NOAA FISHERIES

Pacific Islands Regional Office

Roadmap for the Potential Future Implementation of Electronic Monitoring in the Pacific Islands Region

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Introduction

This paper explores next steps for the development and implementation of an electronic monitoring (EM) program in the Hawaii pelagic longline fisheries operating under the Fishery Ecosystem Plan for Pelagic Fisheries of the Western Pacific Region. This paper incorporates some of the Pacific Islands Fisheries Science Center's (PIFSC) recommendations resulting from six years of EM research, feedback from various divisions within the National Oceanic and Atmospheric Administration's National Marine Fisheries Service (NOAA Fisheries), and input from the Electronic Technologies Steering Committee (ETSC) which was reconvened to participate in this process. An informational update on EM was provided to the Western Pacific Regional Fishery Management Council (Council) at its 193rd meeting, held in December 2022. Following this update, the Council recommended that the ETSC and Pelagic Plan Team begin development of options and scenarios for the implementation of EM in United States (U.S.) longline fisheries in the Western Pacific by September 2023.

Background Information

Background on the Fisheries

The Council and NOAA Fisheries manage pelagic fishery resources, as authorized by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act; 16 U.S.C. § 1801 et seq), that occur in the U.S. Exclusive Economic Zone (EEZ or federal waters, generally 3–200 nautical miles or nm from shore) around American Samoa, Guam, the Commonwealth of the Northern Mariana Islands, Hawaii, and the U.S. insular possessions of the Western Pacific Region known as the Pacific Remote Island Areas. This paper focuses on the Hawaii pelagic longline fisheries and, to a lesser extent, the American Samoa pelagic longline fishery.

In 2021, there were 146 active Hawaii-permitted limited access longline vessels. These vessels took a total of 1,690 deep-set longline trips and made 22,192 sets. Of these vessels, 17 also participated in the shallow-set fishery; they took 57 shallow-set longline trips and made 703 sets. The deep-set longline fishery has an observer coverage target of 20 percent, whereas the shallow-set fishery has an target observer coverage of 100 percent[1]. The 20 percent target in the deep-set fishery is an annual target; although NOAA Fisheries strive to not allow coverage to fall below 15 percent[2]. Information on interactions with species protected under the Endangered Species Act, the Marine Mammal Protection Act and other legislation is a top priority and observers prioritize collection of these data over other data (e.g., fish measurements). In the event of a protected species interaction, industry must follow established catch handling requirements intended to maximize the animal's chances of survival.

[1] The 2019 Hawaii Shallow Set Biological Opinion included a Term and Condition which required NMFS SFD to maintain observer coverage at rates that are at least as high or above those that have been determined to be statistically reliable for estimating protected species interaction rates onboard Hawaii-based shallow-set longline vessels. (Endangered Species Act Section 7 Consultation Biological Opinion: Continued Authorization of the Hawaii Pelagic Shallow-Set Longline Fishery. 2019. NMFS, Pacific Island Region, Office of Protected Resources.)

[2] Hawn, L. 2022. Personal communication.

The False Killer Whale (FKW) Take Reduction Plan (50 CFR 229.37) aims to reduce mortality and serious injury of the Hawaii Pelagic and Hawaii Insular stocks of FKWs incidentally captured in the Hawaii pelagic longline deep-set and shallow-set fisheries. NOAA Fisheries determine the number of FKWs that may be removed from the population (i.e., potential biological removals) on an annual basis[3]. This number, in combination with the expected observer coverage for the fishing year, is used to establish a limit on the number of FKW mortalities and/or serious injuries that can occur on observed trips in the Hawaii pelagic longline deep-set fishery before triggering a closure of the Southern Exclusion Zone (SEZ) for the remainder of the year. This trigger remains in effect until superseded by publication of a revised trigger in the *Federal Register*.

In addition, the Hawaii pelagic longline fleet is limited to 16 leatherback sea turtle interactions in a year while engaged in shallow-set fishing. In the event that the shallow-set fishery reaches this limit, NOAA Fisheries is required by regulation to prohibit shallow-set fishing north of the Equator for the remainder of the fishing year. Hawaii pelagic longline vessels participating in the shallow-set fishery are also limited to a maximum of two leatherback sea turtles and five North Pacific loggerhead turtle interactions on a single fishing trip. In the event that a vessel reaches the limit for either species, the vessel must stop fishing immediately and return to port. The vessel is prohibited from participating in the shallow-set fishery for five days following its return to port. A vessel that reaches the trip limit a second time for the same species in the same year is prohibited from participating in the shallow-set fishery for the remainder of that year. In the subsequent calendar year, the vessel shall be limited to an annual interaction limit for that species that is equivalent to the trip limit (i.e., two leatherback sea turtles or five North Pacific loggerhead sea turtles); if the vessel reaches this limit, it is prohibited from participating in the shallow-set fishery for the remainder of that year.

