

1. Introduction

The National Marine Fisheries Service (NMFS) is committed to the use of appropriate electronic technologies (ET) to collect timely, cost-efficient data needed to manage US federal waters fisheries. In January 2015, NMFS finalized the Alaska Region Electronic Technologies Implementation Plan¹ to meet the milestone outlined in NMFS Policy Directive 30-133², Policy on Electronic Technologies and Fishery-Dependent Data Collection. The 2013 Policy Directive called for the development of Regional Electronic Technology Implementation Plans to address regionally specific fishery dependent data collection issues and electronic technologies to address these issues. NMFS completed an Amendment to the Alaska Region Electronic Technologies Implementation Plan³ in September 2018. The purpose of this document is to update and revise the Electronic Technologies Implementation Plan for Alaska.

In Alaska, NMFS and the North Pacific Fishery Management Council (Council) have been on a path of integrating electronic technology into fisheries monitoring programs for many years. The Alaska Region has Electronic Reporting (ER) systems in place for landing reports (aka “fish tickets”), logbooks, and observer information. Additionally, we have implemented a variety of monitoring tools like motion-compensated flow scales and Vessel Monitoring Systems (VMS).

In the last five years, the Alaska Region has continued to improve monitoring through testing and implementing EM in Alaska fisheries. In 2018, NMFS completed a significant milestone in the Alaska Region Electronic Technologies Implementation Plan by implementing regulations to allow electronic monitoring (EM) as an alternative monitoring option to carrying an observer for small fixed gear vessels in the partial coverage category of the North Pacific Observer Program (50 CFR § 679.51). After the implementation of EM in the small fixed gear fleet, the Council shifted the focus of the EM Workgroup to developing EM for use in the trawl catcher vessel fisheries. As a result of continued work by the Council and industry partners, NMFS issued an Exempted Fishing Permit (EFP) in January 2020 for evaluating the use of EM on trawl catcher vessel fisheries. The two year EFP evaluates the efficacy of electronic monitoring systems and shoreside observers for pollock catcher vessels using pelagic trawl gear in the eastern Bering Sea and Gulf of Alaska. The EFP combines EM systems that provide at-sea monitoring of vessels for compliance with fishery management objectives to achieve maximized retention, electronic reporting of catch and discard information, and shoreside observers to monitor salmon bycatch and collect biological information. The implementation and testing of EM programs combined with continued improvements to existing ER programs help meet the improved monitoring goals set forth by the Council and NMFS.

2. Strategic Direction for 2020 – 2024

2.1 Vision - the future we are working toward

To carry out their responsibilities for conserving and managing groundfish resources, the Council and NMFS require high quality, timely, and cost-effective data to support management and scientific information needs. Our vision is a comprehensive and integrated fishery

¹ Available at: <https://www.fisheries.noaa.gov/resource/document/alaska-region-electronic-technologies-implementation-plan>

² NMFS Policy Directive 30-133 was renumbered to 04-115 in 2019. Available at: <https://www.fisheries.noaa.gov/national/laws-and-policies/science-and-technology-policy-directives>

³ Available at: <https://www.fisheries.noaa.gov/resource/document/amendment-alaska-region-electronic-technologies-implementation-plan>

monitoring program for the groundfish and halibut fisheries off Alaska that enables verification of catch composition and quantity, including those species discarded at sea, and collection of biological information on marine resources. This holistic program integrates at-sea and shoreside information from observers and a range of electronic monitoring and reporting technologies to achieve the necessary fishery-dependent information for the least cost.

2.2 Goals and objectives

At the direction of the Council, NMFS created a strategic plan for EM and ER in the North Pacific (Loefflad et al. 2014). This plan was presented to the Council in April 2013 and at its June 2013 meeting, the Council adopted the strategic plan as a guidance document for incorporating EM into the Observer Program and created an EM workgroup that spearheaded the development of EM in the fixed gear sector in the North Pacific. The strategic plan outlines the following goals and objectives:

