul.	**This information would need to be collected from relevant sensor information on the gear or review of the video, both of which are used in conjunction with GPS equipment. This would identify and store the date/time and position representing the start and end of the hauling.** **The sensor might be best placed on the line hauler for example.**
Date and time of end of haul			Date and time the last buoy of the mainline is hauled from the water to end the haul	
Total amount of baskets, floats monitored by observer in a single set	Yes – The idea is that Satlink SeaTube records when there is fishing activity	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	How many floats or baskets monitored by the observer. Observer can monitor this by counting the number of floats they watch coming on board.	

INFORMATION ON CATCH FOR EACH SET				
Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Hook number, between floats	Yes – The idea is that Satlink SeaTube records when there is fishing activity	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	The hook number that the fish is caught on count hooks from the last float hauled on board to next float hauled on board	**This may be evident and standard for the trip but this information would need to be verified from review of the video.**
Species code			FAO code of species caught	**This information must be collected from review of the video.**
Length of fish			Measure length of species using the recommended measurE-Monitoringent	**This information MAY be determined from video images of fish laid on some form of a colour-coded or gridded measuring mat, possibly positioned at both the landing and processing areas.**
Length measurE-Monitoringent code			Code the type of measurE-Monitoringent used i.e. all tunas are UF upper Jaw to fork length	**Some work may be required in this area. It is acknowledged that these fields may not be possible with E-Monitoring.**
Gender			Sex the species if possible if species checked but to difficult to determine use indeterminate "I" if not seen i.e. on a whole fish use Unknown "U"	**This information MAY be collected from review of the video.** **For fish where evidence of gender is external (e.g. shark species), then this should be possible. However, for tuna species (for example), the video would need to cover the processing of the fish to have any chance of determining gender. May need to ensure the behavior of the crew is encouraged to direct the fish at an angle to determine gender (particularly with tuna).**
Condition when caught			Use condition codes to indicate its status when caught	**This information would need to be collected from review of the video.**
Fate			What happens to the fish after its caught use the codes supplied	**This information would need to be collected from review of the video which would need to cover (i) the processing of the fish and (ii) whether the fish escaped or was struck off before landing. This means at least two video cameras directed to different parts of the vessel.**
Condition when discarded			After being caught what condition is it returned to the sea	**This information would need to be collected from review of video camera(s) directed to the area where discarding/release would always occur.**
Tag recovery information			Record as much as information as possible on any Tags recovered	**This information would need to be collected from review of the video and the vessel compiling the information.**

SPECIES OF SPECIAL INTEREST

Data field	Satlink SeaTube	Satlink View Manager version 1.2.0.16	Instructions	Proposal for E-M
Type of interaction	Doubt – The idea is that Satlink SeaTube records when there is fishing activity i.e. when activated by sensor This means that there is only video when sensor indicated fishing activity If we need sensor information to be recorded apart from starting stopping recording then we need to make some changes Please see SATLINK NOTE 2) at the end of this document	SVM version 1.2.16 does not support reading of sensor information for automatic tagging of video. A new version would have to be made to incorporate intelligence for sensor data. This will have to be ready for at the time of reviewing videos.	Indicate what type of interaction, i.e. caught on line - tangled in net, swimming around outside of net, etc.	**This information would need to be collected from relevant sensor information on the gear or review of the video, both of which are used in conjunction with GPS equipment. This would identify and store the date/time and position of the interaction.** **The video cameras would need to be directed at least to the branch line being hauled to determine the species of special interest.** **The E-Monitoring trial would also need to consider obtaining information on interactions with the gear during the SETTING phase (e.g. birds), so video cameras would need to be mounted appropriately.** **It is envisaged that E-Monitoring would not be able to capture interactions which did not involve the gear (i.e. toothed whales in the vicinity of the vessel).**
Date and time of interaction			Record ships date and time of interaction	
Latitude and longitude of interaction			Record position of the interaction.	
Species code of marine reptile, marine mammal, or seabird.	Yes – The idea is that Satlink SeaTube records when there is fishing activity	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	Use FAO codes for Species.	
Length	Yes – The idea is that Satlink SeaTube records when there is fishing activity	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	Measure length in Centimetres.	**(See above reference for these fields)**
Length measurE-Monitoringent code			Measure using the measure method determined for that species.	
Gender			Sex the animal if possible.	**(See above reference for this field)**
Estimated shark fin weight by species			Weigh each species shark fins separately if shark has been fined by crew, if no scales estimate the weight.	**This information MAY be collected from review of the video.**
Estimated shark carcass weight by species			Weigh each carcass of a finned shark, if no scales available or body is discarded, or if it is too large to handle; estimate the weight.	
Condition when landed on deck			What is the condition when caught use codes	**(See above reference for these fields)**

SPECIES OF SPECIAL INTEREST

Data field	**Satlink SeaTube**	**Satlink View Manager version 1.2.0.16**	**Instructions**	**Proposal for E-M**
Condition when released			What is the condition when discarded use codes	
Tag recovery information			Record as much as information as possible on any Tags recovered	
Tag release information			Record as much as information as possible on any Tags placed on the species before	
Vessel's activity during interaction	Yes – The idea is that Satlink SeaTube records when there is fishing activity	No – not as proposed We suggest using to use the NOTE tag on a video to add information. This is also printed on the Inspection Report	What was the vessel doing when the interaction took place i.e. setting, hauling, etc.	**The main activity (i.e. setting or hauling) would be evident from other information already collected (see relevant fields above).**
Condition observed at start of			Condition of species at the start of the interaction	**(See above reference for these fields)**
Condition observed at end of interaction			Condition of species at the end of the interaction	
Description of interaction			Indicate interaction, with the vessel gear only - caught on line - tangled in	**This information would need to be collected from review of the video. The video cameras would need to be directed (i) the branch line being hauled and (ii) the deck where the animal is landed to describe the interaction.** **The E-Monitoring trial would also need to consider obtaining information on interactions with the gear during the SETTING phase (e.g. birds), so video cameras would need to be mounted appropriately.** **It is envisaged that E-Monitoring would not be able to capture interactions which did not involve the gear (i.e. toothed whales in the vicinity of the vessel).**
Number of animals sighted			How many animals sighted during interaction	

NOTES (SATLINK)

1. Satlink View Manager does not support any catch related standard forms. For electronic reporting we have 2 ERS solutions, one for the Purse-seiner industry and one for general ERS. We could nevertheless include support for import of reports containing information to be printed on the Inspection Report. We nevertheless would need to know the format that we would have to support.
2. We have some doubt about how to support the sensors. Originally we believe that the sensor data was directly related to the recording start and recording stop. Our plan was to include a tolerance so a sensor ACTIVE would start recording and sensor DE-ACTIVE would stop recording (with a configurable time delay e.g. 30 min)

It now seE-Monitorings like the sensor data is unrelated to the recording start and recording end and hence unrelated to the video. We understand from this document that the sensor can be activated and deactivated during a "recording session".

