WESTERN PACIFIC REGIONAL FISHERY MANAGEMENT COUNCIL

Status of Development of Alternatives for FEP Amendment Implementing Electronic Monitoring in Pacific Islands Pelagic Longline Fisheries

EM Action Team Update for the 202nd Council Meeting
March 2025

Table of Contents

1. Introduction and Background

The Western Pacific Regional Fishery Management Council (Council) has promoted the use of electronic technologies (ET) for decades, and became the first in the nation to require vessel monitoring systems (VMS) in 1994. Electronic reporting (ER) trials in the Hawaii longline fishery started in early 2000s, and ER became mandatory in the Hawaii and American Samoa longline fisheries in 2021. Electronic monitoring (EM) refers to the use of technology, such as cameras and sensors, which may be used to monitor fishing activity through the collection of data and/or compliance with regulations. Development of EM in the region started with a Council-funded project in 2009, and subsequent projects led by the Pacific Islands Fisheries Science Center (PIFSC). Dozens of Hawaii longline vessels have voluntarily participated in the EM projects since 2009 with 20 actively participating vessels currently in Hawaii with none in the American Samoa fishery. To date, EM in the Western Pacific region has been a voluntary program dedicated to research and development, not for monitoring under statutory requirements.

In U.S. fisheries managed under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), EM has been applied to improve catch and bycatch accounting through verification of self-reported logbook data. EM systems have used cameras to record the amount and type of fish caught, retained, and discarded. EM can also be used to record incidental encounters with protected species such as turtles, certain species of sharks, mobulids, seabirds, marine mammals, and other animals with statutory protections. EM footage can be reviewed to confirm compliance, to help ensure that fishermen adhere to regulations, such as gear types, size limits, and seasonal closures. These data help to ensure that catch limits are not exceeded, monitor encounters with protected species, and provide insights into bycatch mitigation.

EM can play a role in ensuring consistency with other applicable laws including the Endangered Species Act (ESA) and the Marine Mammal Protection Act (MMPA). EM systems can record bycatch data to monitor the incidental catch of ESA-listed fish, sea turtles, seabirds, or marine mammals, which may be used to assess the impact of fishing practices on these populations.

Under regulations promulgated under the MSA, EM systems can help ensure that catch limits are adhered to by monitoring total catch and bycatch, thereby supporting sustainable fishery management practices. By documenting adherence to regulations, such as the use of approved gear and methods, EM can help fisheries comply with the MSA's goals of rebuilding overfished stocks and ensuring sustainable practices, including bycatch reduction. By integrating electronic monitoring into the management of fisheries, agencies can better ensure compliance with the ESA, MMPA, MSA, and international requirements, ultimately promoting the conservation of marine ecosystems and the species that inhabit them.

In addition to monitoring statutory requirements, EM systems can collect valuable data on fish populations, habitat conditions, and fishing practices, contributing to better management and conservation efforts. Using EM can reduce the costs associated with deploying human observers, making it more feasible for fisheries with in-season accountability measures, annual catch limits, trip limits, and smaller fishing operations to comply with monitoring requirements.

In outlining the regulatory considerations for implementing EM, the most important elements are those that the regulated fishing community must comply with. These may include, but are not limited to, the identification of EM system components and specifications, responsibilities for EM system installation and maintenance, requirements for data storage and submission and cost allocation. Many of these topics are discussed in the NMFS Electronic Technologies Policy Directive, Cost Allocation Procedure, and Implementation Plans. The Council and NMFS reconvened the electronic technologies steering committee in October 2022, which includes members from the industry that has provided advice relative to implementation of EM in the region.