- Goal I: NMFS has the infrastructure and regulatory requirements to support EM/ER operations
 - Objective 1: Communicate through planning documents and processes
 - Objective 2: Dedicate resources to support EM/ER data acquisition, post-processing, and integration
 - Objective 3: Continue to develop the regulatory framework to implement EM/ER requirements
 - Objective 4: Secure funding to advance EM/ER technologies and use
- Goal II: NMFS is advancing cost-effective EM/ER capabilities through science-based studies and technological developments
 - Objective 1: Conduct scientific research to advance the science of monitoring and data integration
 - Objective 2: Reduce costs by gaining efficiencies in data processing and/or improving data quality
 - Objective 3: Understand all aspects of costs associated with EM technology integration, implementation, and processing
- Goal III: NMFS has a cost-effective, adaptable and sustainable fishery data collection program that takes advantage of the full range of current and emerging technologies
 - Objective 1: Implement EM/ER technology where appropriate and cost-effective to improve catch estimation and better inform stock assessments
 - Objective 2: Implement EM/ER technology where appropriate and cost-effective to enhance compliance monitoring
 - Objective 3: Improve procedures, methods or technology to enhance quality of EM data
- Goal IV: The Council and NMFS leverage global EM/ER developments while sharing AK perspectives with others
 - Objective 1: Learn from the experience of others
 - Objective 2: Influence and inform monitoring policies

As described in section 1, there has been a lot of progress toward the objectives identified in the Strategic Plan and this work has been accomplished through collaborative efforts with the Council, industry, stakeholders, and the agency. The priorities identified in section 3 will continue to work toward these four goals.

2.3 Principles guiding ET development and implementation

Through the implementation of ET and the Observer Program, the Council and NMFS have identified a number of principles that are important to successfully monitor the fisheries off Alaska (Table 1). These principles provide direction for the NMFS and the Council in developing ET, guide decision making, and establish standards for assessing proposed actions.

Table 1. Summary of monitoring principles identified by NMFS and the Council and examples of data collection and ET program elements that support these principles.

Monitoring principles	Program elements
1. Gather statistically reliable monitoring data to support management.	<ul style="list-style-type: none"> • Full coverage and random deployment in partial coverage category achieves a statistically reliable sample of vessels. • Annual deployment performance review evaluates “monitoring effect” to determine if monitored vessels are representative of unmonitored vessels. • Annual flexibility to adapt the Annual Deployment Plan to respond to potential biases.
2. Improve discard estimates by minimizing variability and reducing data gaps	<ul style="list-style-type: none"> • Allocation strategy for observer coverage in partial coverage category based on 15% hurdle combined with optimization for variance. • Annual review and evaluation of strata definitions. • The use of flow scales to obtain total catch estimates.
3. Prioritize PSC monitoring	<ul style="list-style-type: none"> • Optimization allocation strategy can allocate available observer days above the 15% hurdle according to the PSC levels. • Census of salmon PSC and associated monitoring components (video, salmon storage, CMCPs). • Full coverage on vessels with transferable PSC allocations. • Development of trawl EM to accomplish salmon PSC census.
4. Collect sufficient fishery-dependent data to support stock assessment, ecosystem assessment, and protected species needs	<ul style="list-style-type: none"> • Annual evaluation of data needs for stock assessment in the Annual Deployment Plan process.
5. Create data collection programs with flexibility to respond to evolving data and management needs in individual fisheries	<ul style="list-style-type: none"> • Annual flexibility in the deployment plan (strata definitions, allocation strategy, selection method).

	<ul style="list-style-type: none"> • Vessel Monitoring Plans developed annually based on a template that can be modified as new issues arise.
6. Distribute the burden of monitoring fairly and equitably among all fishery participants	<ul style="list-style-type: none"> • The system of observer fees distributes the costs of monitoring equitably across all fishery participants. • Annual flexibility allows coverage rates to be adjusted to fairly distribute monitoring (e.g. zero selection pool).
7. Minimize the impacts of monitoring on operational choices of fishery participants	<ul style="list-style-type: none"> • EM is an option for non-trawl vessels in the partial coverage category. • Vessels < 40 ft. LOA are in the zero selection pool. • A separate trip definition was implemented to minimize impacts to vessels delivering to a tender.
8. Foster and maintain positive public perception and stakeholder support	<ul style="list-style-type: none"> • Public and Council input during observer/EM annual review and deployment process. • Collaborative EM development through EM committee with all stakeholders. • Industry costs are limited to the established fee percentage.