We need to agree on:

- How to detect "recording session start" from sensors
- How to detect "recording session stop" from sensors
- How to hand sensor change during "recording session"

APPENDIX 3 – ANALYSIS OF CATCH COMPOSITION FROM OFFICE AND ONBOARD OBSERVERS

Comparison of catch composition data recorded by on-board observers and by office based observers reviewing video footage

Delphine MALLET

This report provides a comparative analysis between catch composition data obtained by independent on-board observers during at sea operations and by office based observers reviewing video footage obtained using Electronic Monitoring (E- Monitoring) equipment on the same vessels for four separate trips. During these four trips, not all sets were recorded by both methods (i.e. when at sea observers were on breaks and when the E- Monitoring equipment malfunctioned). To compare data recorded by both methods, sets which were only reported by one of the two methods were excluded in the following statistical analysis (Table A1). Statistical analyses were thus performed on 146 sets surveyed during the four trips.

Table A1. Number of sets surveyed for each trip.

Trip	Number of sets surveyed by both methods	Number of sets only surveyed by the observers	Number of sets only surveyed by office observers
1	50	4	2
2	33	14	9
3	31	0	7
4	32	7	13
Total	146	25	31

During the surveys, some fish were identified by species codes which did not match with the reference list (Table A2). Most of these mistakes were made by the office observers and are probably due to typing errors. These mistakes only concern very few fish (35) therefore corresponding data were removed from the statistical analysis.

Table A2. Occurrence (occ.) of each wrong species code recorded for each method (correspond only to sets reported by both methods).

Species code error	occ. observer	occ. E-Monitoring
1	-	1
A2	-	3
A3	-	3
, D	-	4
. D	-	4
AG	-	1

Species code error	occ. observer	occ. E-Monitoring
AH	-	1
F16	5	-
FT	-	1
LB	-	6
LX	-	3
OWN	-	1
UFT	2	-

Number of fish recorded

For the 146 sets surveyed, a total of 14 051 fish recorded by both the office and on-board observer were matched, with only 790 fish recorded by the on-board observers and 2 054 fish recorded by the office observers reviewing E-Monitoring video footage that were not matched for one reason or another (e.g. where the on-board observer was taking a break).

The number of fish recorded per set was compared between methods using the Sorensen similarity index[2]. The Sorensen similarity index (S) compares the fish recorded between the two distinct observations. The index ranges from 0 (no similarity) to 1 (total similarity) and was calculated as follows:

$$S = \frac{2a}{2a + b + c}$$

where, a = number of fish recorded in common (may include misidentification)
b = number of fish only recorded by the observer at sea
c = number of fish only recorded by the office observer

The similarity was considered as high when $S > 0.75$, medium for $0.50 < S < 0.75$ and low for $S < 0.50$. The number of fish recorded was highly similar between methods for the majority of the sets surveyed ($0.38 < S < 0.99$, $S_{mean} = 0.88$, see Table A3), meaning that neither of the two methods is significantly better than the other to record total fish caught (in number), and that this E E-Monitoring trial was therefore a viable method for generating total fish number at the set level which was at least as accurate as the on–board observer.

Table A3. Sorensen index calculated on the number of fish recorded by each method
(see Additional Information 1 for details per set)

Similarity between the number of fish surveyed	Sorensen index	Number of set
High	0.75 < S	141
Medium	0.50 < S < 0.75	3
Low	S < 0.50	2

Fish identification

Of the 146 sets surveyed, the on-board observers recorded 68 different species and the office observers recorded 59 different species. Fifty-four species were recorded by both methods whereas 14 species were only recorded by the on-board observers and five species were only recorded by office observers (Table A4 and Figure A1).
In decreasing order, the 10 species the most frequently recorded were albacore tuna (*Thunnus alalunga,* nearly 5 500 fish), yellowfin tuna (*Thunnus albacores,* nearly 4 000 fish), bigeye tuna (*Thunnus obesus,* nearly 1 200 fish), pelagics sting-ray (*Dasyatis violacea,* nearly 1 000 fish), skipjack tuna (*Katsuwonus pelamis,* nearly 900 fish), longsnouted lancetfish (*Alepisaurus ferox,* nearly 900 fish), escolar (*Lepidocybium flavobrunneum,* nearly 400 fish), wahoo (*Acanthocybium solandri,* nearly 350 fish), great barracuda (*Sphyraena barracuda,* nearly 200 fish) and mahi mahi (*Coryphaena hippurus,* nearly 200 fish).

[2] Legendre P. and Legendre L. 1998. Numerical Ecology, 2nd English edition. Amsterdam. 853p.

Table A4. Occurrence (occ.) of each species recorded for each method (only sets reported by the two methods). Species with an occurrence greater than 80 times are highlighted in blue in the table.