2. Council Decisions and Recommendations to Date

At its 196th Council Meeting in September 2023, the Council recommended objectives for a Pre-Implementation Plan. However, in order to transition EM from a voluntary research and development tool to a use for monitoring under regulatory regimes, the Council will need to take action under a specified purpose and need. At its 196th Meeting, the Council recommended the Pre-Implementation Program prioritize EM in Hawaii Longline Fisheries, with a hybridized approach between the shallow-set and deep-set sectors, with a primary objective of EM for protected species monitoring and estimation and a secondary objective for discard accounting. At its 199th Meeting, the Council directed staff to work with NMFS PIRO and advisory bodies to explore regulatory considerations to utilize Electronic Monitoring (EM) for management as a means to supplement and/or fulfill data collection requirements as currently implemented through federal observers, including the following: a.) Objectives of observer and EM and levels of specificity, b.) Benefits and Issues of EM, c) Approaches to implementing EM, d.) Relationship between EM and human observer coverage, e.) Relationship between EM and (electronic) logbooks, f.) Costs, g.) Regulatory review of existing observer and logbook programs, h.) Contingencies and processes for EM data review and appeals. At its 200th

Meeting, the Council directed staff to finalize a draft information paper outlining regulatory considerations for implementing electronic monitoring for review by the Pelagic Plan Team and the Council at its 201st Meeting.

At its 201st Meeting, the Council directed staff to establish an Action Team to develop a proposal for the Pelagic FEP to authorize the use of electronic monitoring (EM) in pelagic longline fisheries with the objective to:

a. Authorize the use of EM to monitor and provide reliable estimates of protected species interactions with the Hawaii and American Samoa longline fisheries.
b. Phase in the use of NMFS-approved EM systems over a three year period (2025-2027) with NMFS funding, as an optional program to supplement the human observer program until permanent resources are available to fully implement a mandatory program.

The Council also requested NMFS and Council advisory groups, during the phase-in of EM, to work on:

1. Establish regional standards for NMFS-approved EM systems
2. Develop a statistically-robust and cost-effective EM data review process to improve precision of protected species interactions using EM data that could be reviewed by the SSC and Plan Teams.
3. Develop a checklist for tasks and timeline needed to implement a fully-mandatory EM program.
4. Provide regular status reports to the Council on the progress of EM development and implementation in the longline fisheries.
5. Develop elements needed for a vessel monitoring plan, which would describe camera configurations and catch handling requirements to ensure the EM systems are able to capture the necessary data images.

The Council also noted the need to provide outreach to the Hawaii and American Samoa vessel owners and therefore requested NMFS and directed staff to engage the Hawaii and American Samoa Longline vessel owners to provide information on the impacts of this action to their continued operation.

Since the Council's initial action at its 201st meeting in December 2024, the status of the human observer program and EM program development have rapidly evolved . The Council is expected to take final action at its 203rd meeting in June 2025. For the 202nd Council meeting in March 2025, the Council will be updated on progress of developing the alternatives to implement EM, considering new information and the direction and recommendations previously recommended by the Council.

3. Status of the Human Observer Program

The current mandatory at-sea human observer program, NMFS Pacific Islands Regional Observer Program (PIROP), was established to monitor the protected species interactions in the Hawaii longline fishery. The Council in 1993 recommended NMFS implement a mandatory observer program under the Pelagic Fishery Management Plan (FMP) Amendment 3 framework procedure for promulgating regulations to prevent harm to protected species (WPRFMC, 1993).

Observer coverage in the Hawaii longline fishery was between 3% and 5% from 1994 through 1999, increased to 10% in 2000, and to 20% in 2001. Since 2004, the shallow-set component of the Hawaii longline fishery has had 100% observer coverage. The deep-set component of the Hawaii longline fishery had a minimum of 20% coverage through 2019, fluctuated between 15-20% in 2020-2023, and was reduced to around 13.5% in 2024. The American Samoa longline fishery's mandatory observer program started in 2006, and its coverage has fluctuated over time, ranging between 6-8% in 2006-2009, 25-33% in 2010-2011, 15-22% in 2012-2019, and below 10% since 2020.

NMFS began reducing human observer coverage in the Hawaii deep-set longline fishery in 2023 as this fishery accounts for 80% of all longline trips and the majority of the PIROP costs. For 2025, NMFS's expected observer funding allocation is expected to allow for 7% coverage rate in the Hawaii deep-set fishery at 7% and maintaining shallow-set coverage at 100%. NMFS funding for PIROP for 2026 is not yet known.

