Alaska Region
Electronic Technologies
Implementation Plan

January, 2015

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1 Introduction

The National Marine Fisheries Service (NMFS) is committed to the use of electronic technologies in fishery dependent data collection to collect timely, cost-efficient data needed to manage US federal waters fisheries. 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: we have advanced Electronic Reporting (ER) systems in place for landing reports (aka "fish tickets"), logbook and observer information; we have implemented a variety of monitoring tools like motion-compensated flow scales and Vessel Monitoring Systems (VMS); and have integrated video monitoring into several fisheries in a compliance capacity. We have conducted and continue to conduct experimental projects with Electronic Monitoring (EM) to configure and advance the technology appropriate for fisheries in the North Pacific. Further, application development, database and web technologies are continuing to revolutionize how we manage and report information to both internal and external constituents and improve cost efficiencies.

Developing and implementing technology requires careful thought given that technologies, such as image processing techniques, are rapidly evolving. Technological investments made today may not best fit the needs of future processing and data delivery capabilities in the near future. Consideration of cost must extend beyond the acquisition of the technology and provide for infrastructure necessary to support the technology into the future, and to adapt and evolve as technology advances. Decisions about where and what to invest in represent strategic choices; wrong choices can be costly. Successful development and implementation of EM/ER depends on engagement of both agency and industry stakeholders and technology needs to be assessed in multiple phases, including: research and development; operational testing in a wider component of the fishery; development of performance standards and vessel operator responsibilities; and development and implementation of regulations.

Throughout the process of integrating electronic technologies into data collection and monitoring NMFS and the Council have continued to consider the tradeoffs between technologies and their ability to meet specific objectives. At the June 2006 Council meeting, NMFS presented a discussion paper about the issues associated with the implementation of EM (Kinsolving 2006). This paper highlighted several issues that needed to be resolved prior to implementation of a large-scale EM program. Since 2006, EM technologies have continued to evolve and the use of video, in particular, has seen considerable interest and has been the subject of many studies. In January 2011, NMFS presented a discussion paper to the Council that summarized the work that has been done evaluating the potential use of EM in commercial fisheries off Alaska and described the EM programs that had been implemented at that time (NMFS 2011).

In October of 2012, the Council initiated an electronic monitoring strategic planning process by requesting that NMFS:

> "Provide a strategic planning document for electronic monitoring (EM) that identifies the Council's EM management objective of collecting at-sea discard estimates from the 40' – 57.5' IFQ fleet, and the timeline and vision for how the EM pilot project in 2013 and future years' projects will serve to meet this objective, including funding."

And that NMFS:

> "...report to the Council on other EM options that may be appropriate to replace or supplement human observers."

In June, 2013, NMFS presented an EM/ER strategic plan (Loefflad et al., 2014, Appendix A) to the Council. The document provided a vision for integrating electronic technologies into the North Pacific fisheries-dependent data collection program:

> Vision: A future where electronic monitoring and reporting technologies are integrated into NMFS North Pacific fisheries-dependent data collection program where applicable to ensure that scientists, managers, policy makers, and industry are informed with fishery-dependent information that is relevant to policy priorities, of high quality, available when needed, and obtained in a cost-effective manner.

The plan then outlined goals and objectives and the specific actions that it will take to achieve the vision.

The Council adopted the strategic plan as a guidance document for incorporating EM into the Observer Program. In addition, the Council recognized the small-boat, halibut and sablefish fisheries as the highest priority for integration of EM and they recommended use of a catch estimation approach to develop EM for these fisheries. Finally, the Council created an EM Workgroup and tasked it to: identify EM performance standards, operational procedures, and sampling and deployment plans appropriate for IFQ vessels and also look at implementation vehicles and potential phase-in approaches. The Council recommended that the EM Workgroup use the following sections of the strategic plan to focus its efforts to develop a catch estimation based program for the IFQ fisheries: Goal II, Objective 1, Strategy C and Goal III, Objective 1, Strategy A (Loefflad, 2014, Appendix A).

Concurrent with the development of this North Pacific EM/ER strategic plan, NMFS was also looking at electronic technologies at the national level. In May 2013, NMFS issued Policy Directive 30-133, *Policy on Electronic Technologies and Fishery-Dependent Data Collection*[1], which 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. Importantly, the Policy Directive did not state that electronic technologies were appropriate for all of a region's fisheries or fishery management plans. Rather, it called for the identification of fisheries or fishery management plans for which electronic technologies are appropriate. For appropriate fisheries, the list has been identified as necessary components for Regional Electronic Technology Implementation Plans, noting that other issues can be added to meet regional fishery planning goals.

This document provides the Electronic Technology Implementation Plan for the Alaska region to meet the milestone outlined in the Policy Directive. This document does not replace the EM/ER strategic plan for the North Pacific nor does it supplant the implementation work that the Council's EM Workgroup is undertaking to integrate EM into the halibut and sablefish fishery. Instead, this document provides information about the specific EM/ER initiatives that are

[1] Available at: http://www.nmfs.noaa.gov/op/pds/documents/30/30-133.pdf

currently being undertaken to work toward implementing our vision where electronic monitoring and reporting technologies are integrated into NMFS North Pacific fisheries-dependent data collection program where applicable. Here we provide a progress report on that implementation and information on the EM/ER initiatives that are underway. The document borrows heavily from the products generated from the EM Workgroup and information in the EM/ER Strategic Plan and, where appropriate, we have provided cross-references to the strategic Goals and Objectives.

2 Electronic Monitoring/Reporting Approaches

EM/ER technologies provide a variety of tools and potential configuration of tools that may be used to help accomplish specific objectives. Clarity in the desired objectives is essential and will help determine the appropriate monitoring approach. Decisions related to costs, feasibility, and effectiveness help to determine the right combination of tools needed to achieve objectives. Here we describe two broad EM/ER approaches that are available to meet specific monitoring objectives and provide examples of where these approaches have been investigated and/or implemented in Alaska and other fisheries.

2.1 Compliance Monitoring

A compliance monitoring approach uses EM/ER tools to enable and/or improve regulatory compliance monitoring and provide independent information to inform agencies if industry is complying with specific regulations. The EM data obtained under the compliance monitoring approach do not feed into catch accounting or stock assessments. Instead EM used in this approach is often used to support data collection through other methods (e.g., observers or industry self-reported data). Depending on the monitoring objectives, there are different approaches to implementing a compliance- monitoring program with EM/ER tools.

2.1.1 Compliance monitoring for a specific requirement

The Alaska region has had success with the use of EM for compliance monitoring and has implemented this methodology for all catcher/processors and motherships that use flow scales, the AFA pollock catcher/processors, the Rockfish and Amendment 80 Programs, and the Pacific cod freezer longline fishery in the Bering Sea (Table **3.1**). In all of these cases, video is being used to verify compliance with regulations for catch sorting and weighing. For example, video is being used on catcher/processors in the AFA fishery to verify that salmon have been sorted and stored properly to enable observer sampling.

In monitoring approaches to verify compliance with specific regulations, EM data can be reviewed when other sources of information suggest the need for review, through random audit checks, or anytime to verify that the EM system is functioning as required. The review can consist of only portions of the information that is recorded or it could be a review of all the information that is recorded. The intensity of the review depends on the need and available resources.

The advantages of EM as a compliance monitoring tool include: relatively low cost to both industry and the agency (especially after the initial years of implementation); depending on the compliance monitoring objective, the data storage and review requirements can be relatively

low; and the tool can serve as an enhancement to enforcement that may not be able to do frequent patrols or at-sea boarding of vessels. The disadvantages include: the fact that these types of EM programs are not able to accomplish other tasks such as catch estimation; the compliance approach usually requires some other method such as observers, flow scale or elogbook to gain the necessary fishery specific information; and special chain of custody requirements may make data storage and handling procedures more complicated since the data may be used for enforcement.

2.1.2 Compliance monitoring (audit) of self-reported data

A different compliance monitoring approach is to require industry self-reported data and to use the EM to audit, or verify, compliance with the record keeping and reporting requirement. The EM program in the Canadian hook-and-line groundfish is the most well known example of this approach. In their program, the goal of requiring self-reported data in the logbook is to document species-specific catch of quota species in an Individual Transferable Quota (ITQ) program. To accomplish this goal, they required detailed logbook reporting by species and by set. All vessels have camera systems and industry contractors review a subset of footage after landing to validate the logbook reports. A critical component of this program is that there are immediate financial penalties to individual fishermen for poor reporting in the logbook. If the audit of the self-reported data are not within a specified tolerance, then the entire video may require review and the individual fishermen bears this cost. Another important aspect of the program is a comprehensive dockside-monitoring component where species identifications are verified during offload. This compliance monitoring approach has been shown to perform well for the species that are included in the audit review, and an advantage of the program is that is provides the public with assurance that self-reported data are being monitored for accuracy.

