

This document is a draft outline of a strategic plan for EM/ER for presentation to the Council in April, 2013 and further refinement in June, 2013. It is not a complete representation of all objectives, strategies and actions at this time.

**DRAFT
Strategic
Plan for
EM/ER in
the North
Pacific**

March 26

2013

**Fishery
Monitoring
Technology
for Fisheries
Operating in
the North
Pacific**

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INTRODUCTION

“Simply put, strategic planning is clarifying the overall purpose and desired results of an organization, and how those results will be achieved.” Carter McNamara, September 30th 2010.

Overview

We live in a world of great technological advances many of which are applicable to fisheries monitoring issues, and many which have already been utilized in Alaska.

Consider this:

1977: MSA was new, a programmable Texas Instrument calculator (TI-59) cost \$300, Apple Computer was just incorporated and key punch cards and mainframes were state of the art in industry.

1987: joint ventures in AK, personal computers (windows 2.0) with floppy disks commonly available, but mainframes dominate business and government; communications from observers at sea were still Single Side Band and Morse code.

1997: MSA continues, joint ventures in AK were long gone, Y2K was a real concern, PC's are the norm (windows 98) with e-mail and web access. Oracle is now the primary NMFS database. We have vastly improved communications from sea via ATLAS application and on-board technologies.

2007: MSA newly reauthorized, i-phone released, vastly improved PC storage and speed, laptops commonplace, continuing improvements in communications, Oracle still serving NMFS needs. We see an emerging use of cameras in fisheries applications.

So, where will we be in 2017? Already we see camera use in surveillance commonplace (how many cameras have seen you today?), an expanded cell phone grid (not always in AK), the use of notebooks emerging, social media pervading everything, improved battery capacity, and some extraordinary integrations of technologies.

NMFS and the Council have been on a path of integrating technology into our fisheries monitoring systems for many years, as we have advanced Electronic Reporting (ER) systems in place, conducted several experimental projects with Electronic Monitoring (EM), and have operational EM in a compliance capacity. The operational EM capacity was expanded as recently as January of 2013 with the implementation of flow scales and video monitoring of them. In turn, application development, database and web technologies have revolutionized how we manage and report information to internal and external constituents.

Developing and implementing technology requires careful thought. Some technologies are short lived, some are rapidly evolving, while others are well established. All technological investments cost money, and the cost extends beyond the acquisition of the technology. The cost includes the infrastructure necessary to support the technology into the future, and to adapt and evolve as

technology advances. Decisions about where to invest in technology represent strategic choices. Wrong choices can be costly.

In October of 2012, the Council passed a motion addressing electronic monitoring as follows:

“The Council requests 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.”

This motion also forwarded an AP recommendation to:

“Recommend that NMFS report to the Council on other EM options that may be appropriate to replace or supplement human observers.”

Concurrent with the development of this Alaskan EM plan, NMFS headquarters (HQ) staff developed several white papers on the use and development of electronic technologies. Drafts of five of these white papers were presented to the Council Coordination Committee (CCC) in February of 2013. These papers provide helpful information that may be useful to NMFS and the Council in future EM/ER developments. The white papers are available on the CCC web site at: http://www.nmfs.noaa.gov/sfa/reg_svcs/Councils/ccc_2013/Agenda.htm

Please note that the HQ white papers addressed both EM and ER. For consistency, and because effective electronic approaches to data collection can include both EM and ER, we have included both in this planning document.

Primary Authorities

Magnuson-Stevens Fishery Conservation and Management Act (MSA) was amended by the 2006 Magnuson-Stevens Reauthorization Act.

The MSA is the primary domestic legislation governing management of the nation’s marine fisheries. NOAA manages fisheries in federal waters through fishery management plans (FMPs) developed in conjunction with the Councils.

Marine Mammal Protection Act (MMPA)

The MMPA provides for, in part:

- A program to authorize and control the taking of marine mammals incidental to [commercial fishing operations](#);
- Preparation of [stock assessments](#) for all marine mammal stocks in waters under U.S. jurisdiction;

Endangered Species Act (ESA)

NOAA's National Marine Fisheries Service (NMFS) and the [U.S. Fish and Wildlife Service \(USFWS\)](#) share responsibility for implementing the [Endangered Species Act \(ESA\)](#).

There are [approximately 2,050 species listed](#) under the ESA. Of these species, approximately 1,430 are found in part or entirely in the U.S. and its waters; the remainder are foreign species.

Generally, USFWS manages land and freshwater species, while NMFS manages marine and "[anadromous](#)" species. NMFS has jurisdiction over 94 listed species.