Background on Electronic Monitoring

Pacific Islands Fisheries Science Center Pre-Implementation Project

Since 2017, the PIFSC has been working collaboratively with members of the Hawaii pelagic longline fleet to field test EM in a commercial setting. EM systems were installed on 18 vessels in 2017 and 20 vessels in 2021 (This included installation of new equipment on those of the original participating vessels that continued in the program as well installation on new vessels for a total of 20 vessels). The systems included video cameras to capture footage, global positioning systems (GPS) to track fishing location, and fishing gear sensors to help detect catch events and trigger camera recording during gear retrieval. PIFSC staff used the EM data collected to evaluate the usability of EM as a monitoring tool for the fisheries. They published their findings in two papers: *Evaluation of electronic monitoring pre-implementation in the Hawaii-based longline fisheries*[4] and *Detection Accuracy in the Hawaii Longline Electronic Monitoring Program with Comparisons between Three Video Review Speeds*[5].

[3] Oleson, EM. 2020. Abundance, potential biological removal, and bycatch estimates for the Hawaii pelagic stock of false killer whales for 2015–2019. NOAA PIFSC Admin Rep. H-20-06, 13 p. doi:10.25923/wmg3-ps37
[4] Carnes MJ, Stahl JP, Bigelow KA. 2019. Evaluation of electronic monitoring pre-implementation in the Hawai‘i-based longline fisheries. NOAA Tech Memo. NMFS-PIFSC -90, 38 p. doi:10.25923/82gg-jq77
[5] Stahl JP, Carnes MJ. 2020. Detection Accuracy in the Hawai‘i Longline Electronic Monitoring Program with Comparisons between Three Video Review Speeds. PIFSC Data Report DR-20-012. https://doi.org/10.25923/n1gq-m468

The first paper focused on the comparison of data collected by observers at sea with data collected via EM systems to accurately detect fish and other bycatch. According to the results of the study, a total of 89 percent of all catch detected by observers (retained and bycatch) was also detected in EM data during video review. For retained fish only, EM video reviewers detected 98 percent of the fish detected by observers in the shallow-set and deep-set fisheries. EM video reviewers were able to use EM data to accurately identify catch over broad taxonomic groupings (e.g., tuna); however, EM data were not able to provide identification to species level in some instances for which an at-sea observer could.

The second paper evaluated the accuracy of detection at various video review speeds and recommended best practices for an operational EM program. The recommendations included: (1) an 8x video review speed for the best detection accuracy; (2) video reviewers should have previous observer experience in the fishery to ensure accurate species identifications, and should continue to accompany vessels for at-sea observation at least once annually; (3) video reviewers should complete a prescribed number of hauls per week; (4) the amount of video review per day should not exceed six hours; (5) standardized operating procedures should be developed to ensure video reviewers are processing EM video properly, and periodic audits of video reviewers data should be conducted to ensure adherence to procedures; and (6) EM review software should allow for verification of detections and identifications (e.g., pause and rewind features, image capture).

NOAA Fisheries Policy Directives

NOAA Fisheries first issued its *Policy Directive on Electronic Technologies and Fishery Dependent Data Collection* [6] in 2013, and updated it in 2019. The policy directive encourages the consideration of electronic technologies to meet science, management, and compliance needs as a cost-effective and sustainable approach to fisheries monitoring, and provides guidance for the implementation of electronic technologies based programs. NOAA Fisheries subsequently released additional policy directives to provide further guidance for the implementation of EM programs: *Cost Allocation in Electronic Monitoring Programs for Federally Managed U.S. Fisheries*[7]; *Third-Party Minimum Data Retention Period in Electronic Monitoring Programs for Federally Managed U.S. Fisheries*[8]; and *Information Law Application for Data and Supporting Guidance in Electronic Monitoring Programs for Federally Managed U.S. Fisheries*[9]. The following paragraphs briefly summarize the policy directives. Please refer to the policy directive documents for full detail.

The cost allocation policy directive establishes a framework for allocating costs for EM programs in federally managed U.S. fisheries between NOAA Fisheries and the fishing industry. The policy directive identifies two cost categories: administrative costs, which include program administration and support (e.g., setting program

[6] Policy on Electronic Technologies and Fishery-Dependent Data Collection; May 2019. Available at: https://media.fisheries.noaa.gov/dam-migration/04-115.pdf
[7] Cost Allocation in Electronic Monitoring Programs for Federally Managed U.S. Fisheries; May 2019. Available at: https://media.fisheries.noaa.gov/dam-migration/04-115-02.pdf
[8] Third-Party Minimum Data Retention Period in Electronic Monitoring Programs for Federally Managed U.S. Fisheries; April 2020. Available at: https://media.fisheries.noaa.gov/dam-migration/04-115-03.pdf
[9] Information Law Application for Data and Supporting Guidance in Electronic Monitoring Programs for Federally Managed U.S. Fisheries; May 2022. Available at: https://media.fisheries.noaa.gov/2022-05/04-115-04_0.pdf

standards), certification of EM providers, monitoring program performance, and data analysis and the storage of Federal Records; and sampling costs, which include EM equipment purchases and installation, equipment servicing and maintenance, vessel monitoring plan development, trainings for industry, data transmittal, video review and storage, and service provider fees and overhead. The policy directive recommends that administrative costs are categorized as NOAA Fisheries' responsibility, whereas sampling costs are categorized as the responsibility of the fishing industry. However, the policy directive also includes the following language: "If NOAA Fisheries determines that EM is necessary and appropriate to meet legal obligations (e.g., requirements of the Endangered Species Act), *and sufficient appropriated funds are available* [emphasis added], NOAA Fisheries intends, as a matter of policy discretion, to fund the sampling costs of such programs, unless the MSA specifically provides otherwise."

