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Global Electronic Monitoring Accelerator

Supporting Industry and Government Leadership in EM Program Design & Implementation

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Global Electronic Monitoring Accelerator:

Supporting Industry and Government Leadership in EM Program Design & Implementation

IOTC WGEMS02 Reference Paper

Rationale

The Case: Electronic monitoring (EM) is a proven tool to expand the availability and accuracy of fisheries data that can be used to improve transparency and compliance while supporting science-based fisheries management.

The momentum to expand EM at scale is building.

- Governments and supply chain actors have made major commitments to EM.
- FIPs and MSC certification are both increasing evidence requirements that EM can facilitate.

The Problem: Uncoordinated pilots, small-scale projects, and the absence of consistent performance standards have hindered efficient data processing and storage, as well as increased costs for service providers and program participants.

Our Solution: The Nature Conservancy (TNC), in partnership with public and private sector partners, is leading the development of **an EM program and an associated procurement process to demonstrate efficient EM program delivery at scale and accelerate uptake of EM on the water.**

Objectives

- Drive **economies of scale for EM** providers and **incentivize innovation**;
- Deliver an **EM performance standard that can be adopted and adapted globally** and model the centralized program infrastructure needed to **successfully operationalize EM at scale**
- **Increase accuracy, consistency, and confidence in fisheries catch and activity data** in tuna fisheries, and to improve the accuracy of logbook reporting
- **Ensure individual vessel compliance with private sector sustainability objectives** and relevant national and Regional Fisheries Management Organization (RFMO) measures and data reporting
- While this program is oriented around private sector leadership, its key attributes are designed to be **readily adaptable to public sector-led EM programs**

The Program

- **High-volume procurement** – The RFP is now open for EM service delivery for ~200 longline vessels in multiple Oceans
- **Strong industry engagement** – Participation from major seafood companies
- **Scalable** – Additional vessels, gear types, and geographies can be easily folded into the program through follow-on tenders

Trusted and actionable data through:

- **Third-party auditing** – The quality of EM data will be verified through an independent third-party auditor
- **A centralized and secure data platform** – All data will be delivered to a centralized data platform and data manager to ensure consistency of data, generate program-wide insights, and manage data access
- **Program coordination** – Operations will be managed against performance standards and will be adapted to improve the efficiency of EM service delivery over time

The Opportunity

- On-ramp to an **efficient, custom, and secure EM program, with reduced transaction costs**
- **Demonstrate the value of EM** through an **adoptable and multi-jurisdictional EM model at scale**
- Support the alignment of public and private incentives to **improve EM functionality and reduce costs**
- Take advantage of **centralized and coordinated EM data management**, making it easier for seafood processors and fisheries authorities to **receive and process EM data and generate insights**

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The Nature Conservancy

Annex I

Industry-Led Electronic Monitoring Program

Draft Program Design & Performance Standards

Reference Paper For the IOTC WGEMS

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1. Background

Several public and private sector stakeholders have made commitments to implementing or expanding electronic monitoring (EM) requirements for tuna vessels that fish in their waters or provide raw material for their supply chain. Broadly shared EM objectives are to increase accuracy, consistency, and confidence in fisheries catch and activity data in tuna longline, purse seine, and pole and line fisheries to improve the accuracy of logbook reporting; to ensure individual vessel compliance with private sector sustainability objectives, and, where applicable, compliance with relevant national and Regional Fisheries Management Organization (RFMO) measures. The EM program outlined in this document will help tuna industry stakeholders meet these objectives.

The EM program will be organized primarily around fishery improvement projects (FIPs) through inclusion of the EM program in FIP work plans as well as a blanket memorandum of understanding (MOU) between program participants. Data from this EM program will support FIPs in their journey to obtaining Marine Stewardship Council (MSC) certification and communicating environmental performance to markets.

The Nature Conservancy (TNC), in partnership with public and private sector partners, is leading the development of the EM program and an associated procurement process to demonstrate efficient EM program delivery at scale. The program will initiate with longline vessels in the Pacific, Indian, and Atlantic Oceans. Additional geographies and gear types may be folded into the program at a future date.

2. EM Program and Tender Overview

The EM program will collect raw EM video and data on all fishing activity and derive annotated fishing data through the review of 20% of fishing sets of participating vessels. The program will also compare annotated EM data with logbook data where possible with a long-term goal of improving the accuracy of self-reported data in logbooks and evolving the program to a logbook audit model where EM is used to verify the accuracy of self-reported data. While this program is oriented around private sector leadership, its key attributes are designed to be readily adaptable to public sector-led EM programs.

EM Service Providers will be selected through a competitive RFP or tender process. The Supply-Chain Sponsors will select a winning EM Service Provider bid for each of their vessel lots. Fishing companies and vessels within each lot will then enter into an EM service contract with the winning EM Service Provider under the terms of the winning bid for each respective vessel lot. A draft uniform contract will be provided to facilitate the contracting process between EM Service Providers and fishing companies/vessels.

3. Roles and Responsibilities

The program will have seven main parties: Supply-Chain Sponsors (e.g., tuna processing companies), fishing companies and/or vessels, EM Service Providers, a Third-Party Auditor, a Data Manager, a Program Coordinator, and a Steering Committee (see Figure 1). In addition, Supply Chain Sponsors may subcontract their day-to-day EM program management responsibilities to an EM Program Manager, a structure that is commonly used in existing EM pilots and FIPs. All parties will be expected to sign a blanket MOU that outlines the basic structure of the program and responsibilities of the primary parties.

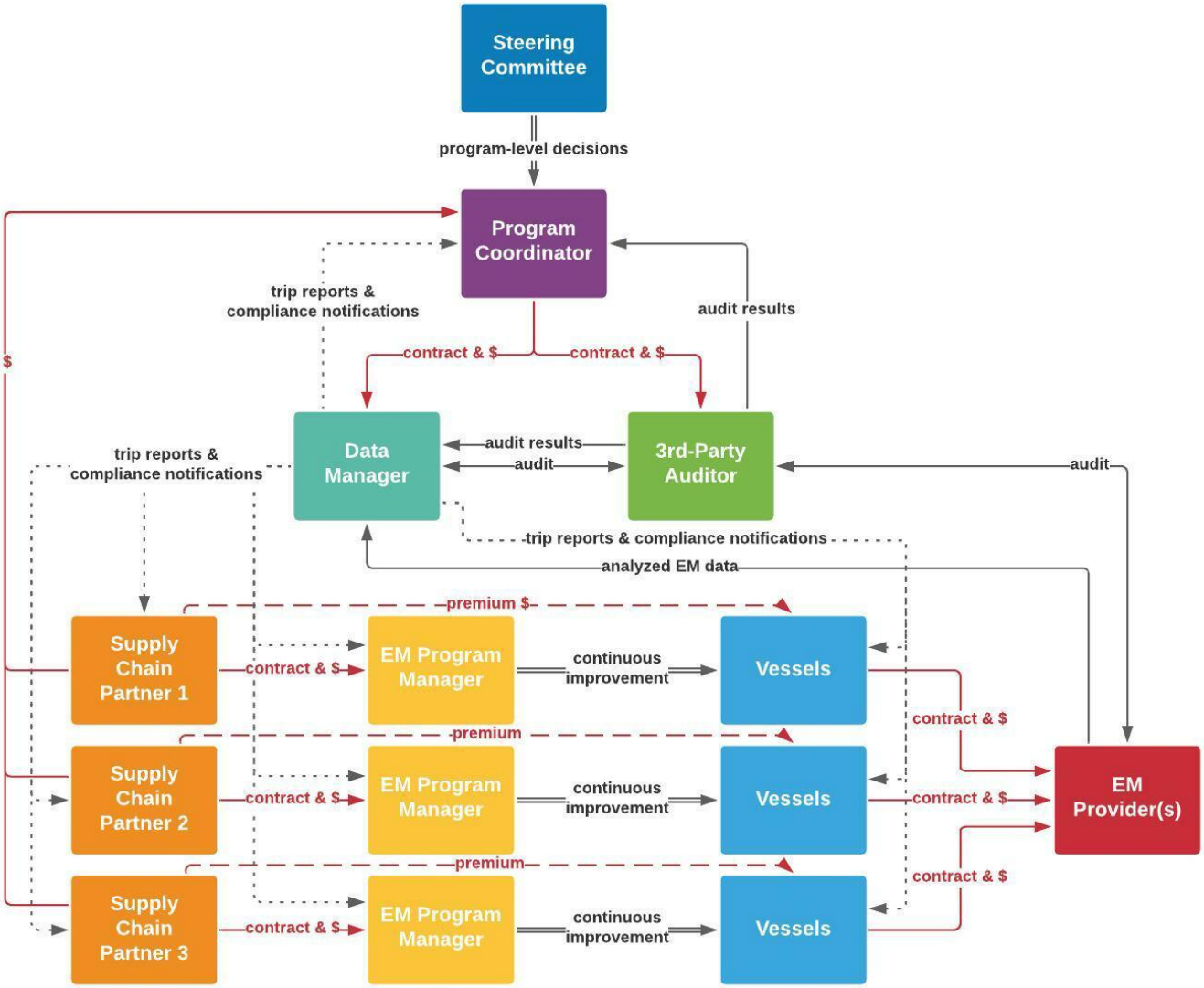

Figure 1. Visualization of draft EM program structure. Price premiums as noted in this graphic are entirely optional and at the discretion of the supply chain sponsor.