2.2 Data Collection for Management and Science

The second broad approach is to use EM/ER tools to collect data that are used to manage fisheries and conduct scientific stock assessments. A primary management objective is to track catch and bycatch of fisheries (i.e., total catch accounting). Often there is a management demand for the catch accounting to occur very quickly, especially in catch share management programs that may necessitate near real time quota accounting. In other fisheries that are being managed in season by NMFS, catch accounting may occur within a week or two. In additional to total catch, managers also need spatial information about fishing locations, as well as data about fishing gear. Scientists also rely on fishery catch and bycatch data to estimate mortality, which is a critical component of stock assessments. Other important science data needs are dates, times, location, depth, and gear information that are used to estimate fishing effort; and biological data such as otoliths, scales, lengths, and weights that are used in stock assessments. The timeliness of data collected for science is generally less critical since most stock assessments are conducted on annual cycles.

Here we outline two scenarios where EM/ER could be used to collect data for management and science: near-real time data collection and less time-critical approaches.

2.2.1 Management data under a catch share program (near-real time)

Catch share programs usually require: near-real time access to data by agency and fishery participants; data that are not subject to wide variability on a day-to-day basis; and information that is frequently vessel-specific that can be legally defensible when holding a quota holder

accountable for staying within their quota allocations. A combination of observer data and a suite of EM/ER tools have been used to accomplish these goals in multiple Alaska catch share programs (Table **3.1**). Information needs under catch share management programs, for both the industry and agencies, have also raised the bar for the level of timeliness and quality of the data collected by EM/ER and these technologies have advanced. Other projects have also sought ways to reduce observer coverage by using information collected from EM.

Suite of EM/ER tools in combination with observers
NMFS and the Council have implemented several catch share management programs in Alaska that include large EM/ER monitoring components (Table **3.1**). The suite of EM/ER tools that have been implemented include: Observer electronic reporting software (Atlas) for timely reporting of observer generated data; elogbook for timely reporting of catch and area information; elandings for timely electronic reporting of landings and production data; flow scales to obtain the total weight of species caught; and, as described in the previous section, EM as a compliance tool to enhance observer data collection. These tools, in combination with observer data collection, provide a single authoritative record of the amount of quota harvested and have greatly enhanced the ability for NMFS and cooperative managers to monitor and manage catch and bycatch. These tools are costly to NMFS (e.g., IFQ crab reporting through elandings requires significant agency support staff and infrastructure for development and maintenance) and to industry (e.g., the cost of flow scales installation and maintenance) and do require additional attention and time by industry (e.g., data entry for electronic reporting). However, these costs can be offset by the benefits of a catch share management program and without these EM/ER tools implementation of some catch share programs would not be possible.

EM/ER to reduce reliance on at-sea observers
To date, NMFS has not implemented any operational systems where video imagery is collected and information is extracted for fisheries management. However, a series of pilot projects in the GOA rockfish fishery evaluated the use of video in management of a catch share fishery to quantify the amount (in weight) of halibut discard from trawl catcher vessels (McElderry 2005; Bonney and McGauley 2008; Bonney et al 2009). Section 1.4.2.1 in the EM/ER Strategic Plan provides a summary of the results from this work (Loefflad et al., 2014).

2.2.2 Less-time sensitive approach

The other scenario where data could be extracted from video to be used for science and management would be in less time-sensitive fisheries. Like catch share programs, NMFS has not implemented any operational systems where video imagery is collected and information is extracted for fisheries management in non-catch share fisheries. However, there have been several projects that have evaluated the potential to obtain data from video to be used to estimate catch in fisheries where there was not an immediate (i.e., near real time) demand for the data. (e.g. ALFA 2013, Ames 2005, Ames et al. 2005, Ames et al. 2007, Cahalan et al. 2010). The work being undertaken by the EM Workgroup builds on lessons learned from previous projects and is specifically working to find solutions to implement EM as an alternative tool to estimate discards on small, fixed-gear vessels where taking an observer is problematic (e.g. small vessels with limited bunk space).

3 List of Alaska fisheries suitable for implementation of EM and ER

A summary of the existing monitoring tools that are currently implemented in Alaskan fisheries is shown in Table **3.1**. As described in the previous section, catch share programs require a more intensive suite of monitoring tools for management and these fisheries are therefore listed separately from the non-catch share programs. The table provides a summary of fisheries where additional ER and EM could potentially be suitable and yellow cells indicate those fisheries that have been identified as the highest priority for implementation. The work being conducted in the high priority fisheries are described in more detail in Section 5 on EM/ER Initiatives.

Table 3.1. Summary of the existing monitoring tools currently implemented in the North Pacific. Catch share programs require a more intensive suite of monitoring tools for management and are therefore listed separately from the non-catch share programs. Green cells indicate fisheries where electronic technologies have already been implemented and regulated programs are in place. Fisheries where additional Electronic Reporting (ER) and Electronic Monitoring (EM) could potentially be suitable are noted; yellow cells indicate fisheries that have been identified as high priority for implementation and have initiatives underway. (Note: AFA = American Fisheries Act; BSAI= Bering Sea/Aleutian Islands; CP = catcher/processor; CV = catcher vessel; GOA = Gulf of Alaska; IFQ = Individual Fishing Quota; IERS=Interagency Electronic Reporting System; LOA = length overall of vessel)

Program Type	Fishery	Current Requirements									Additional ER Potentially Suitable?	Potential EM Application?
		ER for Landings &/or Production (IERS)	Paper logbook[2]	ER for logbook (elogbook in IERS)	ER for Observer data (Atlas)	Flow Scale	VMS	Video	Observer Coverage	2nd Observer		
Catch Share	BSAI pollock trawl CP & mothership (AFA)	Y	N	Y	Y	Y	Y	Y	100%	Y		
	BSAI non-pollock trawl CP (Amendment 80)	Y	N	Y	Y	Y	Y	Y	100%	Y		Y - video and/or flow scale to monitor deck sorted halibut PSC
	Central GOA Rockfish Trawl CP	Y	N	Y	Y	Y	Y	Y	100%	Y		
	BSAI Pacific cod Longline CP	Y	N	Y	Y	Y	Y	Y	100%	Y		
	BSAI rationalized crab CP	Y	Y	Few-voluntary	N	Y	Y	N	100% - not NMFS	N	Y- elogbook	
	BSAI pollock trawl CV (AFA)	Y	Y	Few-voluntary	Y/N[3]	n/a	Y	N	100%	N	Y- elogbook; Atlas	
	CGOA Rockfish Trawl CV	Y	Y	N	Y	n/a	Y	N	100%	N	Y- elogbook	Y-compliance monitoring & estimation of halibut PSC
	IFQ Sablefish CP	Y	Y	Few-voluntary	N	N	Y- AI only	N	100%	N	Y- elogbook	
	IFQ Halibut CP	Y	Y	Few-voluntary	N	N	Y- AI only	N	100%	N	Y- elogbook	
	IFQ Sablefish CV	Y	Y	N	N	n/a	Y- AI only	N	Partial	N	Y- elogbook	Y- video for catch estimation
	IFQ Halibut CV	Y	Y[4]	N	N	n/a	Y- AI only	N	Partial	N	Y- elogbook	Y- video for catch estimation
	IFQ Halibut & Sablefish <40' LOA CV	Y	Y[2]	N	N	n/a	Y- AI only	N	None	N		Y – video for catch estimation
Non-Catch Share	BSAI Turbot longline CP	Y	Y	N	N	N	Y	N	100%	N	Y- elogbook	
	GOA Trawl CP	Y	Y	N	N	N	Y	N	100%	N	Y- elogbook	
	GOA Longline CP	Y	Y	N	N	N	Y	N	100%	N	Y- elogbook	

[2] Paper logbooks are required by NMFS for vessels >60ft

[3] Electronic reporting software for observers, Atlas, is currently required for vessels >125' but some vessels <125' voluntarily use Atlas

[4] Paper logbooks are required by IPHC for vessels >26 ft fishing for halibut; vessels >60ft are also required to submit paper logbooks by NMFS and there is a shared IPHC-NMFS paper logbook.