The ESA requires NMFS to designate [critical habitat](#) and to develop and implement [recovery plans](#) for threatened and endangered species.

Assessing our current Observer Program monitoring activities

Each of the listed activities are current 2013 data collection requirements for observers deployed on hook and line vessels in Alaska. These tasks were excerpted from the observer training manual available on line at: <http://www.afsc.noaa.gov/FMA/document.htm>.

Current Monitoring Activities of Observers on Hook and Line Vessels	Observer	EM as it is currently available	Industry self report	Notes	Purpose
Birds					
Monitor and report take of short-tailed albatrosses	Yes	No	No		ESA Biop
Document all observations of short-tailed albatrosses	Yes	No	No		ESA Biop
Identify and count all other seabirds within samples	Yes	No	No		ESA Biop
Dead short-tailed albatrosses must be frozen and surrendered to the NMFS or the USFWS.	Yes	No	Maybe	Physical specimens	ESA Biop
Mammals					
Record marine mammal sightings	Yes	Maybe	Maybe		MMPA
Record marine mammal interactions including deterrence, entanglements, lethal removals, ship strikes, and predation on fishing gear by sea lions, sperm whales and killer whales.	Yes	Maybe	No		MMPA

Current Monitoring Activities of Observers on Hook and Line Vessels	Observer	EM as it is currently available	Industry self report	Notes	Purpose
Collect marine mammal parts (snouts, etc)	Yes	No	No	Physical specimens	MMPA
Fish					
Catch composition by species in number and weight to incorporate into the CAS for total catch accounting.	Yes, with some species limitations.	No	No		MSA – catch accounting and management under ACL's
Disposition of the catch (retained or discarded) by weight.	Yes	No	No		MSA management
Viability of halibut released	Yes	No	No		IPHC and MSA management
Sexed length frequency data for target and bycatch species	Yes	No	No		Stock Assessments and Council analyses
Sexed length and weight for salmon, crab.	Yes	No	No		Stock Assessments and Council analyses
Misc biological collections (maturity, genetics, scales)	Yes	No	No	Physical specimens	Stock assessments, genetic, and ecosystem studies
Miscellaneous/Invertebrates					
Numbers, weights and identifications of corals and misc invertebrates (degree of ID varies)	Maybe	No	No		Habitat, potential for ESA issues, ecosystem research.
All Species					
Tag recoveries	Yes	No	Maybe	Physical specimens	Stock assessments
Collection of voucher specimens	Yes	No	Maybe	Physical specimens	Training and verification

Current Monitoring Activities of Observers on Hook and Line Vessels	Observer	EM as it is currently available	Industry self report	Notes	Purpose
Fishing, gear characteristics, and management program identifications					
Set/ retrieval dates, times, and locations.	Yes	Yes	Yes		Stock Assessments, Council analyses, Catch Accounting and Management
Location of non-fishing days.	Yes	Yes	Yes		Council analyses
Quantity of gear deployed in each set.	Yes	Yes	Yes		Effort
Quantity of gear retrieved.	Yes	Yes	Yes		Stock Assessments, Council analyses, Catch Accounting and Management
Hook Counts and spacing measurements of specific set segments (sablefish only).	Yes	No	No	Hook and line-sablefish only	Stock Assessment Catch Accounting
Gear performance, including instances of predation.	Yes	No	Maybe		Catch Accounting and MMPA interactions
Beginning and end Depth	Yes	Maybe, with sensor integration.	Yes		Stock Assessments and Council Analyses
IFQ- Yes or no	No	No	Yes		Catch Accounting Management
CDQ group number if applicable	No	No	Yes		Catch Accounting Management

Current Monitoring Activities of Observers on Hook and Line Vessels	Observer	EM as it is currently available	Industry self report	Notes	Purpose
Regulatory Compliance					
Compliance with careful release regulations.	Yes	Yes		Hook and line only	Regulatory Compliance
Ensure rehabilitation of injured short-tailed albatross	Yes	No		Physical handling required	Regulatory Compliance
Compliance with seabird avoidance measures	Yes	No			Regulatory Compliance
Compliance with time area closures	Yes	Yes, with GPS integration			Regulatory Compliance
Real time position monitoring	Yes	Yes, with GPS integration			Regulatory Compliance
Witness flow scale testing and record test weights and results	Yes	Maybe		Flow scale vessels only	Regulatory Compliance

Vision

Vision – What do we see as our future?

A future where electronic monitoring and reporting technologies are integrated into NMFS Alaskan fisheries dependent data collection systems 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.