Reductions in coverage will affect the sample rates needed for robust estimates of protected species interactions, particularly those that are encountered very rarely, such as false killer whales. Reduction in observer coverage to 7% brings the fishery closer to the minimum coverage of 5% required by the Western and Central Fisheries Commission (WCPFC) (CMM 2018-05) and likely to change the Southern Exclusion Zone closure trigger for false killer whales if further reduced to 5%. The shallow-set sector of the Hawaii longline fishery could remain at 100% observer coverage under the discretion of the Pacific Islands Regional Administrator and available funds. Cessation of human observer coverage would potentially put Pacific Islands longline fisheries at risk of non-compliance with domestic and international requirements.

Reduced observer coverage will fundamentally change the information available from the fishery, and may no longer support current and future scientific data needs such as fishery impact and ecosystem analyses or provide the information required for management. Reduced precision in estimates of rare events - like interactions with protected species - will directly affect management of this fishery in the medium and long term. As an example, a 7% and subsequent reduced observer coverage will further reduce the number of observed interactions with protected species and the ability to reliably estimate the number (Ahrens and Crigler 2024) and mortality and serious injury (50 CFR 229.7) of fleet-wide interactions as required by Biological Opinions under the ESA and in MMPA regulations. Overall, there is a growing need for electronic monitoring as a tool in the management of Pacific Islands longline fisheries, supporting sustainability and informed decision-making. NMFS is investing in EM because it is a cost-effective technology to meet FEP fishery monitoring requirements in combination with the existing logbook reporting requirement.

4. Status of EM in the Pacific Islands Region Longline Fisheries

Since the Council's 201st Meeting in December 2024, NMFS has secured dedicated funding to begin operationalizing EM in the Hawaii and American Samoa longline fisheries, which will provide support for equipment and its maintenance, installation and training , data review and storage, and program administration.

NMFS has also established a collaborative partnership with the Pacific States Marine Fisheries Commission (PSMFC) to help advance all aspects of EM including data collection, data storage,

data review/analysis, data access (consistent with data confidentiality laws and policies) and technical support to fishing vessels.

While the Council works to develop an FEP amendment to authorize the use of EM in the longline fisheries, NMFS plans to work with PSFMC, Council, industry and other partners to expand the number of Hawaii longline vessels voluntarily carrying EM systems. NMFS' initial goal would be to review 20% of all deep-set longline and 100% of all shallow-set longline trips through EM, with review rate increasing as funding allows.

NMFS anticipates a three-year time period between 2025-2027 for operationalizing EM, with the goal of EM being fully operationalized by 2028. The current draft timeline is as follows:

- 2025
    - Begin EM outreach engagements with the Hawaii longline fleet starting April 2025 to inform vessel owners and operators on the use of EM and transition from observers to EM
    - Starting in fall 2025, begin deployment of the first 50 EM systems (on a voluntary basis if regulations are not yet in place)
    - Establish the database and data management infrastructure.
- 2026
    - Begin EM data review
    - Continued deployment of another 50 EM systems (on a voluntary basis if regulations are not yet in place)
    - Initiate engagement with the American Samoa longline fleet
- 2027
    - Continue EM data review
    - Continued deployment of another 50 EM systems (on a voluntary basis if regulations are not yet in place)
    - Begin deployment of EM systems in the American Samoa longline fleet

5. Draft Purpose and Need

Given the decline in the use of human observers in 2024, 2025, and beyond due to increasing costs of the program and a decrease in available funding, there is a need to transition the existing EM program from an experimental and research tool to a mandatory program that can address monitoring requirements in Pacific Island fisheries. The implementation of an electronic monitoring program that can support monitoring requirements is currently the highest priority for management of the Pacific Island fisheries.