Program Type	Fishery	Current Requirements									Additional ER Potentially Suitable?	Potential EM Application?
		ER for Landings &/or Production (IERS)	Paper logbook[2]	ER for logbook (elogbook in IERS)	ER for Observer data (Atlas)	Flow Scale	VMS	Video	Observer Coverage	2nd Observer		
Non-Catch Share	BSAI Pacific cod Trawl CV	Y	Y	N	N	n/a	Y	N	Partial; some vessels 100% voluntarily	N	Y- elogbook	
	GOA pollock Trawl CV	Y	Y	N	N	n/a	Y	N	Partial	N	Y- elogbook; tLandings for tenders; Atlas	Y- compliance monitoring of no discard
	GOA non-pollock Trawl CV	Y	Y	N	N	n/a	Y	N	Partial	N	Y- elogbook; tLandings for tenders; Atlas	Y-compliance monitoring & estimation of halibut PSC
	Pot CP	Y	Y	N	N	N	Y	N	100%	N	Y- elogbook	Y – video for catch estimation
	Longline & Pot >=40'LOA CV	Y	Y	N	N	n/a	Y	N	Partial	N	Y- elogbook; tLandings for tenders	Y – video for catch estimation & PSC monitoring
	Longline & Pot <40'LOA CV	Y	N	N	N	n/a	Y- AI only	N	None	N		Y – video for catch estimation & PSC monitoring
	Jig	Y	Y	N	N	n/a	Y- AI only	N	None	N		

4 Regulations implementing EM/ER tools in Alaska

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.

Prescriptive regulations specifically define what activities must to be undertaken, how to conduct those activities, and who is required to comply. In general, the recordkeeping and reporting regulations for electronic reporting in Alaska (§679.5(e)[5]) follow a prescriptive regulatory approach. Implementation of additional ER programs in Alaska would require modification to regulations at §679.5(e).

Type-approval regulations lay out a process to grant approval to a product that meets a minimum set of regulatory, technical, and/or safety requirements. The regulations governing the use of flow scales on catcher/processor and motherships are an example of type-approval regulations (§679.28[6]). Any flow scale that is to be used to weigh catch at sea must be on a list of approved scales. Scales are included on the approved list when they pass type-evaluation and testing (laid out in an appendix to the regulations[7]). This regulatory approach works for equipment, such as scales or Vessel Monitoring Systems (VMS), that are part of a well-established technology with larger international trade organizations determining what types of scales to approve for use in trade.

Performance-based regulations put more emphasis on specifying a performance standard for the desired outcome and do not deliberately constrain how compliance is to be achieved. In Alaska, regulations governing catch monitoring and control plans requirements (§679.28(g)(7)) are an example of performance-based regulations. The regulations describe how a shoreside processor will meet a set of specific standards to ensure that proper accounting for catch will occur and the shoreside processor submits a plan to NMFS for approval that describes how they will meet those standards. One aspect of implementing performance-based regulations is that they take cooperation between NMFS and the regulated entity, especially in the first years of a program. Alaska has had success with these programs, but this regulatory approach does take staff time for both the agency and the regulated entities.

The regulations that are currently in place governing the use of video for compliance monitoring have been implemented using a combination of prescriptive requirements along with performance standards (§679.28(e), §679.28(j) and §679.28(k)). Prescriptive requirements are used for specific types of equipment (for example, "16- bit or better color monitor") where a performance standard would be overly complicated. But if there may be multiple ways to achieve the same goal, the regulations describe a performance standard that gives a vessel the flexibility to have the necessary system configurations to meet that goal. New regulations for

[5] http://www.alaskafisheries.noaa.gov/regs/679a5.pdf
[6] http://alaskafisheries.noaa.gov/regs/679b28.pdf
[7] http://alaskafisheries.noaa.gov/regs/679app.pdf

EM in Alaska would likely implement this combined approach, with performance-based regulations for many of the requirements and either type approval or prescriptive approach where performance-based standards would be cumbersome.

5 EM/ER Initiatives

Section 3 summarizes fisheries where electronic technologies have been implemented in Alaska and identifies potential fisheries where EM and ER could be expanded (Table 3.1). Here we provide more detail about five EM and ER initiatives that are currently being undertaken in Alaska. These initiatives maintain ongoing support to implemented EM/ER programs (green cells in Table 3.1) and support new EM/ER implementation for the highest priority fisheries (yellow cells in Table 3.1).

5.1 Electronic Monitoring

5.1.1 EM for catch estimation in small boat, fixed-gear fishery

Goal

The goal of this initiative is to assess the efficacy of EM for catch accounting of retained and discarded catch, and to identify key decision points related to operationalizing and integrating EM systems into the Observer Program for small, fixed-gear vessels.

Project Description

The project is being conducted through a cooperative research program and a North Pacific Fishery Management Council (Council) committee, the fixed gear EM Workgroup (EMWG). The EMWG provides a forum for all stakeholders including the commercial fishing industry, agencies, and EM services providers to cooperatively and collaboratively design, test, and develop EM systems that are consistent with Council goals to integrate EM into the Observer Program.

The cooperative research includes analytical and fieldwork components to address the following four elements:

- Deployment of EM Systems for Operational Testing
- Research and Development of EM Technologies
- Development of Infrastructure to support EM implementation
- Analyses to support EM implementation decision points

This cooperative research will inform evaluation of multiple EM program design options and consider various EM integration approaches to achieve management needs. This approach will enable the EMWG to identify and resolve implementation issues associated with integrating EM into the Observer Program.

Data and analysis produced on costs, data quality, risks, operational procedures, and vessel compatibility will inform decisions on implementation phases, future investments in technology, and identify the combination of tools that will best meet NMFS, Council, and stakeholder management objectives. These decision points will be analyzed in a regulatory amendment, and the Council's recommendation, and subsequent NMFS rulemaking that will result in integration

of EM options into the Observer Program. The Council and NMFS are not able to use the observer fee, currently collected from vessels participating in the partial coverage category of the observer program, to support EM until the regulatory process is complete. Section 6 contains more information on funding and costs. Appendix B provides more details on the EMWG cooperative research being conducted to implement this initiative.

Linkage to the EM/ER strategic plan
This project addressed the following components of the Strategic Plan for EM/ER in the North Pacific (see Appendix A for action items):

- Goal II, Objective 1: Conduct scientific research to advance the science of monitoring and data integration.
    - Strategy C: Evaluate EM technologies in the 2013-2014 EM project on volunteer vessels in the <57.5 longline and pot vessels.

Analysis of the results from the cooperative research will be used to develop a suite of alternatives for the Council to choose from to address, Council action, and development of regulations that will address:

- Goal III, Objective 1: Implement EM/ER technologies where appropriate and cost effective to improve catch estimation and better inform stock assessments.
    - Strategy A: Implement EM as appropriate based on scientific research from goal II.
- Goal I, Objective 3: Continue to develop the regulatory framework to implement EM/ER requirements.
    - Strategy A: Develop requirements to use EM for catch estimation.

Preliminary Timeline
The EMWG has developed a preliminary timeline (Table **5.1**, Appendix B), although change and refinement of the timeline is expected to be an ongoing process with a sustained commitment to building EM capacity. The Council may recommend implementing EM integration in phases as results from the cooperative research warrant, with ongoing refinement of EM technology, field services, and data review elements, as circumstances warrant. Currently, this is envisioned to occur with the cooperative research leading to "pre-implementation" phase of EM as the Council analysis and regulations are being completed.

Table 5.1. Summary of the preliminary timelines and major milestones for small-boat, fixed gear EM initiative (note that these are subject to change as the project progresses). More details on the timeline are provided in Appendix B.

Activity/Milestone	**Timeline**
Council's Scientific and Statistical Committee (SSC) reviews the Cooperative Research Plan	Feb, 2015
Stereo camera field research	Jan-April, 2015
Operational testing of EM	March-Sept 2015
Presentation a refined 2016 Pre-Imp concept to Council	Oct, 2015
Pre-implementation year 1: likely focused on longline vessels <57.5'. Size of fleet will be dependent on available funding *(independently sourced)* and Council requirements	Jan-Dec, 2016

Initial review for EM analysis. Focus on what type of EM program should go forward, and what regulatory changes are needed to allow it	October, 2016
Council final action on EM analysis	December, 2016
Pre-Implementation year 2, potentially expanded to include other fixed gear vessels *(requires independent funding)* Develop regulations for integrating EM	Jan-Dec, 2017
Integrated observer/EM monitoring program	2018

5.1.2 Video Compliance Monitoring

Goal

The goal of this initiative is to implement EM/ER technology where appropriate and cost effective to enhance compliance monitoring on catcher/processors and motherships.