species code	english name	scientific name	occ. observer	occ. video
ABU	Sargent major	Abudefduf saxatilis	2	1
AKB	Black Bream	Acanthopagrus butcheri	-	1
ALB	Albacore	Thunnus alalunga	5266	5704
ALG	Glauert's anglerfish	Allenichthys glauerti	2	-
ALN	Filefish (Scribbled leatherjacket)	Aluterus scriptus	1	-
ALO	Shortsnouted lancetfish	Alepisaurus brevirostris	141	42
ALV	Thresher	Alopias vulpinus	3	-
ALX	Longsnouted lancetfish	Alepisaurus ferox	592	912
AMB	Greater amberjack	Seriola dumerili	1	-
AML	Grey reef shark	Carcharhinus amblyrhynchos	1	-
ASZ	Razorback scabbardfish	Assurger anzac	5	2
BAB	Blackfin barracuda	Sphyraena genie	6	5
BEC	Red sea catfish	Bagre pinnimaculatus	19	-
BET	Bigeye	Thunnus obesus	1271	1189
BLM	Black marlin	Makaira indica	20	31
BRO	Bronze whaler shark	Carcharhinus brachyurus	2	1
BRZ	Pomfrets and ocean breams	Bramidae	8	4
BSH	Blue shark	Prionace glauca	9	57
BTH	Bigeye thresher	Alopias superciliosus	6	7
BUM	Blue marlin	Makaira nigricans	68	74
CBG	Drift fish	Cubiceps gracilis	1	1
COM	Spanish mackerel (Narrow-barred)	Scomberomorus commerson	-	3
CUT	Hairtails - Cutlassfishes	Trichiuridae	1	1
DOL	Mahi mahi / Dolphinfish / Dorado	Coryphaena hippurus	189	210
EBS	Brillant pomfret	Eumegistus illustris	25	33
ETA	Deep-Water red snapper	Etelis carbunculus	2	-
FAL	Silky shark	Carcharhinus falciformis	94	152
GBA	Great barracuda	Sphyraena barracuda	197	210
GE-MONITORING	GE-Monitoringfish (Southern or silver kingfish)	Rexea solandri	2	-
GEP	Snake mackerels and escolars	GE-Monitoringpylidae	10	32
GES	Snake mackerel	GE-Monitoringpylus serpens	117	113
GSE	Soapfish	Grammistes sexlineatus	3	2
LAG	Opah (Moonfish)	Lampris guttatus	84	108
LEC	Escolar	Lepidocybium flavobrunneum	373	401
LGH	Pelagic puffer	Lagocephalus lagocephalus	3	4
LKV	Olive ridley turtle (new FAO)	Lepidochelys olivacea (new FAO)	8	8
LLL	Crestfish	Lophotus lacepede	1	6
LMA	Long finned mako	Isurus paucus	1	4
LOP	Crestfish / Unicornfish	Lophotus capellei	3	3
LXE	Orange-Spotted E-Monitoringperor	Lethrinus erythracanthus	2	-

species code	english name	scientific name	occ. observe r	occ. video
MAN	Manta rays (unidentified)	Mobulidae	1	-
MLS	Striped marlin	Tetrapturus audax	28	26
NEN	Black gE-Monitoringfish	Nesiarchus nasutus	7	-
OCS	Oceanic whitetip shark	Carcharhinus longimanus	3	10
OIL	Oilfish	Ruvettus pretiosus	4	4
OMW	Omosudid	Omosudis lowei	20	-
PLC	Flathead chub	Platygobio gracilis	1	-
PLS	Pelagic sting-ray	Dasyatis violacea	861	1001
POA	Ray's bream / Atlantic pomfret	Brama brama	9	16
PRP	Roudi escolar	Promethichthys prometheus	32	20
PSK	Crocodile shark	Pseudocarcharias kamoharai	1	1
PTH	Pelagic thresher	Alopias pelagicus	1	3
RMB	Giant manta	Manta birostris	4	2
RMV	Mobula (A.K.A. devil ray)	Mobula spp.	5	4
RRG	Oarfishes nei	Regalecidae	-	1
RRU	Rainbow runner	Elagatis bipinnulata	3	3
RZV	Slender sunfish	Ranzania laevis	27	30
SFA	Sailfish (indo-pacific)	Istiophorus platypterus	91	88
SHK	Sharks (unidentified)	Elasmobranchii	57	25
SKA	Raja rays nei	Raja spp	91	-
SKJ	Skipjack	Katsuwonus pelamis	834	886
SMA	Short finned mako	Isurus oxyrhinchus	4	2
SNK	Barracouta (snoek)	Thyrsites atun	1	3
SSP	Short-billed spearfish	Tetrapturus angustirostris	88	86
SWO	Swordfish	Xiphias gladius	20	23
SXH	Black mackerel	Scombrolabrax heterolepis	20	5
THR	Thresher sharks nei	Alopias spp.	-	1
TST	Sickle pomfret	Taractichthys steindachneri	93	89
TTH	Hawkbill turtle	Eretmochelys imbricata	-	1
TUG	Green turtle	Chelonia mydas	2	1
UNS	Unspecified	-	4	54
WAH	Wahoo	Acanthocybium solandri	343	362
YFT	Yellowfin	Thunnus albacares	3771	4041

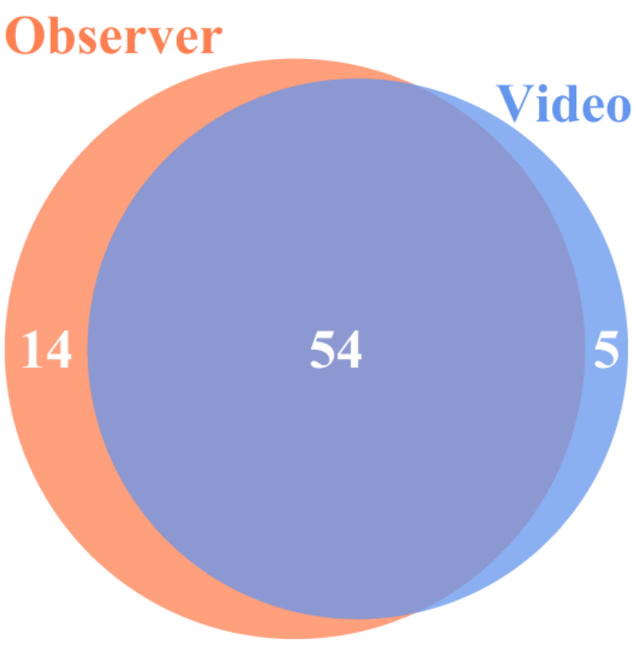

Figure A1. Venn diagram of species recorded by both methods on the 146 common sets of the four trips.

The identification of fish based on the matching of the office and onboard observers' data showed high correlation **(13 219 fish [94%] had the same identification).** Only six per cent of fish (832 fish) were identified differently. Most differences concerned tuna species such as bigeye (*Thunnus obesus*), albacore (*Thunnus alalunga*), yellowfin (*Thunnus albacores*) and skipjack (*Katsuwonus pelamis*) (379 fish) (Figure A2), noting that these species were also the most dominant in the overall catch. Differences in fish identification were also mostly seen between the shortsnouted lancetfish (*Alepisaurus brevirostris*) and the longsnouted lancetfish (*Alepisaurus ferox*) (107 fish) (see Additional Information 2 for details on occurrences of differences between species identified).