The purpose for Council action is to transition EM from a voluntary program dedicated to research and development, to an authorized fishery monitoring mechanism that can be incorporated in existing data monitoring systems. Primarily, as an authorized monitoring mechanism, EM can provide statistically robust (and reliable) estimates of protected species interactions and discards/bycatch in Hawaii and American Samoa limited entry longline fisheries (Carnes et al., 2019; Stahl and Carnes, 2020; Stahl et al., 2023). EM can also provide reliable estimate of all catch at-sea

The need for potential Council action is to address the decline in human observer coverage by

providing a monitoring alternative to satisfy domestic compliance of Hawaii and American limited entry longline fisheries with requirements under the MSA, ESA, and MMPA. For example, MSA Section 301(a)(9), or National Standards 9 (50 CFR 600.350), Councils shall develop: Conservation and management measures that, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch. Also, MSA Section 303(a)(11), or standardized bycatch reporting methodologies (50 CFR 600 Subpart R) require any FEP prepared by the Council to establish Standardized Bycatch Reporting Methodologies (SBRMs) to assess the amount and type of bycatch occurring in the fishery. In order to accurately satisfy these requirements, proper monitoring that can verify logbook reporting must be implemented. EM could be incorporated into the FEPs as a SBRM. EM could also provide a mechanism to maintain compliance with monitoring requirements under the ESA and MMPA. Human observer coverage has been used to fulfill monitoring requirements under Reasonable and Prudent Measures emerging from non-jeopardy ESA Section 7 Biological Opinions of Hawaii and American Samoa longline fisheries. MMPA take reduction triggers are also monitored through the use of human observers. While 5% human observer coverage is required for participating longline fisheries within RFMOs, there have been adopted minimum standards for EM and the possibility for EM to satisfy monitoring requirements in the future.

There is also a need to provide a cost-effective monitoring tool that minimizes costs to the agency under limited budget availability and minimizes cost to longline fisheries. The human observer program has operated at a budget of approximately $7 million per year, with targeted 20% fleetwide coverage for the Hawaii deep-set fishery and 5-19% variable fleetwide coverage for the American Samoa longline fishery. The shallow-set sector has been operating at 100% human observer coverage, but in current regulation under discretion of the Pacific Islands Regional Administrator. According to the 2021-2025 Pacific Islands Electronic Technologies Implementation Plan, outfitting the entire Hawaii longline fishery with EM would cost approximately $2.44 million per year as of 2023. This includes installation of cameras for all active vessels with replacement every three years, annual administrative costs, human review of EM data, and data storage management. Fleetwide EM implementation could likely produce a less costly monitoring program compared to human observers at current monitoring levels. Costs of EM cameras with installation are approximately $10,000 per participating vessel every three years.

There is also a need to provide a monitoring mechanism that would prevent interruptions to fishing operations. Fishing interruptions affect fleets or individual vessels of fisheries or participating vessels that are non-compliant with domestic or international regulations described above. For example, a fishing vessel must be registered for use with a valid permit under the High Seas Fishing Compliance Act, which requires adherence to international regulations, if that vessel is used to fish on the high seas. EM has proven to be a reliable mechanism that does not require minimum effort by fishing vessels to maintain.

6. Development of Potential Alternatives and Action

In developing potential alternatives for Council action at its June 2025 (203rd) meeting, the Action Team considered:

- The phasing in of EM systems from 2025 to 2027, supported by NMFS funding.
- The condition and uncertain future of the human observer program, which monitors;

- MSA, MMPA, ESA, and other domestic and international requirements for longline sectors (Hawaii deep-et, Hawaii shallow-set, and American Samoa longline fisheries)
- Costs and socioeconomic impacts to affected longline fisheries
- Monitoring adequacy in a phase-in period (2025-2027) and beyond
- Fulfillment of stated purpose and need

The Action Team will continue to refine these alternatives and will develop associated analyses in preparation for final action, incorporating Council feedback from the March 2025 meeting.

Characteristics Common Among Potential Alternatives to Implement EM
Any program to implement and authorize EM for monitoring in Pacific Island Fisheries would require participating vessels to have EM systems installed and fulfill a vessel monitoring plan (VMP). VMPs would be unique to a vessel and describe EM system configuration, reporting requirements, and how fishing operations will be conducted. VMPs would define the roles and responsibilities of all parties, including provisions to which each party must adhere. The affected vessel would be required to comply with the provisions of the VMP including catch handling protocols that describe the processing of targeted species, discards, bycatch, protected species, or other species. Noncompliance (e.g., catch handling inconsistent with the VMP or obstructed camera views) may affect a vessel's eligibility to participate in the EM program. A copy the vessel's VMP would be required to be on board the vessel and accessible at all times. EM systems onboard participating vessels would also need to adhere to RFMO standards.