Description

Starting in 2007, NMFS and the NPFMC have been implementing EM as a monitoring tool on catcher/processor vessels in four fisheries (Table **3**.**1**). In all of these cases, video is required in combination with observers and the video is used to verify compliance with regulations governing catch sorting and weighing that are specific to each fishery:

- Longline catcher/processors that fish for Pacific cod in the Bering Sea that have chosen to have a flow scale aboard in lieu of an additional observer are required to have video monitoring of all areas where catch is sorted and weighed. The video monitors compliance with regulations regarding sorting and flow of fish over the scale.
- Trawl catcher/processors that fish for Pollock in the Bering Sea in the AFA program are required to have video monitoring showing all areas where salmon are sorted from catch as well as the location where salmon are stored until sampling by an observer.
- Trawl catcher/processors participating in Amendment 80 and the CGOA Rockfish program fisheries may choose video monitoring of the inside of fish bins as one method of ensuring that catch is not selectively sorted inside the bins before the observer has an opportunity to sample the catch.

In 2015, NMFS expanded requirements for compliance monitoring with video to all catcher/processor vessels and motherships that are required to weigh catch at sea. Under these new regulations, all vessels that weigh catch at sea using a flow scale are required to provide video monitoring of fish entering, moving across, and leaving the weighing platform of the flow scale. The regulations also require video monitoring of all access panels allowing adjustments to the scale, and of crew activities in these areas. The scale display head and the light showing when the scale is in fault mode also need to be within the camera view.

Linkage to the EM/ER strategic plan

This project addressed the following components of the Strategic Plan for EM/ER in the North Pacific (Appendix A):

- Goal III, Objective 2: Implement EM/ER technology where appropriate and cost effective to enhance compliance monitoring.

Timeline

- Work to audit the video to ensure compliance with regulations and improve system performance is ongoing.
- Implement regulations to expand the use of video for compliance monitoring on all catcher/processors and motherships that use flow scales in 2015.

5.1.3 Deck sorting of halibut Prohibited Species Catch (PSC)

Goal

Evaluate and test protocols and technology to enable monitoring and PSC estimation of deck sorted halibut on trawl catcher/processors in the Amendment 80 sector in the BSAI in order to reduce halibut mortality.

Description

The ability to monitor sorting and estimate the weight of discarded halibut that are sorted on-deck of the catcher/processor will require new protocols and electronic technologies including flow scales and/or video. Testing is necessary before this program can be effectively considered, analyzed, and implemented through rule making. Over the summer of 2014, industry tested a chute camera system and a flow scale as a "proof of concept." The initial trials showed promise, but additional testing is required that could be conducted under an Experimental Fisheries Permit (EFP).

Linkage to the EM/ER strategic plan

This project addresses the following component of the Strategic Plan for EM/ER in the North Pacific (Appendix A):

- Goal II, Objective 1: Conduct scientific research to advance the science of monitoring and data integration.

Timeline

The project is still under development so the exact timeline is not known and is subject to change as the project develops and there are results from the research. A very preliminary idea of timing and major milestones could be:

- Development of Exempted Fisheries Permit (EFP): Jan-June, 2015
- Presentation of EFP application to NPFMC: June, 2015
- Research preparation (installation of equipment, etc): Fall, 2015
- Research under EFP: Jan, 2015 – 2016
- Council analysis: 2017
- Development of regulations: 2018

5.2 Electronic Reporting

5.2.1 Interagency Electronic Reporting System

Goal

Provide and maintain a high quality, real-time fishery reporting system that supports sustainable fisheries while fostering positive relationships among partner agencies and with industry.

Description
The Interagency Electronic Reporting System (IERS) is an interagency project involving the three agencies that manage commercial fisheries in Alaska: NMFS, the Alaska Department of Fish and Game, and the International Pacific Halibut Commission. Commercial seafood processors are required to report data on seafood harvest to these three agencies. Traditionally reporting has involved a combination of paper forms, such as fish tickets and weekly production reports, and IFQ web-based reporting of halibut and sablefish. The IERS provides the Alaska fishing industry with a consolidated, electronic means of reporting landings and production of commercial fish and shellfish to multiple management agencies. The management agencies work together to implement the IERS to eliminate redundant fishery reporting to management agencies.

The IERS includes a suite of 5 reporting applications:

- eLandings - web-based access for seafood processors;
- Agency Interface - locally installed access for fishery management agency personnel;
- seaLandings - locally installed program which provides email-based access for catcher/processor and motherships that report at sea. SeaLandings also includes an elogbook for catcher/processors and motherships;
- eLogbook for catcher vessels - locally installed program with an elogbook for catcher vessels;
- tLandings - locally installed program for salmon, shellfish and groundfish tenders with no web access.

The long-term goal of IERS is to provide a single reporting system for commercial harvest, production, and logbook information for groundfish, halibut, salmon, and shellfish fisheries in Alaska. The eLandings reporting system was first released for the BSAI Crab Rationalization Program in August 15, 2005. eLandings reporting of groundfish and halibut IFQ landings started in January 2006 on a voluntary basis. The system became mandatory for groundfish in 2009. eLandings and tLandings for salmon was introduced in 2013 and is currently being incrementally implemented throughout the state salmon fisheries.

Requirements for elogbooks went into effect in 2015 for catcher/processors and motherships that are required to use flow scales. This added to elogbook requirement that were already in place for catcher/processors in the AFA and CGOA Rockfish programs, and longline catcher/processors that fish for Pacific cod in the Bering Sea.

Linkage to the EM/ER strategic plan
This project addresses the following component of the Strategic Plan for EM/ER in the North Pacific (Appendix A):

- Goal III, Objective 1: Implement EM/ER where appropriate and cost effective to improve catch estimation and better inform stock assessment.

Timeline

- Work to support the existing IERS implementation is ongoing.
- Expansion of elogbook on catcher/processors:

    - NMFS has new regulations that went into effect in 2015 that expand requirements for elogbooks to all catcher/processors and motherships that use flow scales.
    - There are currently no plans to require the use of elogbooks by catcher/processors that do not use flow scales. However, these vessels already use seaLandings to submit production and landings data so it is possible for them to start using the elogbook without additional equipment or software and several longline and pot catcher/processors started submitting elogbooks in 2014.
- elogbook on catcher vessels: there are currently no regulations being considered to require elogbooks from catcher vessels although the elogbook is being used voluntarily by several trawl catcher vessels. NMFS is also working with ADFG to test the use of elogbooks on pot vessels fishing for crab in 2015.

5.2.2 Atlas

Goal

Provide and maintain a high quality, near real time reporting system for observer data that supports sustainable fisheries and provides support and guidance to observers deployed in the field.

Description

The Atlas software program allows groundfish observers to enter and send data directly from a vessel or plant to NMFS. The Atlas software application contains business rules that perform many quality control and data validation checks automatically, which dramatically increase the quality of the preliminary data. Data that are transmitted electronically arrive in a timely manner to managers. Without the Atlas program, data are faxed and then keypunched into a database by observer program staff in Seattle; this process increases the time for the data to be available to managers by a week or more. Additionally, observers onboard vessels with the Atlas software and transmission capabilities have the ability to communicate directly with Observer Program staff in near real time to address questions regarding sampling as well as notify staff of potential compliance concerns. Currently, all catcher vessels (CVs) greater than 125 feet length overall (LOA), catcher/processors and motherships, and all shoreside and stationary floating processors that are required to have an observer present are required to have the Atlas software and transmission capabilities. This project would expand the use of the Atlas software on catcher vessels less than 125 ft LOA.

Linkage to the EM/ER strategic plan

This project addresses the following component of the Strategic Plan for EM/ER in the North Pacific (Appendix A):

- Goal III, Objective 1: Implement EM/ER where appropriate and cost effective to improve catch estimation and better inform stock assessment.