2.4 Collaborative and phased approach

Throughout the implementation of both electronic reporting and electronic monitoring programs, NMFS and the Council have strived to achieve a collaborative approach. In the case of EM development, the Council appointed the EM Workgroup to develop and refine an EM program for integration into the Observer Program. As the fixed gear EM program moved into implementation, the Council reconfigured the EM workgroup to shift focus and begin development of EM in the pelagic trawl pollock fisheries. Throughout this process, the EM Workgroup has been an important forum for all stakeholders, including the commercial fishing industry, agencies, and EM service providers, to cooperatively and collaboratively design, test, and develop EM systems, and to identify key decision points related to operationalizing and integrating EM systems in a strategic manner.

Another important component of EM development in Alaska fisheries has been a phased approach (Figure 1) starting with a proof-of-concept, moving through pilot projects, testing, and different stages of implementation before the program reaches maturity. The Council and NMFS have developed this phased process for developing EM technology, and applying it to different gear sectors, in order to ensure that EM is continually providing quality monitoring data. As the Council and NMFS consider annually whether to use an EM selection pool as part of the Annual Deployment Plan, they will need to consider what is known about the reliability of the available EM technology, its suitability for the different fishing patterns or vessel configurations of the

subject fleet, and the ability of vessel operators to successfully interact with the technology onboard.

Figure 1. Stages of EM development

<ul style="list-style-type: none"> • Scale - A few volunteer boats • Data use - Demonstration • Management pathway - undetermined • Costs - unknown • Typical timeline - 1-2 years 	<p style="text-align: center;">Proof of Concept</p> <p style="text-align: center;"><i>Goal: Adaptive development of new technologies</i></p>	<ul style="list-style-type: none"> • EM Hardware - Custom construction • Vessel responsibilities - Limited/informal • Review software - Under development • EM Acceptance - Unknown • Data review protocols - Under development
<ul style="list-style-type: none"> • Scale - a few volunteer boats • Data Use - Program design • Management pathway - Initial management objectives defined • Costs - Gathering cost data • Typical timeline - 1-2 years 	<p style="text-align: center;">Pilot Program</p> <p style="text-align: center;"><i>Goal: Standardized testing</i></p>	<ul style="list-style-type: none"> • EM Hardware - System Components defined • Vessel Responsibilities - preliminary responsibilities defined • EM Acceptance - initially positive • Review software - Standardized and ready for initial testing • Data review protocols - Preliminarily defined
<ul style="list-style-type: none"> • Scale - A diverse portion of the fleet • Data Use - Fishery demographics used to enhance program design • Management pathway - Management objectives approved by Council • Costs - initially promising, now independently evaluated • Typical timeline - 1-2 years 	<p style="text-align: center;">Operational Testing</p> <p style="text-align: center;"><i>Goal: Independent evaluation under operational conditions</i></p>	<ul style="list-style-type: none"> • EM Hardware - Commercially available • Vessel Responsibilities - Preliminary Vessel Monitoring Plan (VMP) process • EM Acceptance - Mixed • Review software - Independent evaluation under operational conditions • Data review protocols - Defined
<ul style="list-style-type: none"> • Scale - All EM candidate vessels • Data Use - Gap analysis + limited use for fisheries management • Management pathway - Protocols for using EM data nearing completion • Costs - Start-up costs funded, long term costs-effectiveness deemed sustainable. Refinements to reduce costs being tested. • Typical timeline - 1-2 years 	<p style="text-align: center;">Pre-Implementation</p> <p style="text-align: center;"><i>Goal: Building scale/ finalizing program design</i></p>	<ul style="list-style-type: none"> • EM Hardware - cost effective and commercially available • Vessel Responsibilities - Defined in VMP • EM Acceptance - Growing • Review software - Commercially available and cost effective • Data review protocols - Defined
<ul style="list-style-type: none"> • Scale - All EM candidate vessels • Data Use - Data routinely used to meet management objectives • Management pathway - Operational • Costs - sustainably funded, cost effective and decreasing • Typical timeline - 3-4 years 	<p style="text-align: center;">Mature</p> <p style="text-align: center;"><i>Goal: Productive use of EM data</i></p>	<ul style="list-style-type: none"> • EM Hardware - Cost effective and commercially available • Vessel Responsibilities - VMP feedback process operational • EM Acceptance - Mostly positive • Review software - Commercially available and cost effective • Data review protocols - Defined