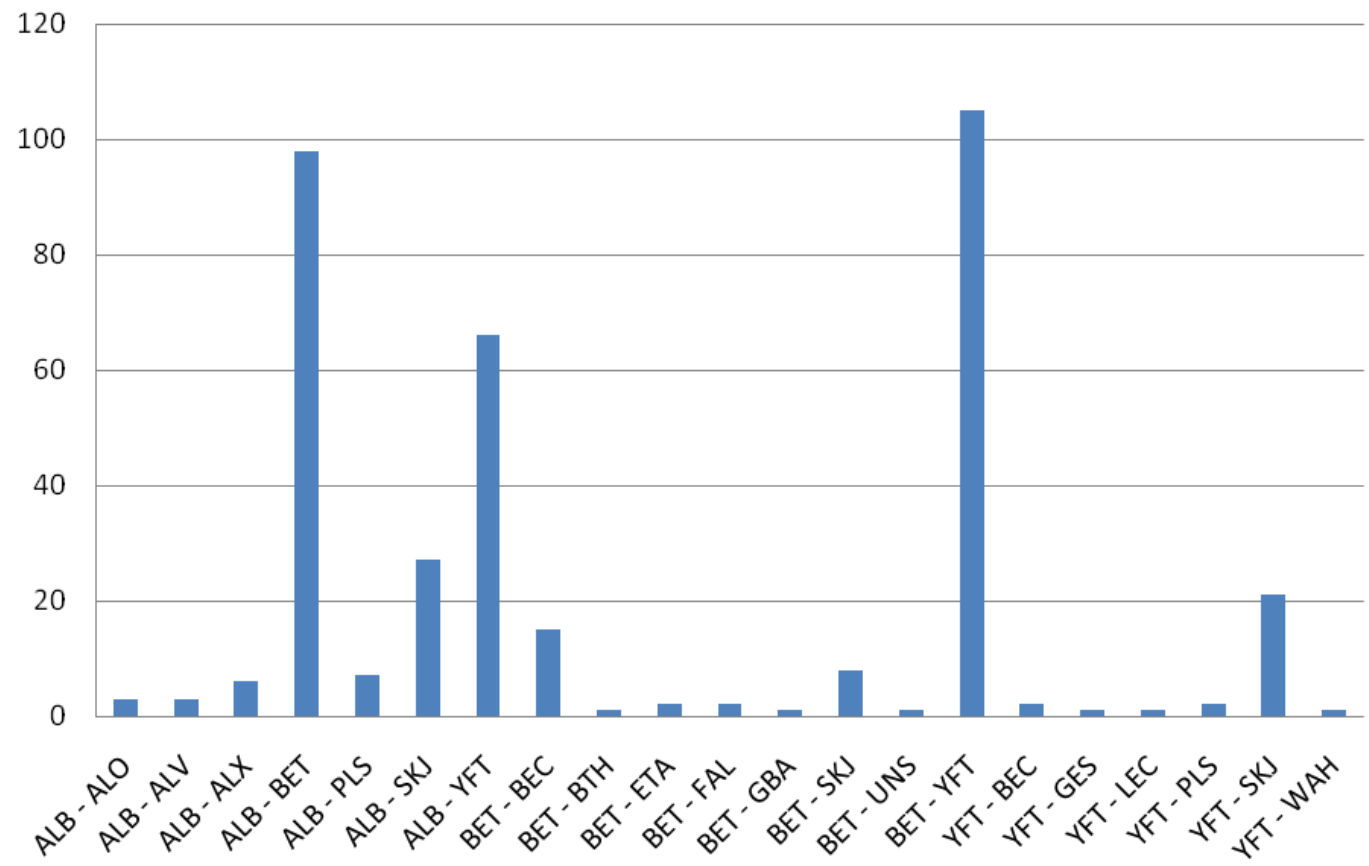

Figure A2. Occurrences of the different identifications of tuna species between both methods.
(see Additional Information 2 for details)

Fish length estimations

The comparison of fish length estimates was undertaken on fish that were matched by the two methods (i.e. 13 219 fish). Of the 13 219 fish matched, only **10 499 had their lengths estimated using both methods**. The correlation between fish length estimates varied according to species. For instance, more differences on length estimates were observed for albacore tuna (ρ = 0.41) and skipjack tuna (ρ = 0.35) than for yellowfin tuna (ρ = 0.81) and bigeye tuna (ρ = 0.87) (see table A5, figures A3, A4 and A5 for details of each species).

Table A5. Details on lengths estimates by each method ("o" for the on-board observer data and "v" for the E-Monitoring video data) per species: nb (number of data), min (minimum length), max (maximum length), mean (mean length), var (variance of lengths), sd (standard deviation of lengths) and ρ (Pearson correlation coefficient. *: $p < 0.01$, ^{NS} : $p > 0.01$).

Species	nb	min_o	min_v	max_o	max_v	mean_o	mean_v	var_o	var_v	sd_o	sd_v	ρ
ALB	4915	66	45	113	112	87.6	87.7	17	29.7	4.1	5.4	0.41*
YFT	3108	51	36	155	158	104.7	115.6	283.7	312.8	16.8	17.7	0.81*
BET	893	22	10	160	155	99.1	107.1	410.5	615.4	20.3	24.8	0.87*
SKJ	509	46	37	93	84	65.2	56.4	22.8	36.5	4.8	6	0.35*
WAH	278	77	58	150	153	115.3	120.1	174.8	321.5	13.2	17.9	0.67*
LEC	147	44	30	392	160	92.5	84.9	1162.3	605.7	34.1	24.6	0.64*
DOL	134	63	65	128	133	97.3	99.7	190.9	178.9	13.8	13.4	0.62*
GBA	121	68	60	134	468	87.9	85.2	129.9	1371.3	11.4	37	0.07^{NS}
SFA	76	105	95	227	226	179	173.5	413.6	469.8	20.3	21.7	0.68*
LAG	62	83	80	123	125	100.2	99.5	67.9	114.6	8.2	10.7	0.47*
SSP	53	102	104	164	187	149.8	158.2	271.9	277.6	16.5	16.7	0.76*
PLS	50	37	36	57	53	46.3	44.4	21	12.6	4.6	3.6	0.47*
BUM	38	155	154	238	210	187.6	178.4	271.1	155.3	16.5	12.5	0.61*
FAL	26	64	54	104	109	84.9	82.3	111.1	231.7	10.5	15.2	0.70*
TST	18	49	35	76	68	65.8	55.1	31.3	59.7	5.6	7.7	0.67*
ALX	12	78	60	149	158	102.5	93.3	620.6	705.5	24.9	26.6	0.85*
SWO	12	81	95	196	180	148.6	158.4	1158.6	480.4	34	21.9	0.83*
GES	10	63	60	137	153	97.8	85.1	438	799	20.9	28.3	0.81*
RZV	10	50	40	56	45	51.9	42.4	3.2	2.3	1.8	1.5	0.10^{NS}
MLS	6	110	97	194	200	142.2	150.7	1189.8	1279.1	34.5	35.8	0.93*
BLM	4	164	155	181	168	174.5	162.8	61.7	40.9	7.9	6.4	0.69^{NS}
EBS	4	40	26	61	48	46.3	34.8	98.3	91.6	9.9	9.6	0.93^{NS}
LKV	4	33	38	47	54	42	44	40.7	48	6.4	6.9	0.21^{NS}
BSH	1	187	160	187	160	-	-	-	-	-	-	-
GEP	1	24	30	24	30	-	-	-	-	-	-	-
LGH	1	27	28	27	28	-	-	-	-	-	-	-
LOP	1	125	125	125	125	-	-	-	-	-	-	-
OCS	1	59	62	59	62	-	-	-	-	-	-	-
PRP	1	82	98	82	98	-	-	-	-	-	-	-
PSK	1	84	75	84	75	-	-	-	-	-	-	-
RRU	1	80	72	80	72	-	-	-	-	-	-	-
SMA	1	194	115	194	115	-	-	-	-	-	-	-