Timeline

- Work to support Atlas for the existing regulated fisheries is ongoing.
- Additional requirements for Atlas software, likely without transmission capabilities, are being considered for trawl catcher vessels under the GOA trawl bycatch management program and for AFA trawl catcher vessels <125ft LOA.

6 EM/ER Costs & Funding Needs to support Implementation

There are a variety of issues to consider when it comes to EM/ER costs and funding. The obvious costs to consider are hardware and software, but many other factors and costs contribute to the successful implementation of an EM/ER program. These include: infrastructure needs such as databases, hard drives, and data storage; data review and processing; staff support; training; and many others. Given the wide range and rapidly changing choices of technology and equipment in today's market, the following section describes the general categories of costs that should be considered during the development of an EM/ER program rather than specific types and costs of equipment. The type and cost of equipment and other infrastructure needed to support EM/ER tend to be highly variable and will depend on the scope and purpose of the EM/ER program. Thus, clearly defining the goals and objectives of the program will be important in determining the overall cost.

The following costs have been identified as the primary drivers of costs and funding needed to support implementation of our EM/ER initiatives. Detailed cost estimates have not yet been developed for all five of EM/ER initiatives described in section 5. The current focus and primary effort is directed forward implementing EM for catch estimation in the small boat, fixed gear fleet. Thus, detailed costs are provided for this initiative. Cost for other initiatives will be updated in future versions of this document.

6.1 Electronic Monitoring

6.1.1 EM for catch estimation in small boat, fixed-gear fleet

To support implementation of an EM program for catch estimation, AFSC and AKR would require funding (Table **6.1**) to support the following activities:

Hardware

Hardware is one of the major cost drivers for video monitoring for catch estimation purposes. Costs include cameras, cables, hard-drives, sensors, and other equipment needed for a fully functioning video monitoring system on board the vessel. One way to reduce costs and provide flexibility might be to install sensors & cables on a large pool of boats, and then select vessels out of this pool to carry EM for a certain period of time. A smaller number of camera and control boxes could be purchased and moved between boats when they were selected for coverage and the existing sensors and cables could make this transition faster and more efficient.

Field services

Personnel, either agency staff or contractors, are needed to visit vessels, install necessary software, verify proper installation and operation, retrieve hard drives, and perform other functions. Costs may include direct staff salaries, contract costs for trained field personnel, travel, and training.

Research and Development

The Fisheries Monitoring and Analysis (FMA) Division of NMFS Alaska Fisheries Science Center (AFSC) is in the process of building an EM program with a focus on cooperative research, and research and development work to advance EM as a tool to supplement fishery dependent data collections. The FMA Division is leveraging the work conducted over several

years by the Marine Assessment and Conservation Engineering (MACE) group in AFSC. The FMA Division is hoping to apply much of the work done with underwater cameras used in surveys to deckside applications on commercial vessels, and to continue its advancement in monitoring. Costs may include development of software for automating image review and analysis for species identification and enumeration.

Data Analysis Services

Trained personnel are needed to process, review, and analyze video monitoring data and incorporate data for management purposes. Data analysis services are required to make meaningful use of any EM data. Costs may include direct salaries for staff to perform video review, analysis, and training. Some of these costs may be reduced through development of software applications that automate the review process as described under hardware and software.

Table 6.1. Estimated costs to implement EM for catch estimation in small boat, fixed-gear fishery in Alaska. Table estimates cost/year for EM pre-implementation in 2016. Cost estimates will be refined using information from operational testing and pre-implementation. Federal funding would be required in 2016 and 2017; industry fees would be used in 2018 once regulations are in place. Some costs would be recurring, other costs, such as equipment and infrastructure, might not be incurred every year.

Item	Cost	Total
Staffing		
1 FTE position for regulation development	$106,201*	$106,201
Hardware		
Camera(s)	30@$2,500/vessel	$75,000
Control box	30@$6,500/vessel	$195,000
Sensors	80@$2,000/vessel	$160,000
Hard drives (some on boat, some in transit, some in review)	150@$200	$30,000
Field Support		
Shipping for equipment and hard drives	$20,000	$20,000
Training (labor, materials, travel)	$25,000	$25,000
Labor for installation, maintenance & repair	80@$3,500 /vessel	$280,000
2 contract or FTE position for field support & program management	2 @ $106,201	$212,402
Research & Development		
1 contract or FTE position for R&D field work	1 @ $106,201	$106,201
R&D IT infrastructure application development	$50,000	$50,000
R&D for data retrieval	$50,000	$50,000
Data Analysis		
Software	$15,000	$15,000
2 contract or FTE positions for video review	2 @ $78,072**	$156,144
Data Storage/Archiving - Infrastructure		
1 contract or FTE position for database administrator	$106,201	$106,201
2 contract or FTE positions for application development	2 @ $106,201	$212,402
Media storage & database hardware - IT infrastructure	$200,000	$200,000
TOTAL		**$1,999,551**

* based on the mid-range salary of a FTE ZP3 Step 2 + benefits. Contractor costs would be higher.
** based on the mid-range salary of a FTE ZP2 Step 2 + benefits. Contractor costs would be higher.

6.1.2 Video Compliance Monitoring

Several video compliance-monitoring programs (catcher/processors and motherships with flow scales, including A91, A80, and freezer longline catcher processors) have already been

implemented in Alaska and costs have been identified and analyzed in the Regulatory Impact Review (RIR) documents associated with those programs[8]. In these programs, video cameras are used for compliance monitoring; cameras record the activities of vessel personnel and provide a record that NMFS can use to enforce requirements. The video is stored on the vessel and made available to NMFS for review upon request. Video data are not extracted from the images for management, instead, the video provides an audit option to confirm whether sorting standards were met and observers were provided the opportunity to collect unbiased samples of catch.

Hardware
Hardware is one of the major cost drivers for video monitoring for compliance purposes. In Alaska, regulations require industry to pay the cost of equipment needed for video compliance monitoring programs. These costs have been analyzed in the EA/RIR for each of the Amendments and costs for hardware include video cameras, cables, and hard drives, and may include installation, maintenance, and repair costs, as well as costs to reconfigure spaces in the factory or on deck to accommodate cameras or other equipment.

Field services
Agency staff are needed to visit vessels, verify proper installation and operation, retrieve hard drives, and perform other functions. Costs include direct staff salaries, contract costs for trained field personnel, travel, and training.

Data Analysis Services
Trained staff are needed to process, review, and analyze electronic data and provide feedback to NMFS OLE regarding potential violations. Data analysis services are required to make meaningful use of any EM data. Costs include direct staff salaries and training.

6.1.3 Deck-sorting of halibut Prohibited Species Catch (PSC)

It is not yet known what the costs will be to use EM to enable accounting of halibut PSC that is sorted on deck of catcher/processor vessels. Further experimental work is needed to determine what combination of EM tools will be the most cost effective and effective in this application. The next step could be work under an Exempted Fishing Permit (EFP) that could start in 2016. The cost structure for EM for deck-sorting under a regulated program would likely be similar to the current compliance monitoring programs, where industry pays the costs of the hardware including video cameras, cables, and hard drives, installation, maintenance, and repair costs, as well as costs to reconfigure spaces on deck to accommodate cameras or other equipment. NMFS would likely cover the costs of agency staff to verify proper installation and to process, review and analyze the electronic data.

[8] Amendment 80: see Section 1.10.6 "Effects on Management, Monitoring, and Enforcement" (starting on page 114, specific video monitoring equipment and storage costs are on page 129. Total installed system cost ranges from $4,050-$24,500/vessel.
http://www.alaskafisheries.noaa.gov/sustainablefisheries/amds/80/earirfrfa0907.pdf
Amendment 91: see section 6.3 "Management & Enforcement Costs" (starting on page 190)
http://www.alaskafisheries.noaa.gov/sustainablefisheries/bycatch/salmon/chinook/rir/rir1209.pdf
Freezer Longliner in the Bering Sea: see section 1.3.1 "Alternative 2: Scales alternative" (starting on page 34)
http://www.alaskafisheries.noaa.gov/analyses/groundfish/rirea_fllme0512.pdf

6.2 Electronic Reporting

6.2.1 Interagency Electronic Reporting System

NMFS, Alaska Department of Fish and Game, and the International Pacific Halibut Commission all support the Interagency Electronic Reporting System (IERS) and costs associated with IERS are borne by all three fishery-management agencies. In addition, the commercial fishing industry that is using the system incurs costs. Here we list broad cost categories, later versions of this plan will include more details and specifics about ongoing costs, current funding sources for agency costs, and funding shortfalls.