3.1 Supply Chain Sponsors

Establishing and Incentivizing Adherence to EM Program Obligations

Supply Chain Sponsors (e.g., processing companies that supply tuna products) will be responsible for establishing, with support from TNC, EM program obligations and continuous improvement protocols for participating fishing companies or vessels. This program will require detailed vessel obligations, such as, following catch and bycatch safe handling and release protocols (including for ETP species), accurate logbook reporting, on-the-water behavior, and EM system duty of care obligations (e.g., basic maintenance, wiping lenses, not blocking camera views) to ensure high quality EM records are delivered to EM Service Providers covering all fishing activity. EM program obligations will be established primarily through a blanket memorandum of understanding (MOU) between program participants, as well as MOUs between Supply Chain Sponsors and vessels/fishing companies.

Supply Chain Sponsors will seek to incentivize fishing company and/or vessel compliance with EM program obligations through a continuous improvement protocol that could include incentives, such as a price premium

for raw material captured under this EM program and graduated responses to compliance violations. For serious breaches, Supply Chain Sponsors will reserve the right to impose sanctions up to and including fishing company and/or vessel removal from the EM program and termination as a supplier.

Contract with the EM Program Coordinator

The Supply Chain Sponsors will contract with the EM Program Coordinator, who will oversee EM program operations, including contracting with the Data Manager and Third-Party Auditor. The combined cost of the Program Coordinator, Data Manager, and Third-Party Auditor will be collected through a fee to participating Supply Chain Sponsors that will include a fixed component and a variable component based on the number of active vessels in the program.

EM Program Manager

Supply Chain Sponsors may subcontract an EM Program Manager to handle their day-to-day responsibilities as part of the EM program. It is common within existing FIPs and EM pilots for Supply Chain Sponsors to subcontract for these functions and we anticipate that some companies will use this structure for this EM program.

3.2 Fishing Company/Vessel Responsibilities

The primary responsibilities of fishing companies/vessel operators will be to:

1) Contract with an EM Service Provider to install and maintain EM systems on vessels, collect and review EM records, and generate and deliver EM data to the Data Manager in accordance with the data requirements and standards outlined in this document. A draft uniform contract will be provided to facilitate the contracting process between EM Service Providers and fishing companies/vessels.
2) Comply with the terms of the EM program MOU with the Supply Chain Sponsor, which will include meeting the following obligations.

EM System Installation

Fishing companies/vessel operators ***must*** support EM system installation on participating vessels including:

- Attend pre-installation training and complete any vessel preparations required for EM system install
- Proactively communicate with EM Service Providers to coordinate EM system installations
- Make the vessel available on an agreed upon date/time for installation
- Provide the EM Service Provider (or their designated installer) unfettered access to the vessel, information on vessel systems to facilitate EM system installation, and information on how fishing is executed on the vessel
- Complete and sign off on a vessel monitoring plan

EM System Operation

Vessel operators must meet their duty of care responsibilities as outlined in their vessel monitoring plan, such as:

- Performing pre-trip and regular EM system health checks
- Ensuring camera lenses are clean and there are no obstructions to the camera field of view
- Ensuring no person tampers with, disconnects, or destroys any part of the EM system or its recorded data
- Following catch handling procedures as outlined in the vessel monitoring plan

- Report EM system malfunctions to their EM system provider within 24 hours of system health alarm or observation of EM system malfunction
- Make a reasonable effort to make basic EM system repairs at sea with guidance from the EM Service Provider
- Make the EM system available for inspection or service at the request of the EM Service Provider

Data Reporting

Vessel owners or operators must:

- Submit EM video and data records to the EM Service Provider in the format and manner specified by the EM Service Provider within 24 hours of return to port; submission may mean physical delivery of hard drive to the EM Service Provider or their designated representative, uploading of video and data to a cloud based server that the EM Service Provider has access to, or initiation of mailing or courier service delivery of hard drives
- Accurately report fishing activity in logbooks and grant EM Service Providers and the EM Data Manager access to logbooks for auditing, where applicable
- Authorize the sharing of annotated fishing data with relevant science bodies (e.g., SPC)

3.3 EM Service Provider Responsibilities

Hardware, Training and Technical Support

The EM Service Provider or their designated representative will:

- Install EM hardware on vessels that meets the required performance standards (5. Hardware Standards)
- Provide field support and 24-hour technical assistance services to fishing companies/vessel operators including hardware installation, service and maintenance, and collection of EM data
- Train designated vessel staff in proper equipment positioning, routine maintenance, identifying malfunctions, reporting protocols, and verifying system functionality. This training must be provided in English.
- Provide a printed guide explaining how to perform basic maintenance and repairs that could reasonably be made by vessel operators or crew. The guide should be provided in English. The guide shall also be provided in Mandarin if that is a primary language of the vessel captain or crew.
- Communicate directly with fishing companies/vessels operators to coordinate service needs, resolve EM system issues, and collect and provide feedback, as requested, on program operations.
- Provide technical assistance for EM systems to fishing companies and vessel operators within 24 hours of a system health alarm or request for service, year-round. This assistance must be available in English.
- Ensure all field service events are scheduled and take place with minimal delay or interruptions to fishing activities.
- Notify the Data Manager of any EM system failures and associated service calls within 24 hours of identification of failure.
- Report and log all technical assistance requests, service events, and system malfunctions in final trip reports, including information on what repairs were made to restore system functionality and whether the system was restored to full functionality.

EM Service Providers may use different approaches to meet installation, service, and maintenance requirements (e.g., remote diagnostics, training designated vessel staff to do repairs and providing spare parts, contracting local marine technicians, using company staff) as long as they are able to meet the performance requirements of the program.

Vessel Monitoring Plan

The EM Service Provider ***must*** complete and submit a Vessel Monitoring Plan to the Data Manager shortly after installation of an EM hardware system on a longline vessel. A copy of the Vessel Monitoring Plan must also be onboard the vessel at all times. The Vessel Monitoring Plan must be submitted to the Data Manager and approved by the EM Program Coordinator in advance of the vessel embarking on a trip that will be covered by this EM program. The EM Service Provider shall update Vessel Monitoring Plans and resubmit them to the Data Manager whenever the EM system configuration or onboard procedures are altered. Updates to Vessel Monitoring Plans must also be approved by the EM Program Coordinator.

The Vessel Monitoring Plan describes how an EM system is configured on a vessel and how fishing operations will be conducted to enable the collection of EM records for complete and accurate generation of EM data. The Vessel Monitoring Plan must include:

- Contact information for the EM Service Provider, vessel owner(s), base manager(s), and vessel operator(s). This should include information that can be used to contact the vessel while at sea, if available.
- General vessel information as specified in the Vessel Information Data section of Appendix 2. Data Outputs to Be Provided by EM Service Provider.
- A diagram, description, and photo(s) of the vessel layout that identifies where key fishing activities will occur on the vessel (e.g., hauling, sorting, discarding) and measurements of all items, tools, or calibrated areas on the vessel that EM analysts will use to estimate lengths.
- A description of the EM setup, including:
    - The number and location of cameras including images of their installation location and an image from each camera's perspective.
    - A description and image of the location of all other components of the installed EM system (e.g., geolocations system, EM control system, power supply).
    - A list of system configuration settings, including:
        - Camera configuration settings (e.g., frame rates, resolution, bitrate)
        - Sensor units and threshold values
        - Data recording frequencies and/or sensor triggers for recording
        - Software and/or firmware versions
        - Required catch handling procedures (e.g., handling in view of cameras, allowable discard locations) to ensure that an EM analyst can generate data for all the required fields of the data fields required under this program (See Appendix 2. Data Outputs to Be Provided by EM Service Provider)
- An attestation from the EM Service Provider that the EM system has been tested, is functional, and meets the program standards.
- Vessel duty of care responsibilities to prevent system malfunctions, including:
    - Completing a system functionality test at the beginning of each trip
    - Required frequency for checking camera lenses and cleaning obligations
    - Vessel responsibilities in the event of system malfunctions that describe the steps that must be taken. This must include a requirement to report system malfunctions while at sea within 24 hours of identifying malfunctions.