The third-party minimum data retention period policy directive recommends minimum retention requirements for EM data held by EM service providers. In particular, the policy directive recommends EM service providers retain EM data for a minimum of 12 months following completion of a fishing year, including the post-year data reconciliation period, if applicable. This would allow NOAA Fisheries sufficient time to achieve its monitoring objectives, which may include assessing data quality and compliance, without placing an undue financial burden on the fleet. The costs associated with EM data retention and storage by EM service providers would be the responsibility of industry. Notably, this policy directive only applies to EM data, defined as "raw data that are created by an EM system and transmitted from a vessel to an EM service provider, including the video, images, or other sensor data collected during fishing operations, as well as associated metadata (e.g., trip sail date, vessel information)," held by an EM service provider. It does not apply to EM data received by NOAA Fisheries and used in the conduct of its official business; these EM data would be subject to Federal Records requirements and must be retained for a period of 5 years, consistent with the National Archives and Records Administration (NARA)[10].

Finally, the policy directive on the application of information law provides guidance regarding the application of the Federal Records Act, the confidentiality provisions in Section 402(b) of the Magnuson-Stevens Act, and the Freedom of Information Act (FOIA); the application of these laws varies depending on the design of the program.

EM data made or received by NOAA Fisheries are Federal Records and must be stored according to the NARA disposition schedule; other types of data (i.e., data output files) must be held indefinitely, consistent with NOAA Fisheries' handling of observer data. EM data made and retained by EM service providers are not Federal Records and are not subject to NARA, but are responsible for meeting third-party retention requirements.

NOAA Fisheries has determined that the confidentiality requirements applied to observer information in the Magnuson-Stevens Act include information collected by an EM system. In addition, we have determined that information collected by an EM system is confidential from the point of collection, regardless of whether it is in NOAA Fisheries' or an EM service provider's possession. EM service providers should have a means to protect the confidentiality of vessels' EM data in their possession. The policy directive is consistent with current practices regarding observer data, and NOAA Fisheries may release confidential data in an aggregate form that

[10] NARA Records Disposition Schedule DAA0370-2020-0001; May 2021. Available at: https://www.archives.gov/files/records-mgmt/rcs/schedules/departments/department-of-commerce/rg-0370/daa-0370-2020-0001_sf115.pdf

does not disclose the identifying information or under the conditions described in Section 402(b)(1) and (2) of the Magnuson-Stevens Act. Any implemented EM program must include an authorization for NOAA Fisheries to access EM data as needed for the purposes of fishery monitoring and management.

Under FOIA, the public may request records created or obtained by the agency and under the agency's control at the time of the request. NOAA Fisheries may release information in aggregate and may release still imagery provided there are no identifiable features that violate confidentiality provisions. FOIA does not require NOAA Fisheries to create new records (i.e., video snippets or still imagery) in response to a FOIA request and, as such, NOAA Fisheries does not expect to release video, except as authorized under Sections 402(b)(1) and (2) of the Magnuson-Stevens Act. EM data held by an EM service provider would not be subject to FOIA.

Current Status of Electronic Monitoring in the Pacific Islands Region

Hawaii Longline Fleets

The characteristics of the Hawaii pelagic longline fisheries are potentially well suited to an EM program:

- **Average trip length**: Trip length differs between the deep-set and shallow-set longline fisheries but, on average, they are roughly 3-4 weeks in duration and a substantial portion of that time is spent steaming to/from the fishing grounds. This results in periods of "dead time" in which an observer onboard the vessel would incur costs to the program without collecting data, whereas a video reviewer reviewing EM data for the same trip could skip over this footage or watch it at high speed.
- **Gear type**: All the vessels in the fishery use longline gear. Although variations among vessels and between the deep- and shallow-set fisheries are to be expected, gear configuration and vessel layout should be relatively consistent across the fleet compared to some other fisheries.
- **Target species and bycatch**: Target species are large and brought onboard one at a time. Common bycatch species in the fishery are also large and, although they are not brought onboard, regulations require that some species (i.e. protected sharks, marine mammals, and turtles) be brought alongside the vessel. These factors would facilitate detection and identification during the video review process. One drawback, specific to the deep-set fishery, is that haulback generally occurs at night, which may interfere with the identification of FKW that are not able to be brought alongside the vessel.
- **Consolidated location**: The majority of longline vessels tie up in a single port in Honolulu, Hawaii. This consolidated access to the fleet would facilitate EM system installations, maintenance and repair, and possibly data collection, depending on the data collection tool used by the program (e.g., hard drives).