Application Development & System Maintenance
The IERS is a single application with multiple components that enables electronic reporting of multiple types of data including: groundfish landings, crab landings, IFQ landings, salmon landings, production, logbooks, tender deliveries. In addition, the system meets the requirements of all 3 management agencies, is flexible to adapt to requirements from any of the agencies, and seeks to be compatible with commercial fishing operations. Intensive and dedicated application development is necessary in order to accomplish all of this functionality and the majority of the costs associated with maintenance of IERS are agency and contracting costs for application development, setting business requirements, and prioritization of application development work.

Hardware & infrastructure
Hardware and infrastructure costs are incurred at both the point of data collection (i.e. at sea or shoreside processor) as well as on the receiving end of the data stream (i.e. agency servers, data storage, and database administrators).

Field support
Field services, training, and user support are key ingredients in implementing ER. Costs include direct staff or contractor for help desk support, staff salaries to provide training events, training materials, and travel needed for support, outreach and education of industry partners.

Data Analysis Services
Trained staff are incurred to process, review, and analyze electronic data and incorporate data for management purposes. Data analysis services are required to make meaningful use of any ER data. Costs include direct staff salaries and training.

6.2.2 Atlas

The expansion of requirements for Atlas software, likely without transmission capabilities, is being considered for trawl catcher vessels under two Council analyses: GOA trawl bycatch management program and BSAI salmon bycatch management (for AFA trawl catcher vessels <125ft LOA). The costs associated with Atlas expansion will be developed and analyzed as part of the Council process.

6.3 Funding sources for EM/ER implementation

6.3.1 Federal Funding Sources

- NMFS FY15 Electronic Monitoring/Electronic Reporting budget line

- NMFS National Observer Program funds
- NMFS Fisheries Information System funds
- NMFS Reducing Bycatch funds
- NMFS Catch Share funds

6.3.2 Industry Cost Share Funding Sources

Observer Fees

In January 2013 the North Pacific Groundfish and Halibut Observer Program (Observer Program) began to assess a broad-based fee to more equitably distribute the costs of observer coverage. This program is authorized under section 313(a) of the MSA. The Observer Program includes a full coverage, pay-as-you-go category, and a partial coverage category that is funded through a landings fee. Landings from all vessels in the partial coverage category are assessed a 1.25% fee on standard ex-vessel prices of the landed catch weight of groundfish and halibut. The fee percentage is set in regulation and is reviewed periodically by the Council and NMFS. The Council could recommend an increase in the future up to the MSA statutory limit of 2.0 %.

At this time observer fees may be used only for the deployment of human observers through a contract with an observer provider following an annual observer deployment plan that is developed by NMFS and reviewed by the Council. The final rule implementing the fee (77 FR 70080) explains that the Council explicitly chose to not include electronic monitoring in the alternatives considered under Amendments 86/76. Any use of observer fees for purposes other than deployment of observers under Amendments 86/76, including for electronic monitoring, would require the Council to change its fisheries research plan by submitting a fishery management plan (FMP) amendment to NMFS. If approved, NMFS would implement revisions to the Council's fisheries research plan through federal regulations in accordance with section 313(c) of the MSA.

In summary, although observer fees cannot presently be used to fund EM, NMFS, the Council, and industry are in the process of developing an analysis that will form the basis of an FMP amendment to implement EM. Following implementation of an EM FMP amendment, observer fees could be used to fund EM. Other options that could be exercised include direct industry funding for video monitoring equipment as is currently the case for compliance monitoring video applications in Alaska.

Cost Recovery

Section 304(d) of the Magnuson-Stevens Act specifies that NMFS is authorized to collect a fee, not to exceed 3%, to recover the actual costs directly related to the management, data collection, and enforcement of any limited access privilege program. In Alaska, NMFS has established cost recovery fee programs in the Halibut and Sablefish Individual Fishing Quota Program; Crab Rationalization Program; and Rockfish Program. In addition, NMFS has proposed regulations to implement cost recovery fee programs for the Western Alaska Community Development Quota (CDQ) Program; American Fisheries Act (AFA); Aleutian Islands Pollock; and the Amendment 80 Program.

Where EM and ER costs are directly related to the management, data collection, and enforcement of the programs, then cost recovery funds are a source for the agency to recoup the associated EM/ER costs.

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Appendix A. EM/ER Strategic Plan for the North Pacific

In June, 2013, NMFS presented and the Council adopted an EM/ER strategic plan (Loefflad et al., 2014). The plan provides a vision for integrating electronic technologies into the North Pacific fisheries-dependent data collection program and outlined goals and objectives and the specific actions that it will take to achieve the vision. The following is an excerpt of section 2 of EM/ER Strategic Plan. The entire document is available at: http://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-276.pdf.

Vision

A future where electronic monitoring and reporting technologies are integrated into NMFS North Pacific fisheries-dependent data collection program where applicable to ensure that scientists, managers, policy makers, and industry are informed with fishery-dependent information that is relevant to policy priorities, of high quality, available when needed, and obtained in a cost-effective manner.

Goals and Objectives

NMFS has identified the following goals, objectives, strategies and actions to implement electronic monitoring tools into the North Pacific fisheries-dependent data collection program. Goals address "How will the world be different" and this vision should not change greatly over time. In aggregate, the strategies and actions are designed to meet a specific objective and the cumulative achievement of objectives is intended to meet an overall goal.

Goal I: NMFS has the infrastructure and regulatory requirements to support EM/ER operations

Objective 1: Communicate through planning documents and processes

Strategy A: Develop an EM/ER strategic planning document in collaboration with the Council to guide actions.

Action: Present EM/ER strategic plan to the Council for feedback.

Action: Periodically update the Council and public on the progress relative to the EM/ER strategic plan.

Objective 2: Dedicate resources to support EM/ER data acquisition, post-processing, and integration

Strategy A: Provide IT infrastructure that supports catch estimation and/or compliance monitoring.

Action: Develop accurate and timely EM data stream to support management.

Action: Maintain accurate and timely ER data stream to support management.

Action: Identify data storage and data processing methods.

Action: AFSC and AKR maintain database and information support staff as part of agency infrastructure.

Strategy B: Assign EM development work to scientific staff for a comprehensive assessment, evaluation, and advancement of technologies.

Strategy C: Include EM and IT support staff in planning and budget requests for offices with data stewardship responsibilities.

Action: Request distinct EM staffing and budget.

Objective 3: Continue to develop the regulatory framework to implement EM/ER requirements

Strategy A: Develop requirements to use EM for catch estimation.

Action: Identify agency/industry responsibilities.

Action: Identify performance-based standards for regulations. Action: Assign and prioritize staff work on regulation development.

Action: Develop vessel monitoring plans, maintenance protocols and operator responsibilities.

Strategy B: Adapt and improve existing EM/ER regulations to ensure compatibility with emerging technology and changing fisheries management

Action: Evaluate at-sea flow scale regulations and approval requirements.

Action: Evaluate regulations for EM/ER on freezer longline vessels (flow scales, video, and e-logbook).

Action: Review and improve existing regulations where EM is required in Alaska (Amendment 91, bin-monitoring).

Action: Evaluate VMS type approval process.

Objective 4: Secure funding to advance EM/ER technologies and use

Strategy A: Monitor and initiate action on opportunities within NMFS for internal funding.

15Action: Develop RFP system within NMFS for National Observer Program money dedicated to EM efforts.

Action: Apply for internal cooperative research and other funding sources to supplement 2013 EM work.

Action: Secure AKR and AFSC funding to conduct EM cooperative research.

Action: Apply for Fishery Information System project funding (e.g., integrate flow-scales with other technologies, other EM/ER work).

Strategy B: Apply for external grant funding through appropriate sources

Action: Submit NPRB proposals in response to RFPs.

Action: Look for other grant funding opportunities.

Strategy C: Use observer fees to fund research and development.

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

Strategy A: Improve catch estimation methods by incorporating data gathered through electronic monitoring.

Action: Evaluate broad e-logbook coverage and technology that independently records specific catch location and total effort for improved specification on post strata assumptions and catch rates to support stock assessments.

Action: Develop potential algorithms to estimate or inform discard in the Catch Accounting System.

Action: Evaluate catch estimation assumptions and post-stratification processes.

Strategy B: Develop methods that can improve EM data to fill existing gaps such as length compositions, species identifications, and fish weights.