EM Video and Data Records Collection

The EM Service Provider will:

- Coordinate with fishing vessels to collect EM records and video at the end of fishing trips. EM Service Providers must specify the format and manner in which vessels should submit EM records and video upon vessel arrival at port; submission may mean physical delivery of hard drive to the EM Service Provider or their designated representative, uploading of video and data to a cloud based server, or initiation of mailing or courier service delivery of hard drives
- Provide vessels with clean storage devices prior to the start of their next fishing trip
- Immediately confirm receipt of EM records at the review center with the fishing company/vessel and the Data Manager
- Ensure EM records and video collection minimize interruptions to fishing activities (e.g., ensuring replacement hard drives are available when a vessel comes to port)
- Ensure EM records and video are sufficient to meet the data outputs of this program, assuming vessel compliance with EM system duty of care requirements described in the Vessel Monitoring Plan and the MOU between Supply Chain Sponsors and fishing companies/vessels
- Implement measures to ensure the security and integrity of video and sensor data (e.g., encryption, digital signatures)

Video and Data Review and Reporting

The Service Provider will:

- Collect raw EM video and records on 100% of fishing activity.
- Complete a review of twenty percent (20%) of sets to generate the annotated fishing data requirements outlined in Appendix 2. Data Outputs to Be Provided by EM Service Provider within 3-weeks of the receipt of raw EM data and video. At program outset, the 20% will be selected randomly, but may move to a risk-based selection over time.
- Save a video clip of each catch and compliance event that captures the entirety of the event (e.g., 5 seconds before and after).
- Compare annotated fishing data with logbook data for the trip and assess the accuracy of the logbook data if the vessel has provided access to a logbook report.
- Identify any potential compliance events (e.g., failure to maintain the EM system, violence or assault, failure to follow catch handling protocols, pollution events) and include this information in vessel trip reports.
- Deliver raw EM records (excluding the EM video files), annotated fishing trip data, completed trip report, compliance notification forms, and video clips of catch and compliance events, to the Data Manager within 24 hours of completing video and data review of a trip.

At a future date, the program may require that the EM Service Provider deliver raw EM video to the Data Manager. Before such a change, an evaluation will be undertaken to assess the financial impact on EM Service Provider(s).

Additional Requirements

The EM Service Provider will:

- Provide the Data Manager and the Third-Party Auditor with training and the necessary information and tools for them to perform EM video review and accurately interpret EM records (e.g., encryption keys, analysis

software, specialized hardware, and full information on EM records and video file formats, data elements, and syntax).
- Store all raw EM records and video as well as annotated EM data for at least 12 months from the date the annotated data for the trip is received by the Data Manager.

3.4 Data Manager

The Data Manager will be responsible for creating and managing a secure central repository for all EM data provided by EM Service Providers, including raw EM records (excluding raw EM video), EM video clips, annotated EM data, fishing trip reports, compliance reports, and electronic logbook data. The Data Manager will store all EM video clips for at least 12 months after the date of receipt, while raw EM records (excluding raw video files), annotated fishing data, fishing trip reports, compliance reports, and logbook data shall be stored indefinitely.

The Data Manager will be responsible for developing an API for accepting EM data and video clips from EM Service Providers. They will also be responsible for finalizing the required data fields and syntax for annotated EM data as outlined in Appendix 2. Data Outputs to Be Provided by EM Service Provider, and for data contained in trip and compliance reports.

The Data Manager will provide access to EM program data to stakeholders as outlined in Section 6.2 and will be responsible for managing data access according to data sharing guidelines of the EM program or data licensing agreements developed by program stakeholders. The Data Manager will develop a web interface that allows authorized stakeholders to access or request data.

The Data Manager will be responsible for facilitating the compliance notification and reporting process, which will involve forwarding compliance notifications, trip reports, or aggregated reports to Supply Chain Sponsors and fishing companies/vessel operators. Notifications shall be pushed to fishing companies and Supply Chain Sponsors when new trip data/reports have been uploaded to the Data Manager.

The Data Manager will also create reports using EM program data to gain insights into fishing activity and assess EM program performance. Reports may include:

- Gear and effort summary
- Share of selected fishing sets with sufficient video quality for review
- EM system uptime based on system health data
- Catch rates of target/non-target/ETPS
- List of EM trips with corresponding logbook data
- Comparison of EM data versus logbook data
- Vessel summaries of adherence to reporting and responsible activity standards
- Compliance notification event summaries by vessel or fishing company

The Data Manager will also facilitate audits of the performance of the EM Service Providers by arranging for a subset of reviewed EM records and video to be delivered to the Third-Party Auditor. The Data Manager will receive copies of Third-Party Auditor reports that it will store indefinitely and forward to Supply Chain Sponsors and EM Service Providers. The Data Manager will generate annual reports summarizing the audit results of each EM Service Provider and will provide them to the respective Supply Chain Sponsors as well as the Program Coordinator. These annual audit reports will be required by Supply Chain Sponsors to validate the integrity of the data generated through the EM Program.

The Data Manager must also organize a third-party audit to validate the integrity and security of their data systems. The results of the audit must be shared with all program stakeholders and the EM Program Coordinator will work with program stakeholders to determine which recommendations from this data audit must be implemented by the Data Manager.

3.5 Third-Party Auditor

The Third-Party Auditor will select a subset (up to ~10%) of EM records and video that have been reviewed by EM Service Providers and will perform an additional review of those EM records and video as described in Appendix 3. This amounts to a review of up to 2% of total fishing activity covered by the program (i.e., 10% of the 20% selected for initial review). The annotated data from this secondary review will be compared with the annotated data generated by the EM Service Provider's primary review to ensure the quality and accuracy of data provided. When applicable, the Third-Party Auditor will also be given access to logbook data to validate the comparison of annotated EM data with logbook reports. The Third-Party Auditor will submit an audit summary report to the Data Manager.

The program will include a process to reconcile any significant differences between the third-party audit results and EM Service Provider data (Appendix 3). If the audit demonstrates EM Service Providers are not meeting program data standards, remediation actions may be taken. Remediation actions will emphasize continuous improvement, but ongoing performance issues may result in penalties such as reduced payment for not meeting program standards or increased frequency of audit rates with fees charged to the EM Service Providers.

3.6 EM Program Coordinator

An EM Program Coordinator will manage the operations of the EM program and put forward recommendations for major program updates to the Program Steering Committee. Functions of the EM Program Coordinator will include: creating and managing contracts with the 3rd-Party Auditor, the Data Manager, and the Supply Chain Sponsors; collecting fees from Supply Chain Sponsors to support the program's centralized infrastructure, running tender processes for new vessel lots to enter the program; recommending program updates (e.g., changing data or performance standards) to the Program Steering Committee; mediating any disputes among program stakeholders; and incorporating guidance from the Program Steering Committee into programmatic decisions.

3.7 EM Program Steering Committee

The EM Program will be guided by a Program Steering Committee, which will advise the Program Coordinator on management of the EM program. The composition of the Committee will include one seat each for TNC, ISSF, a representative for the participating tuna Supply Chain Sponsor companies, and a representative from participating EM Service Providers. Additional steering committee seats will be filled by other tuna fishery stakeholders (e.g., fisheries agency staff, retailers, fishery scientists). The draft terms of reference for the Steering Committee are currently in development.

3.8 Fisheries Authorities

This program is designed to operate as a private-sector led initiative. However, there is ample opportunity for partnership and coordination with fisheries authorities. If a partnership is developed with fisheries authorities, program stakeholders would work with them to:

- Integrate the fishery authority's EM program/performance standard into the program for relevant vessels

- Identify the data that the program should share, in what formats, and on what terms, with regional bodies
- Address compliance/continuous improvement issues with fishing companies and vessels

4. Data Requirements

Table 1. High-level overview of program data requirements (see Appendix 2 for details on required data outputs).

Overall Objective	Specific Objective
Catch events	Identify the species of all catch items (fish, non-fish, and ETP species) to a reasonable level,[1] including: a) catch items retained b) catch items discarded after being brought on board the vessel c) catch items that are discarded or struck off the line by the crew before being brought on board d) catch items in the water adjacent to the vessel during hauling e) Assess the fate for all catch items
Use of mitigation measures	Record the use of mitigation measures during sets.
Fishing effort details	Record the date and location of all sets and hauls. Record the start and end time and location of all trips including the time and location of any unloading events (in-port and trans-shipments).
Catch and management of protected species	Identify to a reasonable level any protected species, validate that it is returned to the water following best practices for safe handling and release, and assess fate to the extent it is reasonably practicable.

5. Hardware Standards

Each vessel will be required to have an electronic monitoring system installed that includes a number of digital cameras connected to a storage device, positioned so as to enable it to meet the data requirements specified in Appendix 2. The EM system should also be equipped with a geolocation device, gear sensors (optional), and allied transmission hardware to enable the transmission of system health data on demand during fishing activity. Video may be used as a synthetic sensor where appropriate.

