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QUALITY ASSURANCE CONSIDERATIONS FOR ELECTRONIC MONITORING DATA SUBMISSIONS

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Executive Summary

As the WCPFC Commission lays the groundwork to incorporate EM data into its scientific and compliance processes, careful planning is required to ensure that the quality of EM data submissions is adequate for the work it will support. As the Commission has matured relative to data provisions and standards, the benefits of standardized, quality-controlled processes have been demonstrated. Although the SSP is not currently receiving EM data from CCMs, this paper briefly discussed suggested work flows for EM data in order to vet the data against minimum data quality standards and to minimize the time required to process these data to support the work of the Commission.

The SSP has already developed data quality assurance tests and APIs for data submitted to Tufman2 (e.g., logbook, observer, etc.). This framework has proven effective and can be applied to EM data with the support of CCMs and EM service providers. With EM, as data will be generated from video footage, data quality should be reviewed as close to the source as possible, as the identification of data quality issues later in the process will require increasingly more time and money to revert back to the raw footage, if necessary, to address data issues. Therefore, we propose collaborative development of increasingly robust data quality checks for EM data to be integrated by EM service providers into their software for the EM analysis and review process to identify and address potential errors as early as possible. The SSP has developed a data quality assurance (DQA) API which can be targeted to review data during the preparation stage or at the time of submission. Use of the DQA API (or the logic contained within) in conjunction with the EM data submission standards will ensure efficient, timely, and robust EM data submissions. Further development of data quality assurance processes and work flows will be progressed through the ERandEMWG.

Introduction

Electronic monitoring (EM) data has not yet been fully integrated into the work of the Western and Central Fisheries Commission (WCPFC); however, progress has been made toward developing interim standards, specifications, and procedures (SSPs) and data standards to support effective implementation. One of the key aims for EM in the WCPFC is to increase monitoring capacity in the longline fishery where observer coverage remains low (mandated at 5%). In 2023, the tropical tuna Conservation and Management Measure (CMM) was revised to include a provision for the use of EM to increase observer coverage, commensurate with an increase in the bigeye catch limit (see Table 3 of Attachment 1 in CMM 2025-02). At the 22nd Regular Session of the Commission in 2025, the Commission agreed that although the use of EM is permitted in the CMM, the Commission has yet to determine the details around how EM programmes and data will be evaluated; therefore, implementation will rely on the work progressed through the EM and ER Working Group (ERandEMWG) and future decisions by the Commission.

The ERandEMWG has recently been focussed on developing a framework for EM programme assurance. In order for EM implementation to be successful and provide timely data for scientific and compliance needs, there also needs to be considerations around the assurance of data quality. In recent years there have been discussions at the Scientific Committee (SC) and Commission level around the challenges with timeliness of the availability of data and meeting papers to support the work of the Commission (e.g., Pilling et al., 2026). There have also been initiatives aimed at improving data work flows as one approach to reduce the time required to process and prepare data for use by the Commission (e.g., Schattschneider et al., 2026); the implementation of standardized reporting templates in particular has demonstrated the value of structured and streamlined data exchange.

When considering the reception of EM data, the Scientific Service Provider (SSP) aims to ensure that data received have been obtained and prepared in accordance to Commission guidelines, are structured in a standardized format for easy processing, and meet minimum data quality standards. Other studies have demonstrated the importance of establishing standards around data, generally, to prevent errors early in the data generation process (Geoghegan, 1996) in order to promote data accuracy, completeness, consistency, and credibility of these data (Miller et al., 2025); these considerations have direct implications for EM data as well. Together these criteria will enable timely processing of data and minimize the time spent reviewing and corresponding with data providers to address potential issues. To support an efficient data flow between EM service and data providers and the SSP, we have outlined in this paper some considerations for the SC and the ERandEMWG to consider regarding data submission standards and quality, existing frameworks that could be leveraged to implement quality assurance processes (DQAs), and recommendations to progress toward EM implementation in a structured, efficient, and cost-effective manner.

Table 1: Current anticipated EM workflow to Tufman2, as understood by the SSP

Stage	Actor	Current Status
1. EM records captured on vessel	EM Service Provider	Functioning in active EM deployments
2. Footage analysed; EM data produced	EM Analyst	Occurring, but inconsistently against data standards
3. Data quality review	EM Data Quality Reviewer	Draft protocols exist; not yet systematically applied
4. DQC-API screening prior to transmission	EM Service Provider / SSP	Available but not yet used by EM service providers
5. Transmission to Tufman2 via API using JSON format	EM Service Provider/SSP	No transmissions yet received using this process
6. Cross-validation with logsheets, observer data	SPC (SSP)	Linking processes are operational, but validation processes not yet applied

Data flow

EM trials in the western and central Pacific Ocean have provided insights about the capability of EM to produce data capable of supporting conservation and management objectives (Emery et al., 2018; Gilman et al., 2020; Brown et al., 2021). At present, the SSP is not receiving EM data from CCMs; however, historically the SSP has received some EM data, largely as part of EM trials (see The Secretariat and SPC-OFP, 2025). Given the absence of EM data, it has not been possible to fully develop data quality assurance procedures. Even so, there are Interim EM Standards adopted by the Commission, which offers a framework for the development of data quality assurance procedures. Below, we describe the anticipated EM data flow and where the proposed data quality procedures could be implemented to support efficient and robust EM data exchange, acknowledging that various EM operations have employed different data quality protocols (e.g., Cahalan et al., 2010; Ulrich et al., 2015; Pierre, 2018).