However, the Hawaii pelagic longline fisheries currently lack a clearly articulated need for an EM program. At this time, there is not a Council directive or other driving force prompting a need for higher coverage or the adoption of a new monitoring tool. It is possible that the monitoring landscape could change suddenly in the coming months or years. It is widely known that the observer program, which is fully funded by NOAA Fisheries, is expensive to the point of exceeding its annual budget allocation. Thus far, NOAA Fisheries has been able to

allocate sufficient funds to support the program, but this is not guaranteed and a funding shortfall could result in an inability to meet the 100 percent and 20 percent observer coverage targets for the shallow-set and deep-set fisheries, respectively. The potential for a funding shortfall may be exacerbated by recent reports from the fishing industry indicating an expected increase in effort in the shallow-set fishery for 2023. Due to the 100 percent coverage target in the shallow-set fishery, even a small increase in effort could have relatively large impacts to program costs, and therefore NOAA Fisheries' ability to maintain 100 percent coverage in the shallow-set fishery. The trip-based turtle limits for the shallow-set fishery were developed assuming 100 percent observer coverage and it is not clear how or whether the regulations could be adapted in response to a lower level of coverage. In addition, observer coverage in the deep-set fishery has historically dropped when the shallow-set fishery is active because it draws on the region's limited and finite observer resources. Reduced coverage in the deep-set fishery may result in less precision and accuracy in the estimation of protected species interactions and could affect management of the fleet and these species.

The FKW Take Reduction Team (TRT) recently reconvened because the number of takes of the Hawaii Pelagic stock in the deep-set fishery exceeded the allowed potential biological removals for the most recent five-year period. The TRT is likely to recommend additional measures aimed at reducing mortality and serious injury of the Hawaii Pelagic stock of FKW by fishing gear. The applicability of EM as a tool to monitor industry compliance with catch handling requirements has been a topic of discussion at TRT meetings and a sub-group has been formed to further explore this possibility.

American Samoa Longline Fleet

The American Samoa pelagic deep-set longline fishery shares some, but not all, of the characteristics of the Hawaii pelagic longline fisheries that are well suited to EM. In particular:

- **Average trip length:** American Samoa longline trips are long (several weeks or months) in duration. However, the majority of trips occur within the EEZ and do not require substantial steam time.
- **Gear type:** All the vessels in the fishery use longline gear and, while some variation among vessels are to be expected, gear configuration and vessel layout should be relatively consistent across the fleet compared to some other fisheries.
- **Target species and bycatch:** Target species are large and brought onboard one at a time. Common bycatch species in the fishery are also large and, although they are often not brought onboard, regulations do require that some species (i.e. protected sharks, marine mammals, and turtles) be brought alongside the vessel. These factors would facilitate detection and identification during the video review process. Like the Hawaii deep-set fishery, haulback generally occurs at night, which may interfere with the identification of protected species that are not able to be brought alongside the vessel.
- **Geographically remote and lacking infrastructure**: American Samoa is located roughly 2,500 miles from Hawaii and NOAA Fisheries has limited infrastructure available on location, which is not conducive to an EM program. Support staff would need to be flown in to complete EM system installations and staff would need to be relocated permanently to provide ongoing program support (e.g., hard drive collection, troubleshooting system issues). However, for these same reasons, it is also relatively costly and difficult to deploy human observers on American Samoa vessels, and incorporating EM into the monitoring plan for this fleet may help to achieve the coverage requirement and offset costs.

Preparations for Potential Future Adoption of Electronic Monitoring in the Region

The development and implementation of an operational EM program is a multi-year process. The Pacific Islands Region is early in this process and still exploring options for the most effective use of the various monitoring tools available. Given this, the following sections outline recommendations for further developing EM in the region.

Identify the purpose and need

A clearly defined purpose and need is a prerequisite for any monitoring program. The existing monitoring program should be evaluated against the regulations and management needs for data gaps and an assessment should be conducted to identify which, if any, of the data gaps can be addressed using EM technology. This process should help the project team identify the program's purpose and the data elements to be collected to meet the need. It is also helpful to keep the data collection goals narrowly focused on critical data needs, rather than data collection for the sake of data collection. Unlike human observers, EM program costs are dependent on the number of data elements required for collection, so each data element should be selected with careful consideration of the overall program impacts.

General awareness campaign

Staff across various divisions of the Pacific Islands Regional Office (PIRO) and PIFSC were interviewed during the development of this roadmap. In general, staff that were not directly involved with EM were found to have a limited understanding of EM as a tool and to be somewhat hesitant about its adoption in the region. This is common and by no means specific to the Pacific Islands region. Building awareness of EM among end users now is critical to familiarizing staff with the tool and encouraging them to participate in planning for potential changes to their workflow resulting from the addition of a new fishery-dependent data source. Examples of impacted staff may include stock assessment scientists, statisticians, and protected resources staff.