3. Regional ET priorities

Draft ET Priorities for the Alaska Region

- Maintain and improve existing monitoring systems that are used for compliance monitoring or integrated into NMFS catch accounting system and stock assessment processes
 - Scales, bin monitoring, CMCPs
- Identify the most appropriate and cost efficient monitoring solutions for partial coverage vessels
 - Integration of EM into the overall monitoring of fixed gear
 - Evaluation of the baseline observer coverage needed to inform fixed gear EM to obtain average weight data for discards and biological samples.
- Continue development of EM solutions for trawl vessels
 - Pelagic trawl pollock fishery EM EFP
 - Implementation of regulations to support an EM option for pelagic trawl vessels directed fishing for pollock in the BSAI and GOA.
- Develop monitoring solutions at shoreside processors in order to collect necessary data while supporting EM options (e.g. maximized retention options)
 - CMCPs designed to support EM
 - *EM options at processing plants
 - Improve precision of prohibited species catch estimation
 - Collection of biological data necessary for stock assessments
 - Support data collection needs in EM options relying on maximized retention
- Improving catch accounting and data collection through the integration and modernization of multiple systems including the permit system, IFQ, ODDS, Elandings, CAS, and EM.
- Improve data quality and use of current EM options
 - Education and outreach to increase compliance.
- Develop a multi-faceted monitoring solution that covers the diversity of fishing opportunities a single vessel may participate in. One EM system, multiple fisheries.
 - Pot and Trawl?
- Other priorities identified by the EM Committee?

4. Council Actions

Section 4 will provide a summary of ET-related Council actions (Past, Current, and Pending).

TBD

5. Electronic Technologies used in the Region

Section 5 will provide a brief overview of ET programs utilized in the region.

TBD

6. Challenges impeding implementation of ET programs

Draft of some challenges in the Alaska Region

- Maintenance of existing ET programs
 - NMFS is faced with end-of-life technology, no longer supported by vendors. Outdated ER systems require substantial staff time to maintain and are often not compatible with current equipment or systems. For example, NMFS staff continues to maintain systems built to accommodate IFQs in the 1990s. But,

migrating to modern systems require dedicated funding and staff time, which have been unavailable.

- Integrating new features and technologies
 - Integrating new features and technologies to existing ET programs built on older systems remains a challenge that NMFS continues to work on. Current ET programs include the Observer Declare and Deploy System (ODDS) for the deployment of fisheries observers in the partial coverage category of North Pacific groundfish and halibut fisheries and the Interagency Electronic Reporting System (IERS) for electronic reporting of commercial fish and shellfish. Both systems have required substantial staff time to accommodate changes and additions to functionality.
- Timeliness of data
 - In the EM program for small fixed gear vessels, there is a time lag for NMFS to receive the data. The time it takes the vessels to send in harddrives and the video reviewer to process and review the data can result in delayed vessel feedback. The timeliness of data is particularly important in instances where timely feedback could correct or prevent repeat vessel issues.
- Cost
 - ET programs can be expensive to set-up and maintain.

7. Research and Development

The Alaska Fisheries Science Center has launched several Intelligent Electronic Monitoring Projects to develop new, more efficient data collection systems. Integrating technological tools into fisheries monitoring will continue to be critical to help meet the demand for highly accurate data.

ET systems under development include stereo rail camera systems; salmon and halibut identification systems; and other species identification tools using artificial intelligence and machine learning techniques. While the existing EM program on fixed gear vessels operating in the groundfish and halibut fisheries capture information on the numbers of fish harvested, NMFS relies on observer information to calculate the tonnage of the harvest. NMFS has prioritized research of tools that could provide weight-based harvest information from EM systems through the use of EM systems which capture length, a proxy for weight.

Innovation work is iterative and incremental and in 2020, NMFS has prioritized both more formally documenting this work and seeking opportunities to integrate advances in our operational EM program. Towards these goals, an AFSC Processed Report is being prepared that summarizes the EM Research work conducted from the inception of the EM Research Program in 2014 through 2019. Further, the AFSC has applied for internal NMFS funding to investigate integrating AI/ML advancements in image review for our operational program. If funding is secured, this work will attempt to apply AI/ML algorithms to video imagery collected by third-party EM providers to improve review efficiency.

8. Data Standards and Interoperability of ET Systems

There are three regulatory approaches that have been used to implement EM/ER monitoring programs in Alaska: 1) prescriptive requirements; 2) type approval requirements; and 3) performance standards. In some cases, for example where EM is used for compliance monitoring, a combination of these regulatory approaches has been implemented to support the program.