Potential Alternative 1: Status Quo, No Action
Under Alternative 1, the Hawaii and American Samoa longline fisheries would not be required or have an option to install and implement EM systems beginning in 2025. The Council would take no action and NMFS would not authorize existing or further voluntary participation of EM to be used to monitor longline fisheries under statutory requirements. Under Alternative 1, there is a risk of non-compliance fleetwide with respect to monitoring requirements in the regulations and under the Pelagic FEP.

Potential Alternative 2: Implement a Mandatory EM Program, 2025 to 2027
Under Alternative 2, the Council would recommend a mandatory EM program to be implemented for the Hawaii and American Samoa longline fisheries by 2027 and authorize the use of EM to monitor and provide reliable estimates of protected species interactions for these fisheries. All Hawaii (151 vessels) and American Samoa (11 vessels) longline vessels would be required to carry and maintain EM systems by 2027. If regulations are implemented before 2027, vessels that have received an EM system may be required to use EM from that point forward Fleetwide participation in EM would be mandatory beyond 2027 for any new, existing, or returning entrants to the longline limited entry fisheries. American Samoa longline limited entry permit holders would likely not be required to use an EM system until outreach to the fleet has been completed in 2026. Alternative 2 would likely mitigate risk of individual and fleetwide non-compliance of domestic and international requirements.

Under Alternative 2, the Council may consider providing direction on the priority for rolling out EM systems during the transition period prior to EM being fully operational. The prioritization options are described as sub-alternatives below.

Potential Sub-Alternative 2A: Random Selection of all Longline Vessels for Implementation
Under potential sub-Alternative 2A, all vessels operating under a Hawaii or American Samoa longline limited entry permit would be eligible for random selection from 2025-2027, with American Samoa vessels incorporated by 2027. Such an approach likely ensures adequate representations of all longline vessels during the phase-in period.

The potential outcome would include full fleet-wide implementation of EM by 2027 and authorized use of EM for monitoring without prejudice or preference for vessels during the interim phase-in period. However this approach may be perceived as a top-down approach without any incentivization (e.g. guarantee that participating vessels would be exempt from carrying an observer or exempt from any other regulation). Outreach to vessel owners and operators would be imperative and needed with immediacy to ensure that vessels are comfortable and adequately informed about the use of EM and to ensure minimal inconveniences. Under sub-alternative 2A, there would be no prioritization of vessels, either those with a perceived more monitoring urgency (i.e., shallow-set sector) or vessels whose owners or operators wish to implement EM.

Potential Sub-Alternative 2B: Prioritization of Shallow-Set Vessels, Random Selection of Remaining Longline Vessels
Under potential sub-Alternative 2B, vessels engaging in shallow-set longline fishing would be prioritized for installation and implementation, authorizing the use of EM for monitoring first. Up to 24 vessels have engaged in shallow-set fishing in a fishing year, in which future participation may vary. On an annual basis from 2025 to 2027, NMFS plans to procure 50 EM systems for systematic installations per year. Vessels that will not engage in shallow-set fishing would be randomly selected in order to fulfill the targeted installation of 50 new vessels per year until 2027.

Possible outcomes could range from 0 to 50 vessels engaging in shallow-set fishing and having EM systems procured and installed for authorized monitoring. The likely outcome would be 10 to 20 vessels engaging in shallow-set fishing in the first year of the phase-in process with fewer additional vessels each year thereafter until 2027. These vessels would have EM installed and authorized for monitoring as a priority, which may not reflect equal representation of the longline fishery until the conclusion of the phase-in period. This may require some incentivization (e.g. omission from vessel pool to accept a human observer) and will require outreach. Outcomes under sub-alternative 2B could reduce agency burdens on the human observer program if participating EM vessels on shallow-setting vessels could be omitted from observer placement. The Council would need to decide and determine if monitoring requirements required for shallow-set vessels that require human observers could be replaced by monitoring using EM.