5.1 Hardware Requirements

1. All hardware components must reliably operate in their installed location onboard fishing vessels (e.g., sufficiently water/dust resistant, operating temperature ranges).

[1] The EM analyst should identify the species to the lowest taxonomic level possible with confidence >90%.

2. System hardware must be tamper resistant and tamper evident to make intentional sabotage difficult to hide.
3. Camera placements should cover all fishing activity areas on vessels required to generate the data specified in Appendix 2.
4. Camera imagery must be of a sufficient quality to meet data collection standards specified in Appendix 2.
5. Cameras must record imagery 24x7, but camera settings may be adjusted to reduce file size during periods where active fishing is not occurring (e.g., steaming).
6. Hardware must be capable of controlled shutdown and include protections to prevent loss of video footage and data during loss of power or system malfunction.
7. GPS data should be integrated with video footage (date, position, time, speed, course, and vessel name continuously stored in a log file, and a timestamp included on every frame).
8. System must store information in an encrypted video file recording/storage system (e.g., tamper-resistant verification). Encrypted formatting will ensure confidentiality and chain of custody.
9. On-vessel storage capacity for video and sensor data shall be sufficient to cover the duration of fishing trips (i.e., up to 9 months).
10. On-board recording will be saved to a storage device, allowing for recovery of imagery and sensor data at the end of each trip for analysis.
11. System must be compatible within close proximity to existing electrical equipment and must not impact the functionality of other onboard systems (no interference).

5.2 System Health Data

1. The system must automatically execute or prompt the user to execute a system health test on power up and provide a visual signal that the system has passed or failed on the system display.
2. The system must be able to run daily system health checks throughout the duration of a fishing trip
3. All EM systems must transmit the following data or alerts (minimum once daily) to the EM Service Provider and the Data Manager. If transmission of data is not feasible (i.e., power outage), requested data shall be stored and transmitted when possible. Vessels operating in this program may be at sea for up to 9 months and the intent of this data is to identify system health issues proactively address them while the vessel is at sea. Prior to installation, the EM Service Provider shall coordinate with the Data Manager to define a method and data format for delivering system health data.
    a. Vessel identification number and location, with date and time stamp
    b. System health status (i.e. noting operational status/malfunctions of any key operating components (e.g., cameras offline, GPS antennae offline, sensors not working))
    c. If the vessel has an existing satellite system and data plan at the time of EM system installation sufficient to transmit still images from each camera daily without undue cost burden, the EM system should transmit a still image from each camera to ensure functionality and sufficient image quality for analysis

5.3 System Maintenance, Failure, or Malfunction Requirements

1. System must have onboard alerts that notify the onboard crew when the system is not fully functioning.
2. System must support remote access software updates and configuration (e.g., CODEC settings, resolution).

6. Video Review, Data Analysis, & Data Management

6.1 Video Review & Data Analysis

At the program outset, the EM Service Provider will review a random 20% of the fishing sets. As information on vessel compliance with EM program obligations is gathered, higher-risk vessels (e.g, that have demonstrated track record of compliance events or high ETP interaction rates) may have a larger share of their fishing activity reviewed, but the program will aim for an overall review rate of 20%. The review process will be as follows:

1. Basic vessel identification and activity data should be recorded (Appendix 2)
2. All fishing sets and hauls should be identified from the sensor data to determine the total number of fishing events for the trip, their time, and location.
3. A brief segment of EM video and data should be quality checked at the beginning, middle, and end of each set and any EM quality or system health issues flagged.
4. The EM Service Provider will obtain a random order of sets to review from the Data Manager.
5. The EM Service Provider will review 20% of all sets of each trip, reviewing them in the order provided by the Data Manager. The EM Service Provider will generate annotated data for reviewed sets that meets the EM program data requirements (Appendix 2).
6. If the quality of video and data from a selected set is insufficient to generate accurate annotated fishing data, this should be documented and the next set in the random sequence provided by the Data Manager should be reviewed. This process shall be repeated until 20% of the sets within a trip have been reviewed or an attempt has been made to review all sets in the trip but there are not enough sets with sufficient video and data quality for successful review to meet the 20% threshold. EM Service Providers should document when a set was selected for review, and whether review was successfully completed (Appendix 2).
7. Complete annotated fishing data from each trip must be uploaded to the Data Manager within 24 hours of the completion of the analysis of a trip in a machine readable format that will be specified by the Data Manager (Appendix 2).
8. A short video clip of each catch and compliance event shall be included in the annotated fishing data that is delivered to the Data Manager.
9. If the vessel has provided access to E-logbook data, the EM Service Provider shall compare annotated fishing data for reviewed sets with self-reported logbook data and include data from this comparison in the vessel trip report.
10. The EM Service Provider shall produce a trip report which must be uploaded to the Data Manager within 24 hours of the completion of the analysis of a trip (Appendix 4). The information in a vessel trip report must also be submitted in a machine readable format that will be defined by the Data Manager.
11. All compliance issues identified during review of the 20% of fishing sets/hauls will be annotated and managed according to the Compliance Notification Requirements (Appendix 5). Compliance reports are to be provided to the Data Manager within 24 hours of completion of the analysis of a trip. The data within a compliance report must also be provided in a machine readable format defined by the Data Manager.
12. The EM Service provider must store all raw and annotated EM video and data for a minimum of 12 months from the date the annotated fishing data from the trip is delivered to the Data Manager.

6.2 Data Access and Sharing

The EM program will generate or collect data on fishing activities of tuna vessels in several forms, including:

1. Raw EM sensor data (e.g., GPS, gear sensors, system log files)
2. Raw EM video
3. Annotated fishing data (Including video clips)
4. Logbook data
5. Vessel trip reports

6. 3rd party audit reports

Some of this data may contain proprietary information (e.g., specific fishing locations), could be used in legal proceedings, or may provide business value or risk (e.g., video of ETP catches being obtained and sensationalized). The table below presents a framework for data access in the program. Ultimately, this framework will need to be refined and formalized into data licensing agreements among program stakeholders. The Data Manager will be responsible for adhering to these data sharing guidelines of the EM program and data licensing agreements among program stakeholders.

Table 1. Data access privileges for EM program stakeholders.

Entity / Data Type	Overall scope of data access	Raw EM sensor data	Raw EM video	Annotated fishing data	Audit reports	Logbook data	Vessel trip reports / Summary Reports	Storage Requirements
Fishing Company	Authorized to access all data generated from EM systems on vessels that the fishing company owns or operates	Yes	Yes	Yes	No	Yes (Note fishing company must authorize SPC or other relevant body to grant the EM Service Provider access their logbooks)	Yes	NA
Supply Chain Sponsor	Authorized to access summary reports for vessels that are under an EM program MOU with the Supply Chain Sponsor	No	No May be granted access for dispute resolution or upon request if approved by the fishing company	No	Yes	No	Yes	NA
EM Service Provider	Authorized to access all data that is generated on vessels for which they have supplied hardware or for which they are the designated EM video reviewer for.	Yes	Yes	Yes	Yes	Yes	Yes	Must store all raw and annotated EM data for at least 12 months
Data Manager	Authorized access to all program data that is placed under their	Yes	On Request	Yes	Yes	Yes	Yes	Video clips must be retained for at least 12 months, all other program data must be

	custodianship in the program							retained indefinitely
3RD PARTY AUDITOR	Authorized to access data on fishing activity that has been flagged for auditing (e.g., the 10% of the 20% of reviewed fishing activity)	Yes	Yes	Yes	Yes	Yes	Yes	May delete EM video and sensor data after submitting a completed audit report for that data.
EM PROGRAM COORDINATOR	Authorized access to all program data that is placed under the custodianship of the Data Manager in the program	Yes	On Request	Yes	Yes	Yes	Yes	NA
FLAG STATES	Authorized to access program data according to relevant laws. Cost and privacy issues should be considered when governments determine what data to access from the program.	Through license to access privately held data. Determined by relevant laws. The project will seek to submit relevant annotated EM data to relevant authorities.						
COASTAL STATES	Authorized to access program data according to relevant laws. Cost and privacy issues should be considered when governments determine what data to access from the program.	Through license to access privately held data. Determined by relevant laws. The project will seek to submit relevant annotated EM data to relevant authorities.						