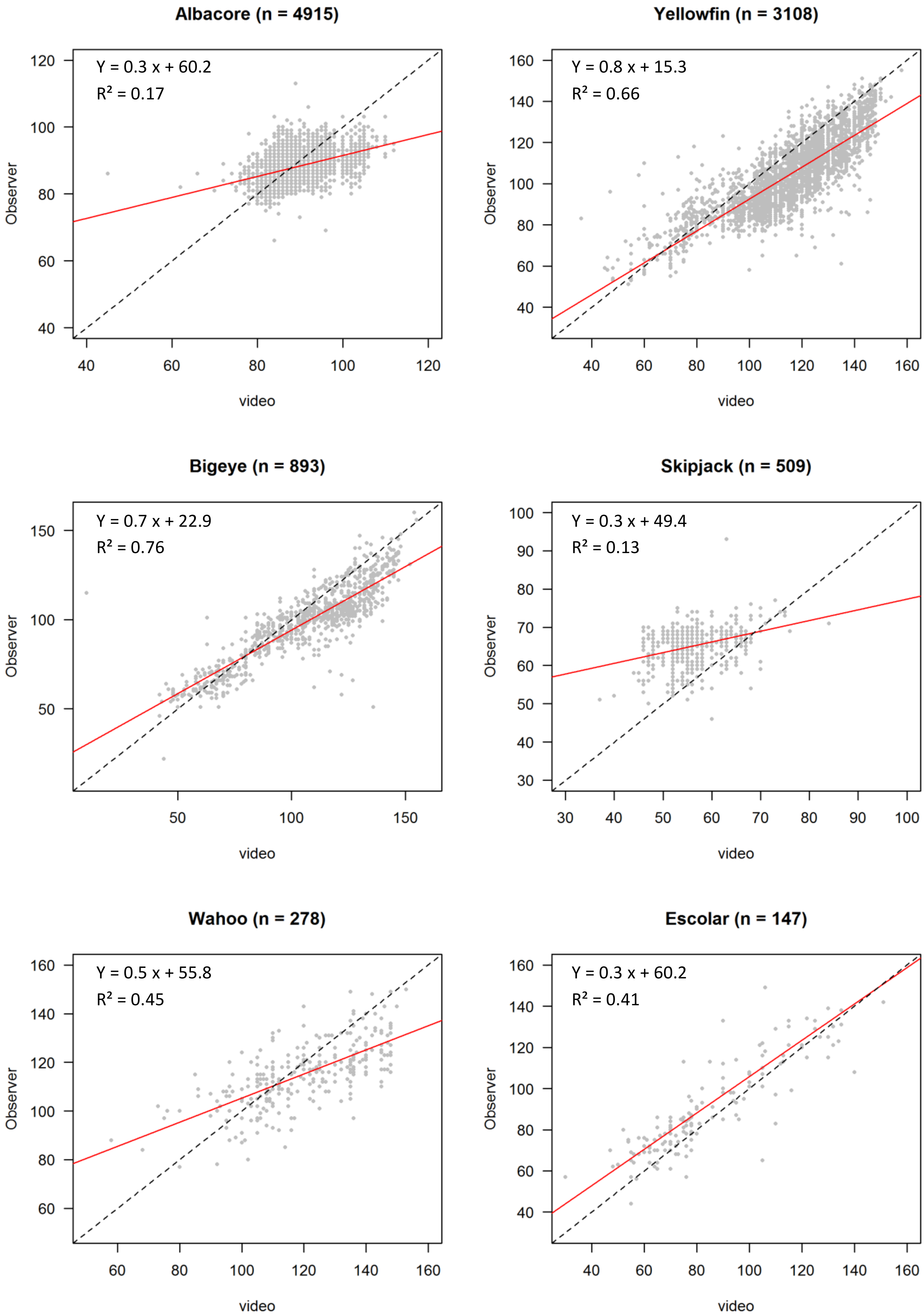

Figure A3. Fish length estimated by each method for the six most often recorded species. The regression lines are represented in red (corresponding equation on each graph). The dotted lines are the theoretical lines corresponding to similar estimates between methods (y = x).

n: number of data studied for each species. R^2: coefficient of determination of each regression line.