Definitions:

Electronic monitoring (EM) – The use of technologies – such as vessel monitoring systems or video cameras – to passively monitor fishing operations through observing or tracking. Video monitoring is often referred to as EM.

Electronic reporting (ER) – The use of technologies - such as phones or computers - to record, transmit, receive, and store fishery data.

Goals – Our goals describe how the future world will be different. They do not describe what we will do. Goals address: “How will the world be different” and should not change over time.

Objectives – Measureable, attainable milestones that we want to achieve on the way to meeting the goals.

Strategies – How we organize our resources and actions to maximize our effectiveness and efficiency to meet the Objective (examples will be provided to illustrate).

Actions – Concrete and sometimes completed steps implementing the strategies.

Electronic Monitoring/Reporting Approaches:

1. Systems that enable and/or improve regulatory compliance monitoring:

Technology is used to provide independent information to inform agencies if industry is complying with specific regulations.

Examples:

- A. VMS

VMS provides a specific tool that provides tamper evident reporting of vessel positions in real time, on a defined and automated reporting schedule. The information is captured in an OLE data system and used to support enforcement of time/area closures. There are secondary uses for science and management.

System requirements are well known and defined elsewhere

- B. Auditing logbook reports (the Canadian EM system)

The Canadian hook and line monitoring system consists of extensive logbook reporting requirements by set, which are audited by industry contractors using on-board camera systems. All vessels have camera systems and a subset of footage is monitored to validate the log reports. There are immediate financial penalties for poor reporting in the log as the entire video may require review and the industry bears this cost. The system appears to perform well for the species they have chosen to monitor.

- C. The West Coast video on trawl C/V's pilot (did they discard hake or not).

The West Coast has experience placing video on board catcher vessels fishing for hake under a no discard requirement. The video appears to be able to detect discard events though some events have occurred outside of the camera view, and a well publicized discard event occurred when the camera was unplugged. The design, however, is simple, and the objective clear.

- D. Existing EM systems in Alaska on the Amendment 80, Amendment 91, and freezer longline fleet.

2. Systems that enable/improve information timeliness, quality and confidence:

Technology is used to improve timely reporting and information quality.

Examples:

- A. E-logs and e-landings.
- B. NMFS at-sea data entry application (Atlas) allows timely reporting by observers.
- C. Web based trip reporting for observer coverage (ODDS).
- D. Flow scales.

3. Systems that collect scientific data used for independent estimation:

Technology is used to monitor events and information is extracted for management/science.

Examples:

- A. Denmark work quantifying discard (what species and quantities did they discard).
- B. West Coast pilot work quantifying hake discard.
- C. Estimating yelloweye rockfish catch in Canada (Stanley et.al. 2011).
- D. Rockfish Pilot projects estimating halibut discard.
- E. Pacific States Alaska longline project (Cahalan et.al. 2010).

Strengths, Weaknesses, Opportunities, and Threats of Current State:

Strengths (internal)

To be developed in consultation with AKR.

Weaknesses (Internal)

To be developed in consultation with AKR.

Opportunities (external)

To be developed in consultation with AKR.

Threats (external)

To be developed in consultation with AKR.

GOALS AND OBJECTIVES FOR EM/ER in ALASKA

Goals address: “How will the world be different” and should not change over time.

In this document, NMFS has identified the following goals, objectives, strategies and actions to implement electronic monitoring strategies in the North Pacific. Are these objectives, strategies and actions sufficient to meet the overall goals?

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

Objective 1: Dedicate resources to support EM data acquisition and post processing.



Objective 2: Develop the regulatory framework to implement an EM requirement.



Objective 3: Fund technology to advance, support EM/ER implementation and integration.



Goal II: NMFS is advancing EM/ER capabilities through science-based studies and technological developments.

Objective 1: Advance the technology of monitoring tools.

Strategy: Conduct scientific research to advance the science of monitoring and integration

Action: Two EM proposals (EM light and Stereo Cameras) were submitted to NPRB in 2012 and if funded will begin October, 2013.

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

Action: We have assisted in providing technical support and guidance on two 2012 NFWF grants to AK.

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

Strategy: Develop automated review and data extraction technologies.

Action: Collaborate with other AFSC staff to develop image analyses procedures.


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.

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

Action: Collaborate with industry to develop Vessel Monitoring Plans.

Goal III: The Council and NMFS are informed on and leveraging 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. 

Objective 3: Communicate through planning documents and processes.

Objective 4: Collaborate with partner organizations and industry.

Goal IV: The Alaska Region has a cost effective, adaptable and sustainable fishery data collection program implementing strategies that take advantage of the full range of current and emerging technologies.