Publication of Summary Statistics

The Data Manager will generate summary statistics on the EM program and operations of vessels within the program that will be made available to all program participants and may be published more widely. The data in these summary reports will be at a sufficient level of aggregation to protect any information proprietary to fishing companies or Supply Chain Sponsors. For example, the program will not publish data on individual vessel tracks as fishing locations are likely to be seen as proprietary information, but may publish data on overall catch, catch rates, and compliance events (See Appendix 2. Data Outputs to Be Provided by EM Service Provider). Publishing these aggregated data are essential to track progress against the objectives of the program and to provide a sufficient level of transparency to build trust in the program. The US National Marine Fisheries Service

follows a “rule of three” in which data sets can only be released if there are at least three entities in the data set and it is sufficiently aggregated at a spatial or temporal scale to protect the identity of a person, business, or proprietary business information, and this program will follow similar guidance for protecting confidential information.

Data Sharing

Entities within the program may be interested in sharing data generated from the program more broadly. The following is a preliminary guideline for appropriate use of data generated from the program by entity.

- Fishing Companies: Fishing companies may share any of the EM data they have authorized access to as a part of the program.
- Supply Chain Sponsors: Supply chain sponsors may share any aggregated information on the program that protects the identities of individual people, fishing companies, and proprietary business information. They may also use more detailed data from the program under use agreements that protect the identities of individual people, fishing companies, and proprietary business information in support of business operations. For example, sharing data on catch to support seafood traceability.
- EM Service Providers: EM Service Providers may only share data from the program that relates to their own performance. For example, their performance on third-party audits reports, their system uptime performance, share of usable video generated on their systems, etc. EM Service Providers may not disclose any data related to activities of fishing vessels or Supply Chain Sponsor companies outside of the data access rules of the program.
- Government Entities and RFMOs: Access and use of data by government entities will be covered based on the flag/coastal state’s governing laws and regulations. Although government entities may be legally entitled to access or use data from the program, other issues such as cost and privacy should be considered when determining what data to access.

As the program matures, there may be interest in sharing data with third-party entities who can provide insights or services from analysis of the program data (e.g., identifying patterns and drivers of ETP interactions or improved catch rates) or use program video to support the development of machine learning tools. In addition, academic institutions and RFMO science bodies may have interest in accessing program data to further research on tuna fisheries. It is recommended that data licensing agreements are established with any additional entity who would like to access the data.

Appendix 1. Video Review Definitions

Sensor Data

The sensor data is a mixture of recorded data, which includes the GPS track and speed, and may include indications of when the drum starts to rotate, and when the vessel's hydraulic pressure achieves a certain threshold. Video may also be used as a "sensor" through analysis that can identify events of interest. These data, along with the video recorded (up to four or more cameras), help to identify the various trips and fishing events for both the location and duration.

Trips

Trips are defined from when the vessel leaves a given port to when it returns to the same or different port using the GPS track. Information of the start and end time of each trip is documented, along with the GPS information (latitude and longitude) of the start and end location.

Fishing Event

A fishing event is defined as a spatially and temporally corresponding set and haul. Under each trip's hierarchy the fishing events are identified using a combination of the available sensor data (e.g. GPS speed, drum rotations, hydraulic pressure) and video data.

Sets

A set is defined from when the first marker buoy has been deployed from the boat to when the end marker buoy has been deployed. The start and end time is recorded, along with the GPS information (latitude and longitude) of these locations. If there is no video data available but there is other adequate sensor data available that defines a set, a set will be documented.

Hauls

A haul is defined as the gear being retrieved, starting from when the first marker buoy is picked up to when the end marker buoy is brought on board. The start and end time is recorded, along with the GPS information (latitude and longitude) of these locations. A haul is defined as an event that involves retrieving deployed gear in its entirety. This also includes when the gear has broken (e.g. snapped line) and the gear is retrieved from the opposite marker buoy, regardless of temporal differences. If there is no video but there is adequate sensor data available that defines a haul, a haul will be documented but not reviewed.

Catch Item Processing

Once all the fishing events for a given trip have been identified, the Data Manager will provide a random order of sets from the trip for the EM Service Provider to review.

In most cases the first 20% of sets in the ordered list provided by the Data Manager will be reviewed, but the ordered list will include all sets such that the EM Service Provider will be able to move to the next listed set in those instances where there is not suitable video data available for the nominated hauls.

All available camera views are used to help identify and document fishing operations (i.e. retained and released catch items). In cases where a camera view is not working and/or adequate for species identification, the next randomly ordered haul will be selected.

Catch Items and Incidental Take Items

All items that have interacted with the fishing gear during the haul are recorded to the species level if possible, but if not, they are identified to the lowest taxonomic level possible.

Fate of Catch Items

The fate of each catch item and incidental take catch item which is either.

- Retained: where the catch item is kept on board for the duration of the video
- Discarded (released): where the catch item is handled either through direct touch, such as when it is removed from the gear, and/or any time a crew member directly handles a catch item in the act of releasing the catch item

More detailed fate classification is not required, but if used shall follow the fate codes defined in Appendix 9 of the Standards, Specifications, and Procedures for Electronic Reporting in the WCPFC.

Condition

The condition of catch items (e.g., alive and healthy, alive but injured or distressed, etc.). The condition of catch shall follow the definitions in Appendix 10 of the Standards, Specifications, and Procedures for Electronic Reporting in the WCPFC.

Seabird Mitigation Processing

In addition to the standard Catch Item Processing, video is to be reviewed for the deployment of seabird mitigation devices. This review will be completed across the fishing events (corresponding set and haul) identified in the random selection of fishing events for review. The same review selection protocol will be used as described in Catch Item Processing.

The set video, which uses the camera view to the aft of the boat, is to be reviewed to assess if mitigation measures are deployed during the gear setting and, if so, the type of seabird mitigation device (e.g., tori lines or lasers). The set seabird mitigation review will take place at three points across the video: the first 30 seconds, 30 seconds at approximately the middle of the set, and the last 30 seconds of the set. This information is gathered to ensure the seabird mitigation has been consistently used over the course of the set where required.

Appendix 2. Data Outputs to Be Provided by EM Service Provider

A:2.1 Required Data Outputs

Field formats shall follow standards set forth in the WCPFC's "STANDARDS, SPECIFICATIONS AND PROCEDURES (SSPs) FOR ELECTRONIC REPORTING IN THE WESTERN AND CENTRAL PACIFIC FISHERIES COMMISSION" version 2.0 unless otherwise specified.

	Longline E-Monitoring minimum data fields	Description	Field Format
EM Analysis Information			
	On-Vessel EM System Provider	Enter the name of the on-vessel EM system provider	
	EM Review Company	Enter the name of the EM review company	
	EM Reviewer	Unique identifier of the EM analyst (e.g., name or code)	
	EM System Software Name and Version	EM software name and version	
	Date and Time Review Start	UTC date and time of review start	
	Date and Time Review End	UTC date and time of review end	
Vessel Information Data			
	Trip Identifier	Internally generated trip identifier	Vessel Identifier + Departure Date
	Vessel Identifier	Vessel WCPFC number as per the WCPFC Record of Authorized Vessels and crosschecked with the number recorded on vessel certificates. or Vessel IOTC number as per the IOTC Record of Currently Authorized Vessels. or	

		Vessel number per the official records of the relevant RFMO	
	Vessel Name	Name of vessel. This information would normally be linked to a VESSEL reference database (e.g. FFA Vessel Register) which will ensure consistency/standardization.	
	Country of Vessel Registration	Record the name of the country in which the vessel is registered as shown on its registration documents. Where chartering occurs, record name of the chartering country.	
	Vessel port of registration	Record the name of the vessel's port of registry (also called home port) and country shown on its registration documents and lettered on the stern of the ship's hull.	
	Vessel IMO or Lloyd's number	Record vessel IMO number. This is the number allocated to the vessel when registered to the International Maritime Organization of the United Nations (e.g.: IMO8814275).	FIELD FORMAT TO BE DEFINED
	International radio call sign (IRCS)	Record vessel radio call sign if available. This is the number displayed prominently on the vessel's side or superstructure.	
	Vessel registration number	Record the number issued by the country in which the vessel is registered, shown on its registration documents, and written on the hull of the vessel. This may be a combination of characters and numbers; record them all (e.g.: CBG303).	
	Vessel phone and email	When available, record vessel contact details, taking note of the ocean region code. A vessel may have several contact numbers and email addresses depending on the satellite communications systems installed onboard.	FIELD FORMAT TO BE DEFINED
	Registered owner	Record the owner's name, nationality, and contact details in full.	FIELD FORMAT TO BE DEFINED
	Charterer / operator	Where the vessel has been chartered and is operated and managed by a company other than the owner, record the operator's full name (company or individual as appropriate), nationality, and contact details.	FIELD FORMAT TO BE DEFINED
		Trip Level Data	
	Trip number	The trip number for the vessel for the year starting at 1 for the first trip of the year	
	Gear type	L - Longline, S - Purse Seine, P - Pole and Line	Note that the program is initiating with LL vessels. Purse Seine and Pole and Line vessels may be included in the future.
	Port of departure, or the departure from the	Port of departure, or the departure from carrier vessel immediately after an at-sea transshipment	