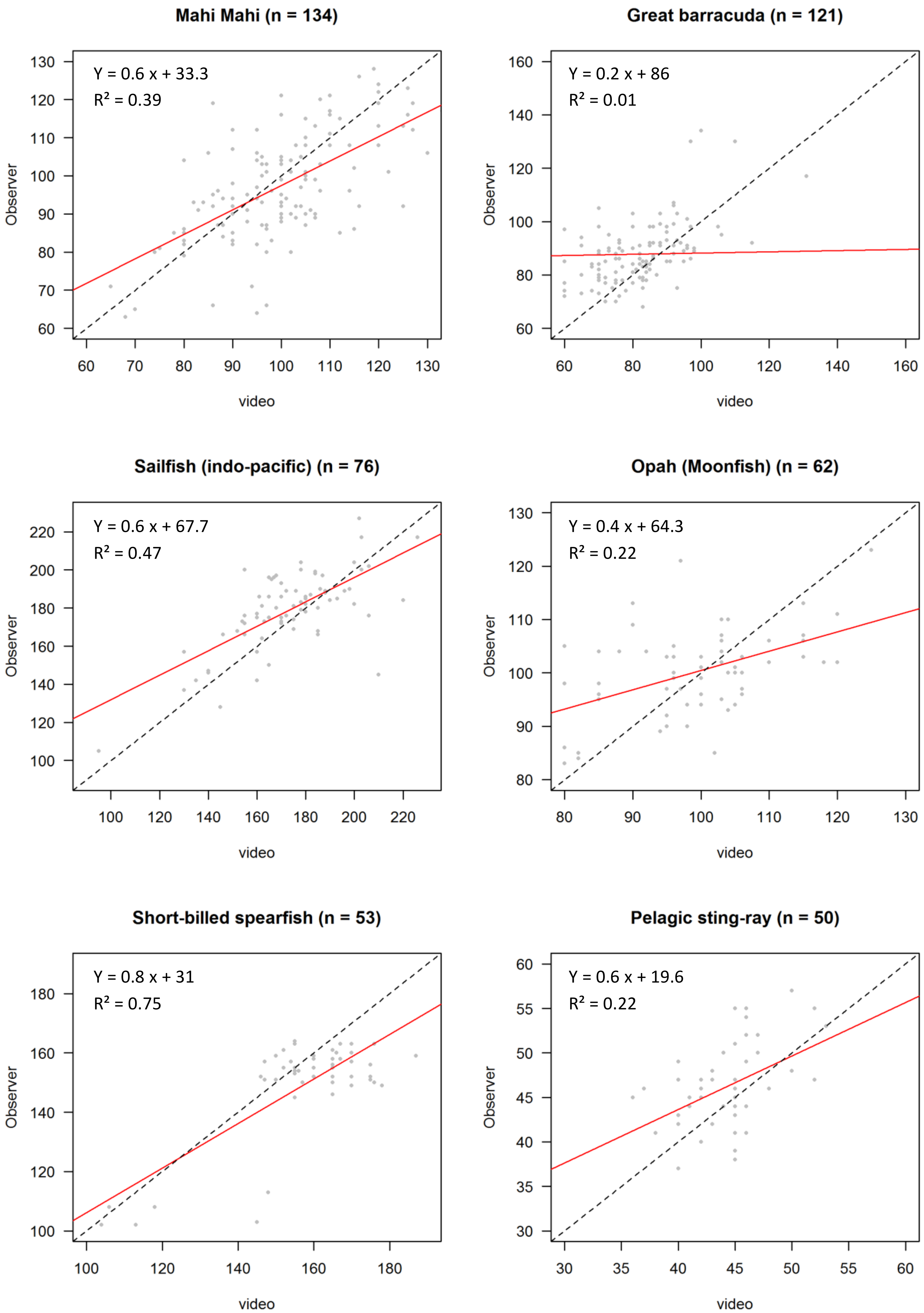

Figure A4. Fish length estimated by each method for six species. The regression lines are represented in red (corresponding equation on each graph). The dotted lines are the theoretical lines corresponding to similar estimates between methods (y = x).
n: number of data studied for each species. R^2: coefficient of determination of each regression line.

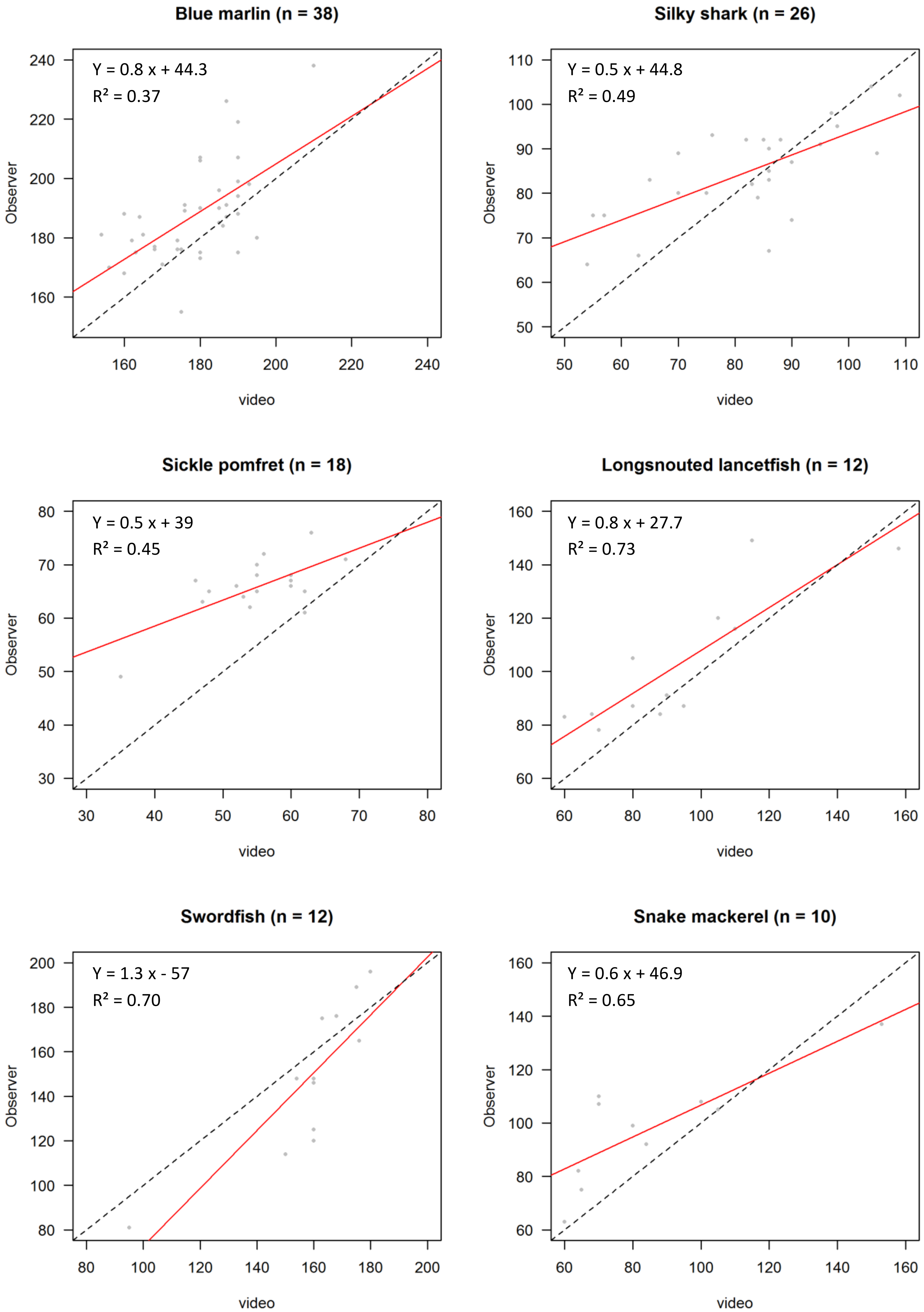

Figure A5. Fish length estimated by each method for six species. The regression lines are represented in red (corresponding equation on each graph). The dotted lines are the theoretical lines corresponding to similar estimates between methods (y = x).

n: number of data studied for each species. R^2: coefficient of determination of each regression line.