Objective 1: Implement EM technology where appropriate and cost effective to improve catch estimation or collect biological samples to better inform stock assessments.

Strategy: Work with Regional staff to identify catch assumptions and post stratification to develop algorithms 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.

Strategy: Develop methods that can improve EM data to fill existing gaps such as length compositions and/or weight specimens.

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

Action: 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: 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.

Objective 2: Implement EM/ER technology where appropriate and cost effective to enhance compliance monitoring or data timeliness to support management.

Objective 3: Collect information on all aspects of costs associated with EM technology integration, implementation and processing.



Strategy: Track all associated costs of the 2013-14 pilot study.

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.

Strategy: Evaluate observer fee to implement operational EM systems.

Action: Dependent on when fee proceeds becoming available in 2014 and we have operational EM systems.

Action: Present evaluation of impacts on observer deployment and coverage rates to the Council.

Objective 4: Improve procedures, methods or technology to enhance quality of EM data.

Strategy: Provide evaluation and solutions to incrementally improve data quality throughout the 2013-14 pilot study period.

Action: Develop performance standards for species identification.



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

Action: Address challenges to managing a fishery using an integrated system approach that incorporates data collected through a variety of sources that includes electronic reporting (eticket, elog and sensors), data obtained from camera based systems and observer information.

Implementing the strategic plan

In 2012, NMFS designed a video based electronic monitoring project to achieve Council's objective of "collecting at-sea discard estimates from the 40' – 57.5' IFQ fleet" and "explore other EM options that may be appropriate to replace or supplement human observers". Individual project action items or steps are mapped to illustrate the relationship to each implementation strategy designed to meet a specific objective which collectively are intended to meet a specified goal (see the Table below).

The EM project will be in place in 2013 and 2014 and is designed to inform logistical, data storage requirements, data processing procedures and methods. Most importantly, it is designed to evaluate

and address universal challenges in using video data to establish or estimate discard. Major challenges include; 1) inability to accurately identify species, 2) inability to obtain weights of discarded fish, 3) time required to obtain and review video and extract all requisite information and 4) inability to collect biological samples from discarded catch. Without first addressing these issues it is not possible to fully develop potential strategies to utilize data for either establishing discard through a compliance program (Canada's logbook audit program) or through estimation procedures. Further, this information will be required prior to resolving integration issues on how these data will or can be used in the catch accounting system to inform discard estimates.

Another important focus for the 2013-14 EM project is to evaluate cost information. Project costs will be used to inform cost benefit ratios in order to evaluate the relative scale and potential target fishery of the program prior to implementation. Only after this step is taken can we then establish the necessary regulatory requirements required to support an electronic monitoring data collection program to inform discard, stock assessments or management.

NMFS is also evaluating the potential to automate capture of single catch events and provide length composition through image processing techniques of stereo images. We believe image processing in real time has great promise in greatly reducing processing time, storage requirements and enable collection of length composition that could be used to infer weight of discarded species. Software routines using wireless technologies are also being examined to automate data acquisition download from vessels landing catch in ports where wireless services exist. These innovations have great prospect to drastically change the cost benefit ratio of collecting and processing video images to inform discard or provide near-real time catch information on temporal and spatial distribution of fishing effort.

Key decision points for Council consideration.

To be developed in consultation with AKR.

	2013-14 EM Project(s) Objectives	STRATEGIES	Actions
GOAL II	Objective 1: Advance the technology of monitoring tools	Strategy: Conduct scientific research to advance the science of monitoring and integration	Action: <i>Two EM proposals (EM light and Stereo Cameras) were submitted to NPRB in 2012 and if funded will begin October, 2013</i>
		Strategy: Provide support to partners in cooperative research, and industry volunteers.	Action: <i>We have assisted in providing technical support and guidance on two 2012 NFWF grants to AK.</i>
	Objective 2: Reduce costs by gaining efficiencies in data processing and/or improving data quality.	Strategy: Develop automated review and data extraction technologies.	Action: <i>Collaborate with AFSC Develop image analyses procedures in collaboration with AFSC staff.</i> Action: <i>Identify potential efficiencies in data processing and improving data quality such as automated review and data extraction technologies.</i> Action: <i>Build a stereo camera system (PSMFC funding support) to provide a prototype for testing automated review and collection of length compositions</i>
Strategy: Identify fish handling practices and integration methods that will facilitate automation and improve data Quality		Action: <i>Collaborate with Industry to develop Vessel Monitoring Plans.</i>	
GOAL IV	Objective 1: Implement EM technology, instead of human observers, where appropriate and cost effective to improve catch estimation or collect biological samples to better inform stock assessments.	Strategy: Work with Regional staff to identify catch assumptions and post stratification to develop algorithms incorporating data gathered through electronic monitoring.	Action: <i>Evaluate broad elogbook 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.</i> Action: <i>Develop potential algorithms to estimate or inform discard in the Catch accounting system.</i>
		Strategy: Develop methods that can improve EM data to obtain biological samples such as length compositions and/or weight specimens.	Action: <i>Build a stereo camera system (PSMFC funding support) to provide a prototype for testing automated review and collection of length compositions.</i> Action: <i>Develop vessel monitoring plans to improve ability to identify and quantify discard through discard control points.</i> Action: <i>Develop procedures where crew could collect.</i>