Action: Develop performance standards for species identification.

Action: Test camera systems in automated review and collection of length compositions.

Acton: Develop vessel monitoring plans to improve ability to identify and quantify discard through discard control points.

Action: Develop procedures where crew could potentially collect random samples.

Strategy C: Evaluate EM technologies in the 2013-14 EM project on volunteer vessels in the < 57.5 ft longline and pot vessels.

Action: Evaluate species identification issues.

Action: Identify data gaps and potential solutions for species weight estimates, biological samples and rare species interactions.

Action: Assess the efficacy of using technology for capturing information that would quantify discard and provide spatial and temporal distribution of effort.

Strategy D: Provide support to partners in cooperative research and industry volunteers.

Action: Assist in providing technical support and guidance to fishing industry and other constituent research initiatives (e.g., two 2012 NFWF grants, EFPs).

Objective 2: Reduce costs by gaining efficiencies in data processing and/or improving data quality

Strategy A: Develop automated review and data extraction technologies to reduce costs, improve timeliness, and improve data quality.

Action: Collaborate with other AFSC staff to develop image processing applications (automated species ID and length estimation).

Action: Identify potential efficiencies in data processing and improving data quality such as automated review and data extraction technologies.

Action: Build a stereo camera system (PSMFC funding support) to provide a prototype for testing automated review and collection of length compositions.

Action: Identify minimum image quality standards necessary for data extraction.

Strategy B: Identify fish handling practices and integration methods that will facilitate automation and improve data quality.

Action: Collaborate with industry to develop Vessel Monitoring Plans.

Objective 3: Understand all aspects of costs associated with EM technology integration, implementation, and processing

Strategy A: Evaluate associated costs of EM cooperative research

Action: Track project expenditures to inform potential logbook audit approach or sample-based approach to inform discard.

Action: Determine cost to support EM such as port sampling and programming personnel, data storage, post-processing, hardware, maintenance and installation.

Action: Determine cost benefit ratios for various fleets or fleet sectors where EM could provide improvements or cost savings compared to observer coverage.

Action: Identify ways to reduce costs and improve cost efficiencies.

Strategy B: Evaluate costs of existing EM programs in the North Pacific.

Action: Track NMFS costs.

Action: Identify fishery participants' costs.

Strategy C: Evaluate trade-offs of using observer fees to fund EM systems versus human observers.

Action: Evaluate impacts on observer deployment and coverage rates of using observer fees for EM.

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

Strategy A: Implement EM as appropriate based on scientific research from goal II.

Action: Select EM approach.

Action: Analyze EM approach, impacts, cost, and benefits.

Action: Write implementing regulations.

Action: Implementation, roll out, outreach.

Strategy B: Expand use of e-logbooks to increase the timeliness and fill data gaps.

Action: Implement e-logbooks in the freezer longline fleet.

Action: Develop a catcher vessel e-logbook.

Action: Evaluate logbook requirements and evaluate whether to expand paper and/or electronic logbook requirements or what self-reported data are needed to compliment EM.

Strategy C: Expand observer data entry application (ATLAS) requirements to improve the quality and timeliness of observer data.

Action: Analyze adding an ATLAS requirement for AFA catcher vessels.

Strategy D: Continue ongoing development and support of e-landings system.

Objective 2: Implement EM/ER technology where appropriate and cost-effective to enhance compliance monitoring

Strategy A: Monitor, evaluate and improve existing ER compliance monitoring programs.

Action: Perform periodic audits to ensure and improve system performance for freezer longline fleet, Amendment 80, Amendment 91, and Rockfish Program.

Strategy B: Expand use of EM in compliance applications.

Action: Evaluate EM for compliance monitoring in shoreside pollock fisheries,

Objective 3: Improve procedures, methods or technology to enhance quality of EM data

Strategy A: Evaluate and develop solutions to incrementally improve EM and data quality.

Strategy B: Address challenges to managing a fishery using an integrated system approach that incorporates data collected through a variety of sources that includes electronic reporting (e.g., e-ticket, e-logbook, VMS, and sensors), video systems, scales, and observers.

Action: Work with EM workgroup to evaluate data needs and data collection approaches.

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

Strategy A: Organize and participate in local, national, and international forums on EM/ER and fishery dependent systems.

Action: EM panel participation at IFOC and other international forums.

Action: Participate in regional, national, and international workshops and committees.

Action: Develop EM subcommittee of NOPAT to inventory and track national EM efforts.

Strategy B: Collaborate with partner organizations.

Action: Meet periodically with Pacific States Marine Fisheries Commission, ADFG, other NOAA entities.

Objective 2: Influence and inform monitoring policies

Strategy A: Assist in national EM policy and procedures.

Action: Work on the NMFS draft policy and procedural directives and Electronic Technologies working group.

Strategy B: Engage in Council processes that inform monitoring policy.

Action: Work with the OAC and OAC sub-committee on issues of onboard catch handling procedures and technology integration or any other tasks assigned by the Council.

Action: Ensure staff members are engaged in standing Council or Agency advisory committees that involve monitoring.

Action: Develop thorough Monitoring and Enforcement sections of analytical documents.

Appendix B. NPFMC EM Workgoup & Cooperative Research Plan

The North Pacific Fishery Management Council (Council) has established an intention to integrate electronic monitoring (EM) tools into the Observer Program for the fixed gear small-boat groundfish and halibut fisheries. The Council's intent is to develop EM to collect data to be used in catch estimation for this fleet. The Council has set an interim goal of pre-implementation in the small boat longline fleet in 2016, focusing on vessels that have trouble carrying an observer. This research plan describes multiple research projects targeted for 2015, which will collect information that will help inform pre- implementation decisions and future Council alternatives for integrating electronic monitoring (EM) into the Observer Program.

These research projects were developed and refined through a Council committee, the fixed gear EM Workgroup (EMWG). The EMWG provides a forum for all stakeholders including the commercial fishing industry, agencies, and EM service providers to cooperatively and collaboratively design, test, and develop EM systems that are consistent with Council goals to integrate EM into the Observer Program.

The information included here is ex excerpt from the Cooperative Research Plan, the entire document is available on the Council's website: Study designs for the 2015 field research projects are available on the Council's website: http://npfmc.legistar.com/gateway.aspx?M=F&ID=9d0c163b-2991-4163-8632-7c98c05f4ac7.pdf.

The Cooperative Research Plan includes analytical and fieldwork projects to address the following four elements:

- Deployment of EM Systems
    - Operational testing with standard camera
    - Self-reported data elements
- Research and Development of EM Technologies
    - Assess the feasibility of EM data to estimate catch by weight
    - Pot Gear, IFQ setline, IPHC survey
    - Integration of Sensor Data with e-logbook
- Infrastructure to support EM implementation
    - Application development to support EM data integration into the observer database
- Analyses to support EM implementation decision points

The EMWG has developed a preliminary timeline, although it subject to change and refinement of the timeline is expected to be an ongoing process with a sustained commitment to building EM capacity. The Council may recommend implementation EM integration in phases as results from the cooperative research warrant, with ongoing refinement of EM technology, field services, and data review elements, as circumstances warrant. Currently, this is envisioned to occur with the cooperative research leading to "pre-implementation" phase of EM as the Council analysis and regulations are being completed.

Year	Fieldwork / Pre-implementation (Pre-Imp)	Council process, Regulations	Observer Program/ Annual Deployment Plan (ADP)
2014	Fieldwork	EMWG developing purpose & need, alternatives, 2015 Cooperative Research Plan (CRP)	October – 2015 ADP places 10 vessels that are participating in EM research into the no selection pool
2015	Jan-Feb – stereo camera field research on pot vessel (RFP) Feb – SSC reviews CRP Mar-Apr – stereo camera field research on longline (RFP and NPRB) Mar-Sep – operational research	Feb – SSC reviews CRP October – present a refined 2016 Pre-Imp concept to Council	October – 2016 ADP proposes all EM Pre-Imp vessels in no selection pool
2016 (PreImp-1)	Pre-implementation will likely focus on longline vessels <57.5'. Size of fleet will be dependent on available funding *(independently sourced)* and Council requirements. Fieldwork as necessary/ possible for other elements (e.g., pot vessels, >57.5') *(requires independent funding)*	October – initial review for EM analysis. Focus on what type of EM program should go forward, and what regulatory changes are needed to allow it December – final action on EM analysis	October – 2017 ADP proposes all EM Pre-Imp vessels in no selection pool
2017 (PreImp-2)	Pre-Imp 2, potentially expanded to include other fixed gear vessels *(requires independent funding)*	Develop regs for integrating EM	June – 2016 Observer Annual Report provides preliminary analysis to support how to allocate observer fee between observer and EM deployment October – 2018 ADP allocates funding between observers and EM deployment
2018	**Integrated observer/EM monitoring program** Funding for EM could come from the observer fees.		