Data generation

EM data are expected to be generated through an approved EM system including hardware installed on the vessel, software to obtain and process the raw footage, and a robust review process based on Commission SSPs to produce a processed EM data set to be submitted to the SSP. Kearney et al. (2019) provide general best practice guidelines for data quality to be applied across the entire flow of data from data generation to preparation for analysis, which for EM would span from the footage captured on the vessel to the final data integration in Tufman2. These data are expected to be submitted to the SSP via a standardized data exchange protocol.

None of the EM data submitted to the SSP as part of the EM trials have passed the basic data quality checks currently in place; however, it should be noted that the minimum data standards upon which these checks have been developed were not in place at the time of the EM trials, but it does demonstrate the existing gaps between the data submitted to date and the agreed minimum standards. Therefore, to ensure subsequent data received by the SSP adhere to the minimum data standards we propose to integrate the existing data quality verification checks into EM programs at the earliest possible stage in the data generation process.

Data quality verification options, in preferential order:

1. Integrate DQAs developed by the SSP into the EM software and data generation process. This would operationalize DQAs closest to the data source (i.e., the video). The aim is to incorporate verification checks on the data at the first stage of data generation by an EM Analyst (noting that some aspects of data generation can be done using AI) so that if issues are identified, the EM Data Quality Reviewer can easily refer back to the video footage, if necessary, to address the issue. Such an approach is anticipated to drastically reduce downstream errors which may delay or prevent data exchange altogether.

2. Incorporate DQAs at the data quality review stage. In the agreed SSPs, the data are expected to be first generated/prepared by an EM Analyst and then verified by an EM Data Quality Reviewer (a more experienced EM Analyst) to detect potential errors or discrepancies. If the DQAs are implemented at this stage, there may be several steps required to revert to the raw video footage to resolve an issue, which may require additional time compared with integrating these DQAs at the first stage of data generation.

3. A third option is for the DQAs to be implemented as part of the data submission preparation. At this stage it is assumed that data have been generated from the raw footage and reviewed sufficiently by the EM Analyst and Data Quality Reviewer. The SSP has developed data quality application programming interfaces (API) for all data sources that are submitted to Tufman2 (e.g., logbook, observer, etc.), including for EM data. The benefit of the DQA APIs is that CCMS for EM data providers can target the APIs as a check on the data prior to submission. These DQ APIs can be targeted independently of the submission process simply as a pre-submission verification step. This step is further removed from the data generation process, so if errors are detected at this stage, it is assumed it will require additional time and effort to address them.

4. Lastly, it is possible to implement the DQAs at the submission stage. Here, when EM data are submitted using the standardized JSON-formatted data submission structure, the API will return a summary of the data quality process, and if critical errors arise, the data will not be passed on for processing. Fatal errors are required to be addressed by the data provider. This step differs from #3 in that the DQA API is targeted as part of the submission process whereas in #3, the DQA API is targeted as a standalone check prior to data submission.

Based on this understanding of a simple EM work flow, the recommendation is to integrate the DQAs into the EM data generation process as close to the point of data generation as possible.

Data reception and cross-validation

Once data have been submitted to the SSP via the standardized submission process, they will be incorporate into Tufman2 and made available to CCMs, depending on agreed data visibility rules (as with other data sources). At this point in time, the SSP would be able to cross-validate EM data with other data sources (e.g., logbook, observer, and VMS), which may be a critical step in identifying discrepancies or potential errors in the data. Should errors arise during this cross-validation stage, considerable effort may be required to revisit the video footage, if necessary. There is ongoing work to develop Edge computing technology to conduct some of these cross-validations at the data source by comparing EM data with e-logbook data via an integrated EM software platform. However, as we do not yet have a full understanding of the anticipated elapsed time between a fishing event and the submission of EM data, and whether or not the original raw video footage will still be available at that time if a review is required.

Scientific review

The DQAs largely referred to in this paper include basic format checks (against the defined data standards) and simple range checks (e.g., dates and times, species catch volumes, size/weight relationships, etc.), but there are likely to be deeper assessments of these data as they are integrated into scientific and compliance evaluations. The potential issues arising from these more analytical explorations may not be apparent at the outset, but they can be incorporated into the DQA process iteratively and collaboratively. We can imagine a situation where there is a community of practice among EM service and data providers where, as issues arise, the SSP will be in a position to enhance the DQAs (which are publicly available) using an agreed structure, such that EM providers will be able to adapt their processes to easily incorporate increasingly robust validation procedures.

Future work

This paper outlines a high-level approach for the SC and CCMs to consider how to incorporate data quality assurance processes into EM data submissions to ensure EM programmes are as efficient as possible and producing reliable data while minimizing potential time and costs associated with prolonged review of EM data issues. We encourage CCMs and EM service providers to work with the SSP to ensure development and structure of the DQAs are able to be integrated into the data generation and review process at the earliest stage possible.

Once the SSP begins receiving EM data, these DQAs can be tested against contemporary data and iteratively refined to improve efficiencies, reliability, and usability of these data to support the work of the Commission. Recommendations to progress the implementation of EM data in the near-term

includes continuing to engage with the ER and EM Working Group to promote data quality assurance processes as an integral aspect of the SSPs.

Declaration of generative AI and AI-assisted technologies

Generative AI and AI-assisted technologies were not used in the preparation of this paper.

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