	<p>Objective 1: Implement EM technology, instead of human observers, where appropriate and cost effective to improve catch estimation or collect biological samples to better inform stock assessments.</p>	<p>Strategy: Evaluate EM technologies in the 2013-14 EM project on volunteer vessels in the <57.5 ft longline and pot vessels</p>	<p>Action: Evaluate and species identification issues.</p> <p>Action: Identify data gaps and potential solutions for species weight estimates, biological samples and rare species interactions</p> <p>Action: Assess the efficacy of using technology for capturing, quantifying discard and effort</p>
<p style="writing-mode: vertical-rl; transform: rotate(180deg);">GOAL IV</p>	<p>Objective 3: Collect information on all aspects of costs associated EM technology integration, implementation and processing</p>	<p>Strategy: Track all associated costs of the 2013 pilot study.</p>	<p>Action: Track project expenditures to inform potential logbook audit approach or sample based approach to inform discard</p> <p>Action: Determine cost to support EM such as port sampling and programming personnel, data storage, post processing, hardware, maintenance and installation</p> <p>Action: Determine cost benefit ratios for various fleets or fleet sectors where EM could provide improvements or cost savings compared to observer coverage</p>
		<p>Strategy: Evaluate observer fee to implement operational EM systems</p>	<p>Action: Present evaluation of impacts on observer deployment and coverage rates to the Council.</p>
	<p>Objective 4: Improve procedures, methods or technology to enhance quality of EM data</p>	<p>Strategy: Provide evaluation and solutions to incrementally improve data quality throughout the 2013-14 pilot study period.</p>	<p>Action: Develop performance standards for species identification</p> <p>Action: Develop vessel monitoring plans, maintenance protocols and operator responsibilities</p> <p>Action: Address challenges to managing a fishery using an integrated system approach that incorporates data collected through a variety of sources that includes electronic reporting (eticket, elog and sensors), data obtained from camera based systems and observer information.</p>

Appendix A: Council Motions on EM/ER

Appendix B: Strawman compliance monitoring options

Appendix C: Requirements of using Video information in the Canadian B.C. Audit based approach for fishery monitoring to a potential estimation based approach.

Comparison of the Canadian B.C. audit-based approach to establish total discarded weight by species versus a estimation-based monitoring approach to estimating discard rates in a fishery.

Required Elements	Audit based ¹	Estimation based
Logbook	Y	Y
EM sensors	Y	Y
Video imagery	Y	Y
Species weight	Y	Y
Hails	Y	N
Dockside monitoring	Y	N
Port Sampling	Y	N
Complex Scoring/Audit	Y	N
Catch based on self reported data	Y	N

Source: ¹Stanley et.al. 2011

General Considerations	Audit based	Estimation based
Scalability is a function of	Ports/Fisheries/Season	Rate/Fishery/Season
Coverage flexibility	Difficult	Easy
Dependence on compliance	High	Low
Species ID limits	Species on audit scoring list	Any identifiable species
Industry support and training	3 years	1 year
Potential cost controls	Audit rate/Scoring list	Sampling rate
Precision	Unknown-Self Reported	Depends on Sample intensity and rarity
CAS integration difficulty	High	Low
Discard spp. weight required	Yes	Yes
Limited Port of landing	Yes	No
Start up costs	High	Low
Monitoring costs	3.33% ¹	1.25% ²
Total	998	908

Source: ¹Stanley 2010 personal communication with NEFSC; and ² current Observer Program's cost recovery rate

Regulatory Considerations	Audit based¹	Estimation based
Retention Requirements	Y	N
Data confidentiality and control	Y	Y
Industry responsibilities	High	Low
Enforcement action and penalties	High	Low
Port hail requirements	Y	N
Dockside monitoring requirements	Y	N
System component requirements	Same	Same
Maintain logbook	Y	Y
Logbook Audit requirements	Y	N
Species ID requirements	Scoring list	Maybe some

Source: ¹Stanley et.al. Personal communication