	"carrier" vessel immediately after an at-sea transshipment event (coordinates of at-sea transhipment).	event, and this field will be "AT SEA" and the coordinates of the 'at sea' transhipment will be generated.	
	Date and time of departure from port, or the departure from the "carrier" vessel immediately after an at-sea transhipment event.	The date and time the vessel leaves port to start its fishing campaign, or the date and time of the departure from a carrier vessel immediately after an at-sea transhipment event.	
	Date and time of unloading, or the arrival at the "carrier" vessel just before an at-sea transshipment event.	The date and time the vessel returns to a port after a fishing trip, or the date and time of the arrival at the carrier vessel just before an at-sea transhipment event.	
	Port/place of unloading, or the arrival at the "carrier" vessel just before an at-sea transshipment event. (Coordinates of at sea transhipment)	Port where the vessel returns, or the arrival at the carrier vessel just before an at-sea transhipment event (Coordinates of at sea transhipment) and this field will be "AT SEA".	
	Primary target species	Provide the primary target species for the trip	
	Total Sets	Indicate the total number of sets for the trip	
	Sets reviewed	Indicate the total number of sets reviewed for the trip	
Fishing Activity			
	Trip Identifier	Internally generated trip identifier	Vessel Identifier + Departure Date
	Set Identifier	Internally generated activity identifier	Vessel Identifier + Date + Start Time of Set
	Selected for Review	Yes or No if the set was selected for review (either in initial 20% or as a replacement for an unreviewable set)	
	Set Reviewed	Yes, No, or Partial if the set was reviewed	
	Start time of set	This is the date and time the first buoy enters the water to start the setting of line	
	Latitude of start of SET	GPS reading at time first buoy enters water	
	Longitude of start of SET	GPS reading at time first buoy enters water	
	Date and time at end of SET	UTC date and time a the time the last buoy enters the water	
	Latitude of end of SET	GPS reading at time last buoy enters water	
	Longitude of end of SET	GPS reading at time last buoy enters water	

	Latitude and longitude of start of HAUL	GPS reading at time first buoy is hauled from the water	
	Date and time start of start HAUL	UTC date and time first buoy is hauled from the water	
	Date and time of end of HAUL	UTC date and time the last buoy of the mainline is hauled from the water onto the deck to indicate end the haul	
	Latitude and longitude of end of HAUL	GPS reading at time last buoy is hauled	
	Hooks Between Floats	Number of hooks between floats or number of hooks per basket. PROTOCOL is to count hooks from first 3 baskets, middle 3 baskets and last 3 baskets and the average HOOKS per BASKET (successive floats) can then be determined. Note that this does not need to be measured on every set, and can be assumed static for the trip after measuring at least 3 sets.	
	Total number of baskets or floats	Number of baskets set; usually it is the same as the number of floats set minus one	
	Total number of hooks used in a set	Total number of hooks set, calculated by multiplying the number of baskets by number of hooks between floats.	
	Target species	Primary target species of the set	The most abundant species of the set.
	Bait Species	Primary bait species used, may specify multiple species	
	Offal discharge	Was offal discharged during the set (Y/N)	
	Strategic offal management	Were strategic offal management practices used?	
	Tori lines deployed	Was a tori line deployed during setting of gear	Yes or no
	Number of tori lines deployed	The total number of tori lines deployed during the setting of gear. To be checked twice during each setting event.	Unknown: The analyst could not determine if Tori lines were in use. No: Tori lines observed. One: Tori line observed. Two: Tori lines observed. Three: Three tori lines observed
	Other mitigation measures used	Record any other mitigation measures observed (Y/N)	Yes or no
	Description of other mitigation measures used	Text description of other mitigation measures observed (e.g., circle hooks)	FIELD FORMAT TO BE DEFINED
	Observer present	Yes or no	

EM Quality Events			
	Trip Identifier	Internally generated trip identifier	Vessel Identifier + Departure Date
	Set Identifier	Internally generated set identifier	Vessel Identifier + Date + Start Time of Set
	EM Quality identifier	Internally generated EM quality event identifier	Vessel Identifier + Date + Start Time of Set + Event Time
	Event Start Date and Time	UTC start date and time of event	
	Event End Date and Time	UTC end date and time of event (Optional if a single point event)	
	Event Category	(CREW, EM SYSTEM, VIDEO QUALITY)	
	Event Code	(e.g., Camera system not maintained, blocking camera view, video gap, sensor gap, cameras out of position, poor lighting)	EVENT CODES TO BE DEVELOPED
Catch Identification			
	Trip Identifier	Internally generated trip identifier	Vessel Identifier + Departure Date
	Set Identifier	Internally generated set identifier	Vessel Identifier + Date + Start Time of Set
	Catch identifier	Internally generated catch identifier	Vessel Identifier + Date + Start Time of Set + Catch Event Date + Catch Event Time
	Catch Date and Time	Date and time when the catch is brought onboard or if not landed, when it is released or struck off.	
	Latitude of catch event	GPS reading at catch event (as recorded by EM equipment)	
	Longitude of catch event	GPS reading at catch event (as recorded by EM equipment)	
	Species code	FAO code of species caught (http://www.fao.org/fishery/static/ASFIS/ASFIS_sp.zip)	Alpha Code: e.g. YFT
	Length	Measured length using the calibrated digital measuring tool (No length measurement required for secondary non-target species)	
	Length measurement code		
	Fate	Is the fish retained or discarded	1. RET Retained - Kept for commercial or crew consumption. 2. DIS Discarded - Landed and not retained.

	Condition at capture	For species of special interest only	
	Condition at release	For species of special interest only	
	Catch handling	For species of special interest only, were WCPFC bycatch handling guidelines followed	Yes or No
Potential Compliance Events			
	Trip Identifier	Internally generated trip identifier	Vessel Identifier + Departure Date
	Compliance Event Identifier	Internally generated pollution incident identifier	Vessel Identifier + Departure Date + Incident Date/Time
	Incident date and time	Date and time of a marine pollution event observed during review of sets and hauls.	
	Latitude of the compliance event	Latitude where the event occurred	
	Longitude of the compliance event	Longitude where the event occurred	
	Category Code of the Compliance Event	MARPOL Pollution, Targeting Unlicensed Species, Social/Criminal Events (e.g., physical abuse), Illegal Gear (e.g., Wire Trace), Transshipment Event, SSI Interaction	EVENT CODES TO BE DETERMINED
	Description of Potential Compliance Event	Text description of the potential compliance event (e.g., physical abuse, presence of firearms, injury, shark finning, wire trace)	

A:2.2 Future Labor Monitoring

It is of high value to Supply Chain Sponsors that the EM program is eventually able to monitor reasonable aspects of onboard labor and safety conditions. The goal of this aspect will be to increase the value of EM by increasing coverage and certainty on high priority aspects of Supply Chain Sponsor codes of conduct without significantly increasing the cost of EM service.

It is expected that when the video review and analysis contract goes to rebid three years into the EM program, a more detailed labor monitoring standard may be included in program standards, and it is expected that a higher weighting will be placed on innovative and high-value labor monitoring products. Potential labor monitoring fields could include: accident and abuse identification, use of PPE, crew verification, average daily fishing hours per crew member, days at sea, and other verification of compliance with Supply Chain Sponsor code of conduct or EM program obligations. Labor standards for future contract rebid will be developed by the EM Program Coordinator with guidance from the Program Steering Committee. In developing the reporting standards for this program, the Program Coordinator will work with EM Service Providers to understand where EM can be used to

cost-effectively monitor labor standards according to Supply Chain Sponsor codes of conduct and EM program obligations.

It is possible that Supply Chain Sponsor companies may request that the EM Service Provider conduct additional labor monitoring pilots within the three/four years of the program. Fees associated with those pilots will be contracted separately (e.g., additional cameras, additional review time).

A:2.3 Catch Reporting Data Standards

EM Service Providers must provide data on the number of catch events and species caught (See Appendix 2. Data Outputs to Be Provided by EM Service Provider). The species can be broken down into four main categories:

1) Target species

2) Primary non-target species

3) Secondary non-target species

4) Endangered, Threatened, and Protected Species

The tables below outline the key species that fall within these categories and the expected data quality standards for catch events. The primary catch monitoring objective of the EM program is to obtain data on target species, primary non-target species, and ETP interactions. Longline tuna fisheries catch a wide range of species and EM Service Providers should attempt to identify all species, but greater effort should be expended on identifying target, primary non-target, and ETP catches. Species identification may be challenging in some individual cases or for some groups (e.g., turtles); in these cases analysts should identify the species at the lowest taxonomic level possible. Analysts should not guess at species identification if there is significant uncertainty. If catch items cannot be identified to species level then they should be recorded to group level (e.g., *Tuna Species* or *Sharks or Rays).* Species that cannot be identified to group level (e.g., cut off underwater or outside the view of the cameras) should be reported as *Unidentified Catch Item*.