Additional Information 1. Details of the number of fish recorded by each method and Sorensen similarity index for each set surveyed. The similarity was considered as high when S > 0.75, medium for 0.50 < S < 0.75 and low for S < 0.50. Medium and low Sorensen index are highlighted in red in the table.

Trip	Observer set number	Number of fish recorded by both methods	Number of fish only recorded by the observer	Number of fish only recorded by the video	Sorensen index
1	117920	48	2	4	0.94
1	117921	31	3	8	0.85
1	117922	79	5	2	0.96
1	117923	34	1	0	0.99
1	117924	57	12	1	0.90
1	117925	66	5	4	0.94
1	117926	72	8	8	0.90
1	117927	63	6	7	0.91
1	117928	49	6	14	0.83
1	117929	42	6	3	0.90
1	117930	27	3	3	0.90
1	117931	41	2	3	0.94
1	117932	35	1	1	0.97
1	117933	41	2	4	0.93
1	117934	123	6	8	0.95
1	117935	136	1	3	0.99
1	117936	117	1	8	0.96
1	117937	165	12	6	0.95
1	117938	136	8	12	0.93
1	117939	84	5	1	0.97
1	117940	66	4	4	0.94
1	117942	70	1	9	0.93
1	117943	130	5	16	0.93
1	117945	103	2	13	0.93
1	117946	168	1	10	0.97
1	117948	134	1	20	0.93
1	117950	100	4	6	0.95
1	117953	68	0	3	0.98
1	117955	85	0	105	0.62
1	117957	91	1	3	0.98
1	117958	36	1	2	0.96
1	117959	60	1	4	0.96
1	117960	70	2	4	0.96
1	117962	33	4	1	0.93
1	118015	14	3	4	0.80
1	118016	47	8	5	0.88
1	118017	26	6	3	0.85
1	118018	120	5	3	0.97
1	118020	69	4	6	0.93

Trip	Observer set number	Number of fish recorded by both methods	Number of fish only recorded by the observer	Number of fish only recorded by the video	Sorensen index
1	118021	147	4	2	0.98
1	118022	27	1	3	0.93
1	118023	27	4	1	0.92
1	118024	52	2	14	0.87
1	118026	78	6	7	0.92
1	118027	40	2	10	0.87
1	118028	114	7	9	0.93
1	118029	114	4	3	0.97
1	118030	73	8	2	0.94
1	118031	52	103	13	0.47
1	118032	113	8	8	0.93
2	117944	33	10	11	0.76
2	117947	45	3	2	0.95
2	117949	48	4	8	0.89
2	117951	50	1	7	0.93
2	117954	58	5	7	0.91
2	117956	28	8	1	0.86
2	117963	54	4	6	0.92
2	117964	36	3	5	0.90
2	117966	37	5	5	0.88
2	117967	33	2	5	0.90
2	117968	47	5	5	0.90
2	117969	19	3	5	0.83
2	117970	38	3	9	0.86
2	117971	35	1	4	0.93
2	117973	139	3	19	0.93
2	117974	95	5	10	0.93
2	117976	99	0	11	0.95
2	117977	106	2	11	0.94
2	117978	36	36	4	0.64
2	117980	63	4	8	0.91
2	117981	56	6	17	0.83
2	117982	70	1	13	0.91
2	117983	110	5	21	0.89
2	117984	68	1	22	0.86
2	117986	153	1	15	0.95
2	117987	66	5	9	0.90
2	117989	53	6	8	0.88
2	117990	113	5	16	0.91
2	117992	76	0	124	0.55
2	117995	11	1	35	0.38
2	117998	87	5	24	0.86
2	117999	44	7	11	0.83
2	118001	23	0	2	0.96

Trip	Observer set number	Number of fish recorded by both methods	Number of fish only recorded by the observer	Number of fish only recorded by the video	Sorensen index
3	119906	250	3	20	0.96
3	119907	174	5	11	0.96
3	119908	187	4	22	0.94
3	119909	151	1	25	0.92
3	119910	166	2	21	0.94
3	119911	167	3	14	0.95
3	119912	265	2	31	0.94
3	119913	89	1	23	0.88
3	119914	141	1	18	0.94
3	119915	252	1	18	0.96
3	119917	172	2	21	0.94
3	119918	156	2	17	0.94
3	119919	209	3	38	0.91
3	119920	68	1	20	0.87
3	119921	144	0	29	0.91
3	119922	48	3	11	0.87
3	119923	253	0	35	0.94
3	119924	171	5	24	0.92
3	119926	211	2	36	0.92
3	119927	231	3	33	0.93
3	119929	164	4	32	0.90
3	119930	163	4	9	0.96
3	119931	136	5	22	0.91
3	119932	122	0	13	0.95
3	119934	98	3	18	0.90
3	119935	120	1	14	0.94
3	119937	126	0	15	0.94
3	119938	92	3	11	0.93
3	119940	64	5	12	0.88
3	119941	88	2	15	0.91
3	119943	57	0	13	0.90
4	119854	137	3	25	0.91
4	119855	82	5	33	0.81
4	119857	94	13	16	0.87
4	119859	199	27	20	0.89
4	119861	146	13	13	0.92
4	119862	121	15	24	0.86
4	119864	133	20	15	0.88
4	119865	105	14	11	0.89
4	119867	216	15	30	0.91
4	119868	120	5	25	0.89
4	119870	113	17	29	0.83
4	119871	124	5	20	0.91