Identification of data elements to be collected

The next step is to identify the data elements to be collected using EM. Ensuring end users have a foundational understanding of the tool will enable them to contribute to this process. The data collection requirements should:

- **Be constrained to the elements that are necessary to meet the program's purpose**: Historically, observers are sometimes tasked with opportunistic data collection because they are on the vessel and the cost of deployment is the same regardless. This is not true of an EM program; cost is generally based on review time, which is dependent on the number and complexity of the data elements

collected. For this reason, the data elements should be selected carefully to ensure they meet program needs.

- **Take into consideration what electronic monitoring can collect compared to an observer**: EM and observers are different tools with different strengths and weaknesses. Ideally, they should be used in a complimentary manner. It may be tempting to treat them as interchangeable and attempt to collect the same suite of data elements across both programs, but this is generally not advisable. EM and observers are not equivalent and confidence in the accuracy and precision of the data may differ between them. To treat them as equivalent may obscure these differences for end users, result in inaccuracies in data analysis and estimation, and create unrealistic expectations among stakeholders.
- **Plan for some level of observer coverage on electronic monitoring vessels**: There are things observers can collect that EM cannot (e.g., otoliths). The Alaska region experienced data loss specific to a certain subset of the fleet (e.g., midsize vessels) that opted into EM as an alternative to observers. The lack of observers deployed on these vessels resulted in a data gap that negatively affected stock assessments. The Alaska region is now working to incorporate observer coverage onto EM vessels. To avoid a similar issue in the Pacific Islands region, a predetermined amount of observer coverage should be deployed on EM vessels to collect information best collected by a person.
- **Plan for the future**: EM is still relatively new and rapidly evolving. As research and development continues globally, end users may want to revisit data collection requirements in response to technological advances.

Data infrastructure and integration

An operational EM program will produce new types of fishery-dependent data to be managed by NOAA Fisheries, including but not limited to, raw EM data–commonly defined as the data that are created in the collection of fishery-dependent data by EM systems during fishing operations, including the video, images, and other sensor data, as well as the metadata that provides information (e.g., trip sail date, vessel information) about the raw data–and video review data output files.

- **Video review data output files and similar data types**: New information technology (IT) infrastructure should be built for the purpose of housing EM data. To provide context, these data would likely be alphanumerical. In the Northeast region, EM data is maintained in a JavaScript Object Notation (JSON) file format submitted via an application programming interface (API). Merging EM data into the existing observer IT infrastructure is not recommended. Observer data are complicated and sometimes fragile and reprogramming the underlying logic to incorporate a new fishery-dependent data stream may result in unexpected breakages. In addition, the data elements to be collected are likely to differ (see previous section), which would result in missing or blank data fields in the existing infrastructure. Instead, IT staff and end users should work together to build the necessary support infrastructure and integrate the new data source into existing data streams.
- **Raw EM data**: Raw EM data can take up significant amounts of space and be very expensive to store. The NARA disposition schedule for EM data requires NOAA Fisheries to keep any EM data we take possession of for a period of five years. PIFSC staffer and ETSC member, Josh Tucker, used the region's EM pre-implementation program to develop a rough estimate of an operational EM program's annual needs. The estimate made the following assumptions: (1) cameras are installed on all permitted vessels in the longline fleet; (2) 100 percent of all trips are recorded and taken possession of by NOAA Fisheries;

and (3) a data capture rate of 30 frames per second. The upper bound of the resulting estimate was 1,930 terabytes per year. This information was provided to PIRO's IT division to support the development of a storage cost estimate, and further follow-up on this subject is necessary.

Resource Planning

This section will focus on two issues: program management and funding.

Program management

PIRO and PIFSC leadership will need to determine which entity will be responsible for managing an operational EM program. It seems logical that PIRO would manage the program given that it falls under the "monitoring program" umbrella, but there may be compelling reasons for PIFSC to take responsibility for the program.

Funding and costs

While using EM to meet some monitoring needs may reduce observer costs, it also introduces new costs (e.g., EM data storage) that must be accounted for in the annual budgeting process. It would be premature to estimate the costs associated with an operational EM program at this time because key program design questions have yet to be resolved. However, the following information should provide some additional context on this subject:

- **Cost estimates for the Pacific Islands**: Keith Bigelow (PIFSC) and former PIRO staff member, Josh Lee, developed informed cost estimates for a hypothetical EM program, which were included in the region's Electronic Technologies Implementation Plan[11]. The hypothetical program includes the following parameters: EM equipment installed on 160 deep-set vessels; 25 percent of sets are reviewed; and the program is administered by NOAA Fisheries (i.e., NOAA Fisheries receives and reviews the EM data). The total estimated annual costs of such a program, inclusive of both administrative and sampling costs, is estimated to be roughly $2.5M. Of these costs, roughly $1.9M are categorized as sampling costs; $1M in operational costs, such as video review and storage, and $0.9M in equipment purchase and installation costs. The remaining costs–roughly $0.6M–are categorized as administrative costs. Note: EM equipment is expected to last 3-5 years and, as such, these costs should be amortized across fishing years.
- **Cost estimates for the Atlantic Highly Migratory Species EM program**: The Atlantic highly migratory species (HMS) EM program offers the most comparable example to the Pacific Islands region based on (1) similarities in gear type and target species; and (2) EM program objectives, which include monitoring bluefin tuna bycatch (i.e., identifying, enumerating, and collecting lengths) and verifying whether shortfin mako shark bycatch is dead or alive at haulback. Currently, the program is funded by NOAA Fisheries, with the exception of data transmission (i.e., mailing hard drives), which is paid for by industry. NOAA Fisheries is exploring ways to transition the sampling costs of the program to industry.

[11] Pacific Islands Regional Electronic Technologies Implementation Plan; August 2021. Available at: https://media.fisheries.noaa.gov/2021-08/Pacific%20Islands%20ETIP_080621.pdf

The program costs an estimated $1.2M annually for 67 vessels[12]. Atlantic HMS staff estimate the per day cost at $280 per day[13].

- **Funding to pay for EM:** As of now, there are not any EM programs with permanent appropriations. In fact, the Atlantic herring industry-funded monitoring program, which includes an EM option operating under an exempted fishing permit (EFP), will be suspended starting April 1, 2023, due to a lack of funding to support NOAA Fisheries' shoreside costs. There has been some discussion regarding whether Observer Program funding may be used to pay for EM program costs. Some regions use Observer Program funding to support their EM programs, whereas other regions do not. At this time, the Observer Program has not provided national guidance on this topic. It would be worth following up with the Observer Program lead in the event that PIRO finds itself with a surplus of observer monies in the future, possibly as the result of a reduction in observer coverage, and would like to allocate the funds to supporting EM in the fishery.

Next Steps to Further Develop an Electronic Monitoring Program

This section outlines possible next steps to consider adopting in the region to further develop an operational EM program.

Support for the Electronic Technologies Steering Committee

The ETSC, which was instrumental in implementing electronic reporting in the region, has been reconvened to assist in the development of EM in the region. The membership includes members of PIFSC and PIRO, NOAA Office of Law Enforcement, Council staff, and the Hawaii Longline Association. The ETSC will be tackling tough questions in the coming months and will likely require guidance and feedback from NOAA Fisheries regional leadership. Regularly scheduled check-ins between leadership and the staff participating on the ETSC are recommended, both to ensure leadership is informed of the ETSC's progress and to ensure staff contributions to program development are aligned with regional goals.

Consider Implementing an Electronic Monitoring Program under an Exempted Fishing Permit

Of all the EM programs implemented in federal fisheries across the country, only one–Atlantic HMS–has been implemented without an EFP. All the other EM programs started and/or continue to operate under an EFP. An EFP offers a valuable opportunity to test and refine an EM program design prior to implementing the program in regulation. An EFP also allows NOAA Fisheries to offer incentives to encourage participation, if so inclined. To make the best use of an EM EFP program, the program should align as much as possible with the intended

[12] Atlantic Highly Migratory Species Electronic Technologies Implementation Plan; August 2021. Available at: https://media.fisheries.noaa.gov/2021-08/ATL%20HMS%20ETIP_080621.pdf

[13] Personal communication, Ian Miller, Atlantic HMS Fishery Management Specialist.

design of an operational program and NOAA Fisheries should use the resulting data to familiarize end users with data outputs; revise data collection requirements; complete additional analyses (e.g., to determine acceptable levels of data uncertainty); and develop a more informed estimate of costs. This requires answers to the majority of these key program design questions (below), although some (e.g., what audit rate allows NOAA Fisheries to have confidence in the data) are better answered once EFP data has been collected and analyzed.

- **Key program design questions**:
    - **Who manages the data?** This question depends on who receives and reviews the data. This responsibility generally belongs to either NOAA Fisheries or an EM service provider contracted by the government or the fishing industry.
    - **Who pays for the program?** NOAA Fisheries may pay some or all of the costs if funds are made available through appropriations, or NOAA Fisheries may work with the Council to develop a program that adheres to the recommendations in the cost allocation policy directive, which recommends allocating administrative costs to the agency and sampling costs to the industry.
    - **How often are the cameras on?** Some programs require full coverage, in which cameras are on for 100 percent of trips, whereas others only require partial coverage, in which cameras are turned on when the vessel is selected for coverage. The former offers full accountability, but includes soft costs, such as adhering to catch handling on all trips, and higher storage costs. The latter lessens the burden to industry and produces smaller amounts of data, but may result in inconsistent catch handling or insufficient data to characterize rare protected species interactions, and does not resolve monitoring bias issues that may exist.
    - **How much video is reviewed?** Some programs use a census approach, in which all trips are reviewed, while others use an audit, in which only a subset of trips are reviewed. Audits are more cost-effective and can be conducted to validate other fishery-dependent data sources, like logbooks or dealer reports, or for sampling estimation, similar to a human observer. The amount of EM data reviewed is dependent on the purpose of the program; programs designed to validate logbooks can be audited at low rates, while programs used for sampling estimation should be audited at levels sufficient to provide confidence in the precision and accuracy of the data. Audit rates may need to be higher in programs intended to capture rare events, such as protected species interactions.