Target Species

Unless otherwise indicated, the following species are designated target species for longline vessels for this program.

Common Name	Scientific Name
Albacore tuna	Thunnus alalunga
Bigeye tuna	Thunnus obesus
Yellowfin tuna	Thunnus albacares

Primary Non-Target Species

Unless otherwise indicated, the following species are designated primary non-target species for longline vessels in this program. These species either make up more than 5% of the catch or have a management plan in place.

Common Name	Scientific Name
Swordfish	Xiphias gladius
Saury	Cololabis saira
Striped marlin	Kajikia audax
Skipjack tuna	Katsuwonus pelamis
Pacific bluefin tuna	Thunnus orientalis

Secondary Non-Target Species (Selection of Species)

These species make up less than 5% of catch and do not have a management plan in place. The following is a selection of secondary non-target species, but there are many more that are incidentally caught in tuna longline fisheries.

Common Name	Scientific Name
Blue marlin	Makaira nigricans
Pelagic stingray	Pteroplatytrygon violacea
Wahoo	Acanthocybium solandri
Mahi mahi	Coryphaena hippurus
Oilfish	Ruvettus pretiosus
Opah	Lampris guttatus
Black marlin	Istiompax indica

Indo-Pacific sailfish	Istiophorus platypterus

Endangered, Threatened, and Protected Species

Accurate accounting of ETP interactions is of critical importance to the EM program. Insufficient data on ETP interactions has been flagged as an issue in MSC pre-assessments of longline tuna fisheries. The EM program must collect accurate and verifiable data on ETP interactions to support sound management decisions or meet the requirements of the MSC standard. The table below is a selection of ETP species that may be caught in tuna longline fisheries.

Common Name	Scientific Name
Olive ridley turtle	Lepidochelys olivacea
Green turtle	Chelonia mydas
Hawksbill turtle	Caretta caretta
Leatherback turtle	Dermochelys coriacea
Flatback turtle	Natator depressus
Sea birds	N/A
Silky shark	Carcharhinus falciformis
Giant manta	Mobula (Manta) birostris
Mobula, nei	Mobula spp.
Blue shark	Prionace glauca
Oceanic whitetip shark	Carcharhinus longimanus
Longfin mako shark	Isurus paucus
Shortfin mako shark	Isurus oxyrinchus

Porbeagle shark	Lamna nasus
Thresher sharks	Alopias spp.
Hammerhead sharks	Sphyrna spp.
Black footed albatross	Phoebastria nigripes
Antipodean albatross	Diomedea antipodensis
False Killer Whale	Pseudorca crassidens
Sperm Whale	Physeter macrocephalus
Short-Finned Pilot Whale	Globicephala macrorhynchus
Common dolphin	Delphinus capensis
Melon-Headed Whale	Peponocephala electra

Data Performance Standards

EM Service Providers are expected to meet the following data performance standards for catch events, which will be validated through the third-party audit process as outlined in Appendix 3. These performance standards will be continually evaluated and adjusted as more data becomes available through program implementation with an eye towards balancing the cost and feasibility of meeting these performance standards with the data requirements of the program.

Catch Type	Data Element	Required Alignment with Third-Party Audit Review
Total	Total count of retained catch events	+/- 5%
Total	Total count of non-retained catch events	+/- 5%

Target Species	Total count of retained target catch	+/- 5%
Target Species	Total count of retained target catch by species	+/- 10%
Target Species	Total count non-retained target catch	+/- 10%
Target Species	Total count non-retained target catch by species	+/- 20%
Primary Non-Target Species	Total count of retained primary non-target catch	+/- 5%
Primary Non-Target Species	Total count of retained primary non-target catch by group (e.g., tuna, billfish)	+/- 5%
Primary Non-Target Species	Total count of retained primary non-target catch by species	+/- 10%
Primary Non-Target Species	Total count of non-retained primary non-target species	+/- 10%
Primary Non-Target Species	Total count of non-retained primary non-target catch by group (Tuna, billfish)	+/- 10%
Primary Non-Target Species	Total count of non-retained primary non-target catch by species	+/- 20%
Secondary Non-Target Species	Total count of secondary non-target catch by group (e.g., tunas, billfishes, rays, other bony fishes)	+/- 25%

ETP Species	Total ETP Catch Events	+/- 10%
ETP Species	Total turtle catch events	+/-10%
ETP Species	Total shark catch events with species brought onboard identified to the species level	+/- 10%
ETP Species	Total shark catch events not brought onboard identified to the lowest order practicable	+/-20%
ETP Species	Total seabird catch events	+/- 20%
ETP Species	Total marine mammal catch events by species	+/- 10%

A:2.4 Raw EM Video and Data Standards

No more than 20% of the sets selected for review may have EM system or video quality issues flagged that prevent a full review of the set. EM quality issues due to crew failure to meet their EM duty of care or vessel monitoring obligations will not be included in this calculation. If the quality of raw EM video and data falls below this standard, the EM Service Provider must develop an improvement plan. This plan must be presented to the EM Program Coordinator who will approve implementation. If raw EM video and data quality continue to fall short of this quality standard, the fishing company/vessel may withhold payment for sets that are of insufficient quality for EM review and the supply chain sponsor withholds incentives for supplying raw material caught with EM.

A typical longline vessel will make approximately 180-250 sets per year which means that an average of 36-50 sets per vessel will be flagged for EM review. Based on this “typical vessel” and quality standard, between 9-12 sets selected for review may have insufficient quality for accurate analysis and be replaced with a substitute set for review and still meet the performance criteria.

Appendix 3. Third-Party Audit

The EM program will include a third-party audit to ensure that program participants are meeting their obligations and contract requirements.

A3.1 Auditing of Annotated EM Data from EM Service Providers

A Third-Party Auditor will review annotated fishing trip data from EM Service Providers to ensure that they are meeting the performance standards of the program. The EM Service Provider must provide the Third-Party Auditor with random samples of annotated data from EM Service Providers and the associated raw data and video files. The random sample will be selected by the Third-Party Auditor, and the Data Manager may facilitate the selection process. Audits will cover up to 10% of the trips reviewed by the EM Service Provider in a calendar year. For selected trips, the Third-Party Auditor will review the EM video and sensor data using an EM video review software platform and generate an independent trip report. This trip report will be compared against the trip report generated by the EM Service Provider and the Auditor will generate a summary report that compares the trip data, including percentages of misalignment and whether or not the EM Service Provider performance has fallen below the thresholds identified in Appendix 2. The report will include a comparison of all data outputs, including:

1. Vessel information data
2. Vessel activity data
3. Fishing activity data
4. Catch data
6. Compliance event data
7. EM quality event data

The Third-Party Auditor will conduct a summary audit of each EM Service Provider every year. The annual audit report will summarize alignment of all the Third-Party Auditor's EM review with the EM Service Provider's review across all data outputs and highlight the degree of misalignment between the primary review and audit. One report will be generated for each EM Service Provider servicing the program and will be shared with the Data Manager, who will share them with the Supply Chain Sponsor, the EM Program Coordinator and the EM Service Provider.

EM Service Providers participating in the program will be required to supply the Third-Party Auditor with training and review software, licenses, and encryption keys and/or provide necessary information about their raw EM video and data files to allow the Third-Party Auditor to perform the auditing function.

A3.2 Response to Discrepancies in Trip-level Audit Reports

Data elements that are found to be out of alignment on an individual trip will be flagged in an audit report that will be shared with the Data Manager, who will share the report with the Supply Chain Sponsor, EM Program Coordinator, and the EM Service Provider. The following actions should be taken if alignment of data on a single trip between the EM Service Provider and the Third-Party Auditor falls outside of the performance standards:

1. **ETP catch events** – If estimates of ETP interactions fall outside of specifications, the Data Manager will request that the EM Service Provider review the EM video in question and review instances where only one of the two reviewers identified an ETP event or the EM Service Provider and Third-Party Auditor allocated

the ETP event to a different group or species. The EM Service Provider **must** provide a summary of their additional review of ETP catch events to the Data Manager diagnosing the discrepancies between the Third-Party Auditor and the EM Service Provider's initial review and improvement recommendations.

2. **All other events** – Lack of alignment across other categories will be flagged as opportunities for improvement to both the EM Service Provider and the Third-Party Auditor. No immediate action will be required from a lack of alignment on a single trip, but repeated lack of alignment across a category will trigger a review of the performance standard, the performance of the EM Service Provider, and the performance of the Third-Party Auditor (see annual audit reports below).