Trip	Observer set number	Number of fish recorded by both methods	Number of fish only recorded by the observer	Number of fish only recorded by the video	Sorensen index
4	119873	111	5	23	0.89
4	119874	187	22	26	0.89
4	119875	124	6	21	0.90
4	119877	135	5	18	0.92
4	119878	18	0	5	0.88
4	119880	114	7	16	0.91
4	119881	78	5	11	0.91
4	119883	46	3	1	0.96
4	119884	101	5	19	0.89
4	119886	92	12	8	0.90
4	119887	45	1	3	0.96
4	119888	148	6	24	0.91
4	119890	69	2	19	0.87
4	119891	77	5	12	0.90
4	119892	63	7	3	0.93
4	119893	131	6	36	0.86
4	119895	111	2	19	0.91
4	119896	85	3	5	0.96
4	119898	83	3	11	0.92
4	119899	106	15	19	0.86
TOTAL		**14 051**	**790**	**2 054**	**0.91**

Additional Information 2. Occurrences (occ.) of differences between species identified. Different identifications are highlighted in red in the tables.

obs id - video id	occ.
ABU - ALB	2
ALB - ABU	1
ALB - AKB	1
ALB - ALB	5070
ALB - ALO	1
ALB - ALX	6
ALB - BET	19
ALB - DOL	1
ALB - GES	2
ALB - LAG	1
ALB - LEC	1
ALB - PLS	3
ALB - SKJ	6
ALB - TST	1
ALB - UNS	1
ALB - WAH	2
ALB - YFT	34
ALG - LAG	2
ALN - ALB	1
ALO - ALB	3
ALO - ALO	5
ALO - ALX	91
ALO - GES	2
ALO - LEC	1
ALO - UNS	1
ALV - ALB	3
ALX - ALO	16
ALX - ALX	446
ALX - GEP	1
ALX - GES	3
ALX - LEC	1
ALX - PLS	4
ALX - UNS	4
AMB - ALB	1
AML - ALB	1
ASZ - ASZ	2
ASZ - CUT	1
ASZ - GES	1
ASZ - RRG	1
BAB - GBA	6
BEC - ALB	2
obs id - video id	**occ.**
BEC - BET	15
BEC - YFT	2
BET - ALB	79
BET - BET	1042
BET - FAL	2
BET - SKJ	6
BET - UNS	1
BET - YFT	91
BLM - BLM	5
BLM - BUM	12
BLM - MLS	2
BRO - FAL	1
BRZ - POA	2
BRZ - TST	2
BSH - BSH	7
BSH - SHK	1
BSH - UNS	1
BTH - BET	1
BTH - BTH	1
BTH - PTH	3
BUM - BLM	14
BUM - BUM	44
BUM - MLS	6
BUM - SFA	2
BUM - SWO	1
CBG - LEC	1
CUT - ALX	1
DOL - ALB	1
DOL - DOL	177
DOL - FAL	1
EBS - BRZ	2
EBS - EBS	13
EBS - POA	2
EBS - TST	4
EBS - UNS	1
ETA - BET	2
FAL - ALX	1
FAL - BSH	3
FAL - FAL	82
FAL - LKV	1
GBA - BAB	4
obs id - video id	**occ.**
GBA - BET	1
GBA - GBA	185
GBA - LEC	1
GE-MONITORING - PRP	2
GEP - GEP	5
GEP - SNK	1
GEP - SXH	1
GES - ALO	1
GES - ALX	8
GES - GEP	1
GES - GES	70
GES - LEC	2
GES - PRP	2
GES - YFT	1
LAG - LAG	81
LEC - ALB	1
LEC - ALX	2
LEC - BRZ	1
LEC - FAL	1
LEC - GBA	1
LEC - GEP	2
LEC - LEC	301
LEC - LGH	1
LEC - OIL	1
LEC - PLS	1
LEC - PRP	2
LEC - SKJ	2
LEC - UNS	3
LGH - LGH	3
LKV - LKV	5
LKV - TUG	1
LLL - LLL	1
LMA - UNS	1
LOP - LLL	1
LOP - LOP	1
LOP - UNS	1
LXE - ALX	1
MAN - SHK	1
MLS - ALX	1
MLS - BLM	3
MLS - BUM	12
obs id - video id	**occ.**
MLS - MLS	6
MLS - SFA	1
MLS - SSP	4
MLS - SWO	1

NEN - GEP	3
NEN - GES	1
OCS - OCS	3
OIL - LEC	1
OIL - OIL	2
OIL - UNS	1
OMW - ALX	13
OMW - PRP	2
PLC - PLS	1
PLS - ALB	4
PLS - ALX	5
PLS - FAL	1
PLS - LAG	1
PLS - PLS	764
PLS - UNS	2
PLS - YFT	1
POA - POA	7
PRP - ALX	1
PRP - GEP	15
PRP - PRP	5
PRP - SNK	2
PRP - UNS	3
PRP - WAH	1
PSK - PSK	1
PTH - BTH	1
RMB - RMV	1
RMV - BTH	1
obs id - video id	**occ.**
RMV - OCS	1
RMV - RMB	2

RMV - RMV	1
RRU - RRU	3
RZV - RZV	26
SFA - BUM	1
SFA - MLS	3
SFA - SFA	81
SFA - SSP	3
SHK - ALX	1
SHK - BSH	29
SHK - FAL	8
SHK - LMA	2
SHK - OCS	1
SHK - SHK	7
SHK - THR	1
SHK - UNS	1
SKA - BSH	1
SKA - SKJ	1
SKJ - ALB	21
SKJ - BET	2
SKJ - FAL	1
SKJ - LEC	1
SKJ - SKJ	749
SKJ - UNS	1
SKJ - YFT	11
SMA - BSH	2
SMA - SMA	1
SMA - UNS	1
SNK - PRP	1
SSP - ALB	1
SSP - BUM	2

obs id - video id	**occ.**
SSP - MLS	8
SSP - SSP	70
SSP - WAH	7
SWO - SWO	20
SXH - GEP	1
SXH - GSE	2
SXH - LOP	1
SXH - PRP	1
SXH - SXH	1
TST - ALB	1
TST - BRZ	1
TST - EBS	10
TST - LEC	1
TST - POA	1
TST - TST	73
TUG - LKV	1
TUG - TTH	1
UNS - LAG	1
UNS - UNS	1
WAH - COM	3
WAH - SSP	1
WAH - WAH	323
YFT - ALB	32
YFT - BET	14
YFT - LEC	1
YFT - PLS	1
YFT - SKJ	10
YFT - WAH	1
YFT - YFT	3538