Options for Implementing an Electronic Monitoring Program

The ETSC evaluated three fisheries–Hawaii pelagic deep-set longline, Hawaii pelagic shallow-set longline, and American Samoa pelagic deep-set longline–and identified the pros and cons of introducing EM in each (Tables 1 through 3). Of all the fisheries, the American Samoa pelagic deep-set longline fishery seems to be the one with the most significant need but also the most significant barriers to implementation. The Hawaii shallow-set fishery seems to be the most viable initial option for an EM program. EM is better suited to identify turtle interactions, which generally occur during daylight hours and sometimes involve the animal being brought onboard, than FKW interactions, which generally occur at night and sometimes out of camera view. In addition, the number of vessels participating in the shallow-set fishery is small relative to the size of the fleet, which would allow for targeted training and manageable levels of industry support (e.g., hard drive retrieval, camera maintenance) to start. The Hawaii deep-set fishery requires a minimum observer coverage level of 15 percent per quarter; coverage below this level may affect the accuracy and precision of incidental take estimates. It has

not been determined whether EM would be sufficient to meet a portion of this monitoring requirement. An EM program does not seem to be a viable option for the Hawaii deep-set fishery until: (1) it is determined that EM is sufficient to meet data needs and contribute to the minimum 15 percent quarterly requirement; (2) data needs for the Hawaii deep-set fishery result in an increased coverage level requirement; or (3) monitoring needs in the shallow-set fishery significantly reduce our ability to maintain minimum coverage in the deep-set fishery using human observers alone.

Table 1: Hawaiian Deep-Set Longline Fishery

Top monitoring priority: Maintain a minimum of 15 percent coverage per quarter on the deep-set fleet and a minimum of 20 percent annually. Maintain a minimum of 15 percent coverage when fishing effort in the Hawaii shallow-set fishery displaces observer effort.
Priority species for monitoring: FKW; oceanic whitetip sharks; sea turtles.

Pros	Cons
▪ EM could be used to maintain a minimum of 15 percent coverage per quarter on the deep-set fleet during periods with limited human observer availability, which would mitigate data estimation concerns related to FKW takes and other rarely caught protected species on unobserved trips. ▪ 20 vessels already have EM systems installed and are familiar with EM protocols. ▪ The majority of vessels offload their catch in Honolulu, Hawaii.	▪ Vessels set during the day and haul at night, which may make it difficult to identify protected species interactions on video. ▪ Largest longline fleet in the region so would have the highest start-up costs to outfit the entire fleet with EM. ▪ Supplementing observer coverage with EM could lead to some data loss (e.g. biological samples cannot be collected by camera), if it is used to reduce observer coverage below 20 percent of trips.

Table 2: Hawaiian Shallow-Set Longline Fishery

Top monitoring priority: Maintain 100 percent coverage on the shallow-set fleet.
Priority species for monitoring: Loggerhead and leatherback turtles (for trip limit/hard cap monitoring).

Pros	Cons
▪ In the event that observer coverage is reduced below 100 percent*, supplemental EM coverage would allow for consistency with existing trip-based turtle regulations, which assume 100 percent monitoring. ▪ Only a subset of limited-access pelagic longline vessels participate in the shallow-set fishery (estimated at 30 vessels for 2023),	▪ Human observer coverage in the shallow-set longline fishery is currently 100 percent, and there is not presently a financial or sampling need to supplement this coverage with EM. Shallow-set longline observer coverage would need to be reduced below 100 percent to make this proposal relevant.

which would require fewer EM systems than outfitting the deep-set longline fishery. ▪ Vessels set at night and haul during the day, which is advantageous for capturing protected species interactions on video. ▪ The majority of vessels offload their catch in Honolulu, Hawaii.	▪ Supplementing observer coverage with EM could lead to some data loss (e.g. biological samples cannot be collected by camera), whereas currently observers are deployed on every trip.

*Potentially, due to funding limitations or to maintain 15 percent minimum observer coverage per quarter in the deep-set fishery.

Table 3: American Samoa Deep-Set Longline Fishery

Top monitoring priority: Achieve the 20 percent observer annual target coverage rate recommended for the fishery.
Priority species for monitoring: Oceanic whitetip sharks; sea turtles, marine mammals.