A3.3 Response to Discrepancies in Annual Audit Reports and Improvement Measures

As a result of the findings of the annual audit report, the EM Program Coordinator may request the following as remediation actions by the EM Service Provider. These activities will not be compensated but will be required as part of the EM Service Provider's contract with fishing companies/vessels.

1. ETP catch events – If the alignment of the EM Service Provider and Third-Party Auditor annotated fishing data for ETP interactions falls outside the performance standards, the EM Service Provider ***must*** complete a diagnosis of the issue and put forward an improvement plan, which may include a recommendation to adjust the performance standards. The EM Program Coordinator will consider the proposed improvement plan and determine the final response.

2. Target or primary non-target catch – If the alignment of the EM Service Provider and Third-Party Auditor annotated fishing data of target or primary non-target catch fall outside the performance standards, the EM Program Coordinator ***may*** *require* the EM Service Provider to complete a diagnosis of the issue and put forward an improvement plan, which may include a recommendation to adjust the performance standards. The EM Program Coordinator will consider the proposed improvement plan and determine the final response.

3. Secondary non-target catch – If the alignment of the EM Service Provider and third party Auditor and EM Service Provider on secondary non-target catch species the the EM Program Coordinator ***may*** require the EM Service Provider to complete a diagnosis of the issue and put forward an improvement plan, which may include a recommendation to adjust the performance standards. The EM Program Coordinator will consider the proposed improvement plan and determine the final response. ***It is unlikely that significant effort will be invested in improving alignment of secondary non-target catch data***.

4. Other data elements (vessel information, vessel activity, fishing activity, marine pollution, labor incidents) – If there is significant misalignment of the EM Service Provider and Third-Party Auditor reviews of these data outputs, the EM Program Coordinator ***may*** require the EM Service Provider to complete a diagnosis of the issue and put forward an improvement plan, which may include a recommendation to adjust the performance standards. The EM Program Coordinator will consider the proposed improvement plan and determine the final response.

A3.4 Auditing of the Data Manager

The Data Manager must complete an annual audit of its data management practices to be shared with the Program Coordinator. This audit will review data management architecture, security, access management,

backup practices, procedures, etc. to ensure that the Data Manager is taking appropriate measures to store, manage access, and ensure quality of program data. The audit of the Data Manager must be made available to all Supply Chain Sponsors and EM Service Providers.

Appendix 4. Example EM Trip Report Template

The following EM trip report is an illustrative example of a trip report that will be created for this program.

ELECTRONIC MONITORING TRIP REPORT

Vessel Name: XXXX

Data Set Reviewed Dates: XXXXXXXX

Purpose: The purpose of the report is to describe the fishing activities carried out from XXX to XXX by the XXXX owned by XXXX. XXXXx

Publish Date: XXXX

Prepared by: EM EM Service Provider Analyst Name

Contents

1. Main Electronic Monitoring Trip Report Takeaways

- *The EM system was operational for all trips and video data was recorded for all fishing events.*
- *The data review showed that over time accumulated ocean spray and water spots reduced the video quality to the point where some cameras were unusable.*
- *Could the crew ensure the cameras are cleaned more frequently as it would assist the review.*
- *Catch handling was undertaken within camera view and there were no obstruction issues.*

2. Vessel Details

Vessel Name	
Vessel Owner	
Vessel Operator	
EEZ or high seas area fished	
Hard Drive Disk (HDD) Numbers	

3. Trip Summary

Map	
Trip date start & port departure	

Trip date end & port return	
# of days in the EEZ	
# of days outside EEZ	
# of sets undertaken in trip	
# of sets successfully recorded in trip	
# of sets analyzed	
Trip Summary *Issues with EM systems or fishing operations (bycatch handling, hardware issues, video loss, difficulties identifying species, etc.)*	

4. Catch Summary *(for each set analyzed)*

Set Date, Time, Latitude and Longitude

Common Name	# Retained	# Discarded	# Total	# Retained	# Discarded	# Total
	EM Data			Logbook Data		
Target Species						
Albacore						
Bigeye						
Yellowfin						
TOTAL						
Non-Target Species						
Skipjack tuna						
Pacific bluefin tuna						
Swordfish						
Striped Marlin						
Mahi Mahi						
Tuna Species						
Skates and Rays						
Species x						
Species y						
Species z						

TOTAL						
Unidentified Catch Item						
Endangered, Threatened, & Protected Species						
Turtle sp.						
Silky Shark						
Blue Shark						
Oceanic Whitetip						

5. Potential Violation Summary

Events Occurring	#	Notes and Details	Link to Image and Video File
Improper Catch Handling Techniques			
Garbage Overboard			
Pollution			
Transshipments			
Crew Abuse and/or Social Welfare Abuses			

6. Changes and Improvements Needed by Stakeholders

Change Needed	Description	Who needs to be notified?	Responsible Party?	Notification Date	Confirmation received by who & when	Date problem fixed
INDUSTRY						
Cleaning of lenses						
Adjust cameras						

Bring fish across measurement area of deck						
Bycatch handling procedure						
FISHING AUTHORITY						
EM SERVICE PROVIDER						

7. Appendix

8. Maps
9. Methodology
10. Auditing entity information
11. Detailed trip data
12. Detailed catch data
13. Detailed compliance data
14. Images and Video of target catch
15. Images and Video of Bycatch
16. Images and Video of compliance events

Appendix 5. Compliance Notification Requirements

The EM Service Provider shall complete a compliance notification report for each trip where a compliance event is observed. This report shall be shared with the Data Manager within 24 hours of completion of trip review.

Failure to Maintain E-Monitoring Equipment
Where poor maintenance of equipment (e.g. dirty cameras) results in unusable video data this should be reported as a 'compliance notification' report.

Interference with E-Monitoring Equipment
Wherever it is suspected that the crew have deliberately attempted to interfere with the effectiveness of e-monitoring equipment, for example through deliberate obstruction or movement of cameras, removal of sensors, etc., this should be reported as a 'compliance notification' report.

Non-Report Listed Species or ETP Interactions
Failure to report interactions with Endangered, Threatened, or Protected (ETP) species (e.g., turtles, seabirds) is a serious offense. Failure to record these interactions on logbooks should be reported as a 'compliance notification' report.

Non-Reported Set/Haul
Failure to report/record a set/haul or fishing event, where detected through routine analyses, should be reported as a 'compliance notification' report.

Gear Violations
Instances of gear violations should be reported as a 'compliance notification' report**.** These include:

- The use of fishing methods other than that which the vessel is licensed to use (e.g., rod and line or pots)
- Failure to deploy RFMO required mitigation devices (e.g., bird scarers, tori lines)

Mistreatment of Bycatch
The intent of this section is to require the reporting of unnecessarily or intentionally harmful treatment of any catch that is returned to the water.

If actions that include (but not limited to) 'clubbing/hitting', shooting, stabbing, or maiming of species are observed in a context which seems intentionally and unnecessarily harmful and are not undertaken in accordance with the bycatch handling principles, these should be reported as a 'compliance notification' report.

Appropriate bycatch handling will be defined by the WCPFC guidelines and ISSF Best Practice Handling techniques, including:

1. Turtles - https://www.wcpfc.int/file/83783/download?token=pent64F6
2. Sharks - https://www.wcpfc.int/file/227059/download?token=oVs47f7K
3. Seabirds - https://www.wcpfc.int/file/372654/download?token=xwqdU6h7
4. ISSF Longline Guidelines - http://www.issfguidebooks.org/longline-2-title

Loss of Gear

Where it is evident that fishers have lost a significant amount of gear (e.g., long section of longline) this should be reported as a 'compliance notification' report. Loss of small items (e.g., individual hooks) need not be reported.

Violence and Assault

Any instances of suspected violence or assault should be reported as a 'compliance notification' report.

Pollution

The *International Convention for the Prevention of Pollution from Ships (MARPOL)* is the main international convention covering prevention of pollution of the marine environment by ships from operational or accidental causes.

Any instances of obvious intent to discharge plastic, fishing gear, and oil into the water should be reported as a 'compliance notification' report .

Accidental instances of low-scale pollution from vessels, such as a glow stick washing over the side, do not need to be flagged.

Presence of Firearms

The presence of any firearms on a vessel should be reported as a 'compliance notification' report.

Compliance Notification Template

Vessel Name	
Vessel ID	
Data Disk Identification	
Video File Name	
Time Offset (from UTC)	
Date	
Time (UTC)	
Latitude / Longitude	
Category	
Description	A short summary of what was observed by the reviewer that led them to decide it was a 'compliance notification' event.

Appendix 6. Dispute Resolution

In the event of a dispute, for example a disagreement between a fishing company and an EM Service Provider as to whether appropriate ETP catch handling protocols were followed, all involved parties should seek amicable resolution. If an agreement can not be reached, the EM Program Coordinator may provide a decision on the matter in question. All program participants must abide by the final decision of the EM Program Coordinator.