Potential Sub-Alternative 2C: Prioritization of Voluntary Vessels, Random Selection of Remaining Longline Vessels
Under potential sub-Alternative 2C, vessels whose owners and operators wish to volunteer and elect to install EM systems would be prioritized for placement and installation of EM systems. Any remaining non-participating vessels among 50 available EM systems each year would be

selected randomly.

Possible outcomes could range from 0 to 50 vessels volunteering each year to install and implement EM and to authorize for monitoring. A likely range of vessels annually that would volunteer during the phase-in period is unknown. Similar to outcomes under 2B, this approach may bias representation of the fleet during the phase-in period until full implementation. Vessels that are more informed with Council and NMFS activities, do not have language barriers among owners and operators, or who have had proper outreach may be more inclined to volunteer for participation in implementing EM. This may lead to less adequate representation of the fleet in monitoring the fishery fleetwide, as compared to 2A. Incentives may be needed to garner support for vessels to volunteer. Such an approach would likely have less negative perception among fishing vessel owners and operators as a top-down approach from the Council and the agency as compared to 2A and likely 2B.

Potential Alternative 3: Implement EM as an Optional Program

Under Alternative 3, the Council would recommend an optional EM program, which would give vessel owners the opportunity to elect to install and implement EM as participating vessels. EM would then be authorized for use in monitoring statutory requirements in those participating vessels. While full implementation of all longline vessels is a goal of NMFS from 2025 to 2027, implementation would remain elective until a fully mandatory program is developed through a separate Council decision to implement EM as mandatory at a later time. This Alternative would not guarantee full participation of EM among Hawaii and American Samoa longline fisheries, in contrast all outcomes under Alternative 2.

Alternative 3 is consistent with the Council recommendation at its 201st meeting; however, the situation regarding the human observer program has changed which may affect the Council's decision at final action. Alternative 3 has some similarity to the implementation of electronic reporting (ER) logbooks as an optional program in 2007 until the Council took action in 2021 to implement ER as a mandatory reporting requirement replacing paper logbooks.

Possible outcomes under this Alternative may range from 0 to full participation (151 Hawaii longline vessels, 11 American Samoa vessels) in an EM program by 2027, with 0 to 50 possible participants electing to participate each year. The participation of an EM program could also remain with the existing 20 participating vessels. Similar to the outcomes under 2C, this alternative may bias representation of the fleet. Vessels that are more informed with Council and NMFS activities, do not have language barriers among owners and operators, or who have had proper outreach may be more inclined to volunteer for participation in implementing. Participating vessels would need or request incentivization (e.g. exemption from observer placement). While Alternative 3 would likely have no perceived negative top-down mandate among participating vessels, possible outcomes could leave longline fleets and possibly a significant portion of longline vessels vulnerable to non-compliance. Non-compliance may cause interruptions to fleetwide or individual fishing operations.

The following sections provide background information comparing and contrasting EM and Human Observer Programs as provided to the Council at its December 2024 meeting

Appendix A: Supplementary Information on Relationship of EM with Human Observer Program

The purpose and objectives for implementation of the current mandatory at-sea human observer program, Pacific Islands Regional Observer Program (PIROP), were to monitor the protected species interactions. The Council in 1993 recommended NMFS implement a mandatory observer program under the Pelagic FMP framework procedure for promulgating regulations to prevent harm to protected species. The Council recommendation was implemented through an interim final rule (58 FR 67699, Dec 22, 1993; effective Jan 6, 1994). The mandatory observer program also satisfied the requirements under the 1993 ESA Section 7 Biological Opinion of the Hawaii longline fishery. Under the interim final rule, the observer program was established "to ensure collection of sufficient data to produce statistically significant results and to evaluate the accuracy of logbooks submitted for the fishery."