9. Costs of EM programs

Section 9 will provide a summary of the Administrative costs as detailed in the EM Cost Allocation procedural directive⁷.

TBD

10. EM Cost Transition Plans

Alaska monitoring programs are unique in the nation in that the majority of costs are borne by the fishing industry through pay-as-you-go, cost recovery, or an observer fee.

Pay-as-you-go

Alaska's longest running EM programs are aboard fishing vessels covered by fishery observers. These EM systems help ensure compliance with myriad regulations as well as allow observers to view areas of the vessel where catch is kept prior to an observer's sampling area(s). These EM programs are established in regulation and are fully funded by the industry, with the vessels often acting as their own EM hardware provider. Under this model, the industry covers the costs of all hardware, short-term data storage aboard the vessel, and imagery transfer to NMFS upon request. NMFS may also use cost recovery to recoup the agency's costs associated with system inspection and certification.

Observer fees

Observer coverage in the partial coverage category is funded through a system of fees based on the ex-vessel value of groundfish and halibut landed. The funds generated by these fees can also be used for implemented EM programs in the partial coverage category as part of an integrated monitoring program.

While this EM program was established prior to the EM Cost Allocation procedural directive, it serves as a successful example of a stepwise transition to an industry funded program. The trajectory of the fixed gear EM program is as follows:

2015-2016: Alaska Longline Fishermen's Association (ALFA) secures \$492,553 in grant funding from the National Fish and Wildlife Foundation (NFWF) to outfit up to 60 volunteer longline vessels with EM systems with the goal of collecting information contributing to catch accounting. Partners include the AFSC, AKR, Pacific States Marine Fisheries Commission, and Archipelago Marine Research.

2016: Saltwater Inc. receives \$595,047 from NFWF to support EM development on pot gear vessels with a goal of collecting information contributing to catch accounting.

2017: ALFA is awarded an additional \$577,959 from NFWF to expand the volunteer EM fleet up to 120 vessels.

2018-2019: NMFS develops regulations for the fixed gear EM program. With much of the infrastructure costs already provided by NFWF, NMFS provides supplemental federal funding to supplement data review costs, data storage, and ongoing field support.

2020: NMFS supports the fixed gear EM program using observer fee funding and begins to identify cost efficiencies in an integrated monitoring program.

Cost recovery

NMFS has not yet used a cost-recovery program to support EM costs as defined by the EM Cost Allocation procedural directive but having this option has allowed the industry to pursue a new

⁷ National Marine Fisheries Service Procedure 04-115-02. *Cost Allocation in Electronic Monitoring Programs for Federally Managed U.S. Fisheries*. Available at: <https://www.fisheries.noaa.gov/national/laws-and-policies/science-and-technology-policy-directives>

EM model for pollock catcher-only vessels operating in the full-coverage category. Many of these vessels are participating in the Exempted Fishing Permit for Trawl Catcher Vessels, using EM systems to replace a pay-as-you-go at sea observer.

11. Regional Communications and Outreach Plan

Draft communication forums and tools

- North Pacific Fishery Management Council (NPFMC)
- NPFMC Committees include members from industry, observer service providers, agency, and Council staff. The Committees present updates and an annual report to the Council and have the opportunity to engage with the public through the Council process.
 - Trawl EM Committee
 - Fishery Monitoring Advisory Committee
- NOAA fisheries website
- Annual workshop meetings
 - Occurs in multiple communities
 - Elandings, partial coverage, and EM
- Weekly check ins when a program is under development or early in implementation
 - Includes members from industry, observer service providers, agency, and Council staff.
 - Provides an opportunity to work through issues as they come up
 - Open and transparent process
- Enforcement
 - Enforcement acts in an education and outreach role with compliance in mind
- Information Bulletins
 - Targeted outreach on specific issues
- Industry engagement through the NPFMC Trawl EM Committee and Fishery Monitoring Advisory Committee. When programs are introduced, weekly participant meetings
- Workshops and conferences such as Electronic Technologies Professional Working Group (ETPSG) and the International Council for the Exploration of the Sea (ICES)

12. References

Loefflad, M. R., F. R. Wallace, J. Mondragon, J. Watson, and G. A. Harrington. 2014. Strategic plan for electronic monitoring and electronic reporting in the North Pacific. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-276, 52 p.

<https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-276.pdf>