Overview of cooperative research projects

The various research projects that have been initiated by the EM Workgroup to inform Council decision points for moving forward to pre-implementation and eventual implementation are summarized in the tables that follow. For projects shaded in orange, at least some component of that project is critical for the Council's discussion, in October 2015, of the design of the 2016 pre-implementation EM program. Study designs for the 2015 field research projects are available on the Council's website: http://npfmc.legistar.com/gateway.aspx?M=F&ID=9d0c163b-2991-4163-8632-7c98c05f4ac7.pdf.

Project	Deployment	R&D	Infrastructure	Analysis	Description	Key Outcomes
Deployment projects						
Operational testing fieldwork	x				Results from the spring 2014 field season and written products (described above) will be used to determine research priorities for the 2015 season. It is expected that the field program will continue to evaluate program operational infrastructure in key ports, continue to socialize EM technology with the fleet, and test some aspects of the strawman monitoring options. This work will be a collaborative effort involving service providers, the fishing industry, NMFS and PSMFC.	Field testing: The key elements of this program include decision points, operational plans, field work, EM data sets, dockside monitoring data, and a technical report, jointly prepared by PSMFC and service providers.
Vessel Obligations	x			x	Each strawman monitoring option will carry specific vessel obligations in order to ensure the data collection objectives are met. This work task provides a comprehensive description of vessel requirements for each option, including duty of care responsibilities, on board catch handling requirements, ancillary data collection and other reporting obligations.	Discussion document summarizing the vessel requirements for each monitoring option; feasibility evaluation for each fishery/fleet; analysis of strengths and weaknesses of each approach.
Monitoring Program Deployment Design	x			x	The use of EM technology for fisheries monitoring requires support services to ensure technology is deployed correctly, operator responsibilities are met, and on-board data sets collected and evaluated against dockside information in a timely manner. This task outlines key elements of an operational EM program, tailored to the Alaska fixed gear fishery.	Discussion document outlining the key elements of the monitoring program and relative cost contribution. The report will present different strategies for equipment deployment and examine the impact of the number of service ports.
Dockside Monitoring Program Design	x			x	Some of the monitoring options require dockside monitoring to obtain an independent estimate of landed catch by species. This task summarizes the information requirements, monitoring procedures, and other program elements for a dockside monitoring program.	Discussion document of key elements and decision points of a dockside monitoring program, information needs, monitoring procedures and cost elements.
Strawman Monitoring Options	x			x	There are a series of 'strawman' monitoring options that can be used to address the different alternatives. A 'strawman' is a methods summary of the key elements of each monitoring option and describes how EM technology integrates with other tools to meet management needs. Key elements include vessel size criteria, data requirements for catch estimation, vessel operator responsibilities, EM system operating specifications, EM data collection specifications, analysis requirements, and integration with other tools. The strawman links the data requirements with the specific way EM technology and other tools are being used.	Discussion document to provide a summary of monitoring approach and decision points for an EM configuration that meets the Council's goal for estimating catch; analysis of each approach in terms of overall suitability, the level of difficulty, decision points, strengths and weaknesses and operational feasibility by fishery/fleet.

Project	Deployment	R&D	Infrastructure	Analysis	Description	Key Outcomes
Self-Reported data elements	x				Discussion of what self-reported (fishery dependent) data elements need to be collected to support EM catch, the timelines and accuracy of these data.	Outline of self-reported data fields & how those compare to current IPHC and NMFS logbook data elements; the timelines and accuracy needs of these data for EM.
Data review protocol	x	x			Identify which data elements should be extracted from the imagery obtained under the various field studies, and the review processes that should be followed.	Continue to refine the video data review protocol procedure document
Seabird Handling	x			x	1) the handling procedures that will be required for seabird interactions when operating EM, and 2) if any permits will be required of EM vessels	Recommendations for handling procedures for 2015 fieldwork
Research and Development projects						
Standard configuration fieldwork		x			The research is intended to provide field-tested methods that allow collection of quantifiable image-based data from fisheries that can be used to estimate species-specific catch and at-sea discard amounts. Specifically, we will evaluate the applicability of EM technologies in a standard configuration at the rail to collect catch, effort, and species composition data.	A research document that will describe results of testing: differences in count and species composition data between EM (single and stereo cameras) in a standard configuration at the rail and an at-sea biologist; ability to derive length from stereo camera.
Chute camera fieldwork		x	x		Image quality from EM systems are often influenced by environmental conditions and system maintenance reducing our ability to distinguish species, an essential part of estimation. A camera chute system provides a way to collected high definition images constantly thus has the potential to derive lengths and improve reliability of species identification.	Research document that describes hypothesis testing to be completed: differences in count, length, and species composition data between a stereo camera in a chute and an at-sea biologist; ability to derive length; potential for automation of species identification.
Stereo camera fieldwork		x			A stereo camera system provides a way to accurately derive lengths from which weight could be inferred. This is a requirement since catch estimation is designed to produce discard estimates of weight by species.	Research document that describes hypothesis testing to be completed: differences in count, length, and species composition data between a stereo camera in a chute and an at-sea biologist; ability to derive length; potential for automation of species identification.
Halibut discard mortality rate (DMR) fieldwork		x			Fieldwork to investigate the relationship between release methods and discard mortality rates. IPHC interested in pursuing this for fixed gear as well as trawl vessels.	Research study that will allow IPHC to assign discard mortality rates based on a release method, rather than based on injury codes.
Incorporate e-logbook into EM system		x	x		Application development and testing of e logbook that could be used to collect self-reported data elements for EM and capture sensor data. Sensor data has great potential for automated identification of set and haul positions in setline fisheries.	Identify QC procedures and automation methods for improving data accuracy and fishermen friendly attributes that could into e-logbooks (e.g. could sensor data automate entry of set and haul positions in elogbook).

Project	Deployment	R&D	Infrastructure	Analysis	Description	Key Outcomes
Infrastructure projects						
Programmer			x		NMFS will hire an application developer to support EM data integration that includes development of GUI interface to enable post-processing video and image data into the observer database that feeds into catch accounting. The infrastructure support and work is a necessary component regardless of the type of EM system it will support.	The meta-data derived from sensor information and e-logbook/self-reported data will provide the link to sample data information both temporally and spatially.
Evaluations that will be used in the analysis						
Alternatives				x	Refine the 'purpose and need' and alternatives document to be analyzed for a Council amendment package, and how the elements of the strawmen mesh with the and analysis.	Discussion draft of 'purpose and need' and alternatives
Fishery Demographics				x	Summarize the fishery demographics - number of vessels, gear used, landing ports, target fishery. Also, summary of effort (trips, length, hauls per day, length of sets), vessel configurations (side/stern haul, shelter deck or open).	Summary paper that describes demographics of the fixed gear fleet in terms of effort, retained and discarded catch by catch area and/or port.
Catch Composition				x	Summarize the catch composition and disposition in each fixed gear target fishery (halibut, sablefish, Pacific cod), and which species are discarded; also which species need inseason data.	Tables describing the catch composition
Catch Estimation				x	List potential catch estimation procedures for EM data for a presumed strata (alternative).	Discussion paper that describes the tradeoffs and assumptions of various catch estimation procedures for expanding catch to the fishery level.
Weight				x	There are a number of potential methods to derive weight for piece counts. Each of these methods will have an accompanying list of assumptions and data collections that will be evaluated.	Summary paper that describes potential ways to derive weight estimates for piece counts.
Video Review Tradeoffs				x	Analysis of how much video review is needed	Summary paper describing the tradeoffs of reviewing video for all fish, or only discards; subsampling; etc.
Cost Framework				x	How will costs be analyzed with respect to EM decision points, what is the framework that will be used in the analysis? What are major cost centers in the program, and how does that affect design or decision making?	Discussion paper framing the range of costs that might be associated with different decisions in the suite of alternatives, and how fieldwork or other methods will be employed to inform those costs.