Duties and Requirements for At-Sea Observers ('665.207, '665.808): The longline fisheries may also be required to carry observers to collect detailed information on the fishery, including total catch and discards, detailed accounts on interactions with protected resources, compliance with protected species mitigation methods and gear requirements, biological characteristics of the catch, and economic information such as trip costs. Observers are able to collect more detailed information than could be expected of fishermen and this information is used to better inform on the impact or effect the fishery is having on protected resources and ensure compliance with applicable laws (e.g. ESA, MMPA, NEPA, RFA)

Data from at-sea observers is combined with logbook data, dealer data, permitting data, and VMS data to obtain a comprehensive view of the fisheries, described in more detail below. These data are needed to monitor the fisheries, determine whether the current management measures are having the intended effects, and evaluate the benefits and costs of changes in management measures. Each of these data sets however has its limitations. For example, logbook data consist of industry reported data, which historically under report bycatch, such as sharks and other protected species (Camhi et al. 2009). Dealer data only represent weights of retained species. At-sea observer data provide information on both discarded and retained catch, including subsamples of lengths. Due to cost constraints however, observers are only present on a subset of trips; whereas logbook and dealer data sets provide data from all fishing trips (Carnes et al. 2019).

EM is being proposed as a way to fulfill some of the statutory monitoring requirements for longline vessels in the region. Given the decline in human observers [1] in 2024, 2025, and beyond, there is a need to transition the existing EM program from an experimental and research tool to a program that can be phased in to partially fulfill reporting and information collection requirements to monitor Pacific Island fisheries. EM may provide a method to supplement the above data streams to reduce potential sources of bias and inform management of the Hawai'i longline fisheries (Carnes et al. 2019) especially with recent reductions in observer coverage. The sections below will explore specifically the relationship between EM and observer data collection summarizing previous work done assessing the utility of EM collecting data streams currently collected and reported by at-set fisheries observers.

- Pros: More data (more affordable) per unit of cost, capacity to validate observer data (another data stream), no down time (unless failure), camera will not miss things observer might miss due to concentration on other duties (e.g., when they are working up a turtle, they might miss sharks on the line etc.).

- Limitations: Possibility for camera footage missing activities (ability to see details such as hooking location etc.), equipment failure/water on lens etc., Delay in reporting, no real time regulatory monitoring (closures, turtle trip limits). Limited capacity for seabird information collection with EM, gear setting information is limited unless utilizing a third camera view from the stern (views are limited to camera placement locations), and no observer means missing out on important tagging and sampling. Blind spots in camera view arrangement can lead to underestimating shark and other protected species bycatch (e.g., observers can see farther from the vessel, at the stern, move about the vessel, and below the water surface.

Previous Work on Efficacy of EM to Compliment Human Observer Data Collection

Previous work in the Pacific Islands indicates that EM can be used to collect some of the data that human observers collect at varying degrees of accuracy. See information papers and summaries below:

- *Data Collectable Using Electronic Monitoring Systems Compared to At-Sea Observers in the Hawai'i Longline Fisheries, 2024* (Stahl et al., 2024)

"This document describes the data which can be collected using EM systems (NOAA, 2023) and the degree of accuracy to which it can be collected compared to at-sea observers. Data fields are compared by each data collection form used by the Pacific Islands Region Observer Program (PIROP). In addition, it is noted whether data can be collected by other sources, such as Vessel Monitoring Systems (VMS), dealer data, or electronic logbooks. Notes elaborating on the accuracy of EM or other data collection methods for each data field are included…"

- *Detection Accuracy in the Hawai'i Longline Electronic Monitoring Program with Comparisons between Three Video Review Speeds* (Stahl & Carnes, 2020)

"This report includes results for a study comparing review speeds of electronic monitoring (EM) data from the Hawai'i longline fisheries (deep-set and shallow-set fisheries)...The intent of the study was to determine accuracy of detection at three different speeds for EM video review, including review of video with known protected species interactions, and to outline best practices for EM data review"

- *The role of electronic monitoring in assessing post-release mortality of protected species in pelagic longline fisheries* (Stahl et al. 2023)

"This report includes results from a study reviewing protected species interactions from electronic monitoring (EM) video collected from the Hawai'i longline fisheries…. The intent of the study was to determine if data could be collected from EM video to assess the likely post-release condition of protected species following fishing interactions, and to provide

recommendations for improving data collection for the assessment of the likely post-release condition."