Pros	Cons
▪ Difficult and expensive to meet the target observer coverage level in this remote location; EM could be used to collect data more reliably and affordably on these trips. ▪ EM could be used to meet the minimum 15 percent quarterly coverage target on the deep-set fleet, which would improve the accuracy and precision of estimated protected species interactions on unobserved trips.	▪ There is a lack of infrastructure to support an EM program in American Samoa; additional on-location human resources would be required. ▪ EM would not meet the need for biological samples; observers would need to be deployed on a subset of trips to collect this data.

Possible Incentives to Participate in an Electronic Monitoring Program

Industry may be more willing to adopt EM if the program offers increased operational flexibility. Some incentives are implicit in an EM program, such as not having to carry a human observer; or higher, more stable levels of monitoring coverage resulting in greater certainty in the data. The ETSC may choose to explore additional incentives designed to encourage participation. Possible examples may include:

- Exempting vessels using EM from the requirement to fish consistent with the manner notified, as described in regulation at § 665.803(a), and § 665.813(d) and (h).
- Exempting vessels using EM in the deep-set fishery from the prohibition on fishing in the SEZ once a closure has been triggered (§ 229.37(e)(3)). Vessels would use cameras to demonstrate a lack of

interaction with FKW in the SEZ. In the event that a vessel did interact with a FKW in the SEZ, it would be the vessel's responsibility to self-police and exit the area immediately for the remainder of the trip.

- Exempting vessels using EM in the shallow-set fishery from the 100 percent monitoring requirement (i.e., implicit incentive) and require that they self-police their interactions with turtles consistent with the regulations at § 665.813(b)(2)(ii) through (iv).

Future Implementation of an Electronic Monitoring Program

Program Design Standards and Regulations

Resolving the key program design questions is a prerequisite to establishing program standards and regulations. The program standards describe what the program will accomplish and the metrics against which to measure performance. As an example, program standards may include metrics such as, "cameras will be used to monitor 100 percent of trips" or "vessels will adhere to catch handling requirements, as described in the vessel's vessel monitoring plan, on all trips", although the actual program standards will be heavily dependent on program design. The program standards are also the foundation of any regulatory language implementing the EM program, in the event that the Council chooses to pursue adoption of an EM program.

Components of a Successful Electronic Monitoring Program

If/when the Pacific Islands region is preparing to advance EM through either an EFP or regulation, the following list of EM program components have been identified as essential by NOAA Fisheries staffers implementing EM programs in other regions:

- **Vessel Monitoring Plans**: These are a vessel-specific document that describes camera configurations and catch handling requirements and are usually kept onboard the vessel as a reference for the captain and crew.
- **Industry Outreach and Training**: These are helpful in familiarizing the captain and crew with a vessel's EM system and expectations for program participation, such as catch handling and camera maintenance.
- **Video Reviewer Performance Standards**: This refers to requirements put in place to ensure video reviewers are producing high-quality data. Examples could include a requirement to recertify reviewers annually, or requiring that reviewers have previous observer experience, or limiting review time to 6 hours per day.
- **Video Reviewer Guidance and Data Specifications**: This describes the need for guidance to ensure reviewers are documenting what is seen on video footage in a consistent manner and producing a standardized dataset for end users.

- **Building IT Infrastructure and a Plan to Integrate New and Existing Data Streams:** In short, there needs to be infrastructure in place to house new fishery-dependent data streams, incorporate them into existing data flows and make them available to end users.
- **Performance Monitoring**: This refers to the need to have a plan to monitor the performance of third parties or video reviewers to ensure they are reporting data according to standards and requirements.

Summary

Developing and implementing an EM program is a multi-year process requiring staff time and resources. As such, project managers should consider whether EM is a suitable monitoring tool for their needs prior to embarking on the process. The first step is identifying the problem that needs to be addressed and determining whether EM is able to meet that need. If so, thus initiates the program design and implementation process.

Attachment 1–Glossary

Electronic Monitoring (EM) – The use of technologies—such as video cameras, gear sensors, and reporting systems—to monitor fishing operations, effort, and/or catch.

Electronic Monitoring (EM) Data – The data that are created in the collection of fishery-dependent data by EM systems including the video, images, or other sensor data during fishing operations as well as the metadata that provides information about the raw data (e.g., trip sail date, vessel information).

Electronic Monitoring (EM) Service Provider – For the purposes of this document, an EM service provider refers to a third-party entity certified and/or permitted by NOAA Fisheries and contracted by NOAA Fisheries or the fishing industry to collect fisheries-dependent EM data in accordance with fishery monitoring requirements.

Electronic Monitoring (EM) Data Output File – Any data collected by EM service provider staff through direct observation of EM data and submitted to NOAA Fisheries to meet monitoring requirements. Data are aggregated according to established standards, often in an alphanumeric format.

Electronic Technology(ies) – Any electronic tool used to support fisheries monitoring both onshore and at sea, including electronic reporting (e.g., e-logbooks, tablets, and other input devices), electronic monitoring (e.g., electronic cameras and gear sensors on-board fishing vessels), and vessel monitoring systems.