- *Evaluation of Electronic Monitoring Pre-implementation in the Hawai'i-based Longline Fisheries* (Carnes et al. 2019)

"To evaluate the efficacy of EM as a monitoring tool, 18 systems were installed on Hawai'i longline vessels for this pre-implementation study….Comparison of data collected by at-sea observers with post-cruise review of EM data indicate EM systems provide an additional means to accurately enumerate fish. A total of 89% of all catch enumerated by at-sea observers (retained and bycatch) were detected in EM data during video review. For retained fish only, EM reviewers located 98% of the fish enumerated by at-sea observers in the shallow-set fishery and 100% in the deep-set fishery. EM data also provided accurate enumeration over broad taxonomic groupings (e.g., tunas, billfishes, sea turtles) and for many economically valuable fish species. However, compared to at-sea observers, EM reviewers were not able to provide identifications to the species level for some species, including those subject to management implications, such as bigeye tuna and hard shell sea turtles…"

Summary of Human Observer Duties EM May Fulfill:

- Number of each species kept by the vessel with a high level of accuracy could be used to validate logbook data
- Bycatch, including protected species, at varying degrees of accuracy (coefficient could be used to improve estimates of some species after enough data is collected (would require auditing of EM data with observer data). Coefficients would need to continue to be updated to remain accurate/useful. Could be used to validate logbook data if we begin enforcing this reporting requirement.
- Mortality at vessel and at release - the first level of mortality estimation.
- Protected species condition and to some extent gear remaining on animals and handling for post release mortality and serious injury determinations. Due to the way this is assessed, (erring on the side of caution) it would likely result in higher mortality or serious injury estimates for certain species. Used in ESA, MMPA, and NEPA impact assessments.
- Date, time, location (begin/end set/haul) of fishing - could be collected passively and used to validate electronic logbooks.
- Some compliance monitoring that takes place during the haul (e.g. prohibitions such as shark finning)
- If a camera is installed to view the set, some seabird information including mitigation and species present could be collected.

Summary Human Observer Duties EM Alone Cannot Fulfill:

- Specimen and biological sample collection: These are often linked with other life history information such as measurements, sex, gear used, etc. These include:
    - International Billfish Biological Sampling Project –
        - The U.S., along with Japanese and Taiwanese partners, developed a collaborative sampling strategy for the uniform collection of biological samples from billfish in the North Pacific to inform life history and

stock assessments of internationally managed billfish and the development of a spatial temporal growth model. Research will likely be expanded to Western and Central Pacific Billfish https://meetings.wcpfc.int/node/23086.

    - PIROP observers collected 417 samples of Striped Marlin from the Central North Pacific from 2019-2020 informing research on stock composition of striped marlin for the Virginia Institute of Marine Science (Martinez 2021)
    - Seabirds and turtles for necropsies
    - DNA plugs for DPS analysis etc
    - Lancetfish stomachs
- Gear measurements and configuration: for compliance with certain regulations and to inform protected species interactions and post release mortality estimates. New or novel gear or configurations is also documented here and may be difficult to see with EM.
- Effort/hooks and floats set - Reviewers have not been able to obtain this information at the high review rates.
- Animal measurements and life history parameters: Observers measure and sex every third fish and measure all protected species when possible. Lengths are used for growth and maturity and life history information for stock assessment models. Information also informs jeopardy determinations in Endangered Species Act Biological Opinions (e.g. sea turtles maturity).
    - Length information collected by observers from U.S. fisheries is more important than data from other countries, because other countries lack systematic and consistent sampling.
- Reduced U.S. observer length data will increase uncertainty in future international stock assessments for billfish, like striped marlin, in terms of estimates of spawning stock biomass and our ability to determine if the stock is overfished.
- Near real time reporting of protected species interactions. Used to meet regulatory requirements, such as monitoring trip and annual interaction limits for sea turtles and area closures for false killer whales.
- Tag animals: (provide a list of tagging programs)
- Conduct interviews of captains (trip cost estimates, crew nationality, WCPFC regulatory compliance…)
- Bird species present during operations as well as # of each species at different operational time (bird scans)
- Required bird mitigation techniques (unless there is a stern facing camera to monitor the setting of gear)