Electronic Monitoring for Compliance on Pelagic Trawl Vessels: Cooperative Research Plan

March 4, 2019[1]

Note: Significant changes from the November 2018 version have been highlighted in yellow.

1 Introduction

The North Pacific Fishery Management Council (Council) has established an intention to integrate electronic monitoring (EM) tools into the North Pacific Observer Program (Observer Program). The Council's EM Committee 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. In February 2018, the Council changed priorities for the EM Committee from a focus on fixed gear vessels to a focus on developing EM as a tool for meeting monitoring objectives on trawl catcher vessels in the Bering Sea (BS) and Gulf of Alaska (GOA) pelagic pollock fisheries.

The EM Committee was reconstituted in April of 2018 and now includes industry representatives and participants that are stakeholders in the catcher vessel pelagic trawl pollock fisheries along with agency

[1] Prepared by the trawl EM Committee. Council staff contact: Elizabeth Figus

and EM service providers. In June of 2018, the Council adopted three monitoring objectives proposed by the trawl EM Committee after its May 2018 meeting: 1) improve salmon accounting; 2) reduce monitoring costs; and 3) improve the quality of monitoring data. A fourth objective was added by the trawl EM Committee at their meeting in August of 2018: 4) modify current retention and/or discard requirements as necessary to achieve Objectives 1-3.

In June of 2018, the Council directed its trawl EM Committee to develop a cooperative research plan for 2019 and to initially focus on using EM for compliance purposes. Therefore, *this cooperative research plan is focused on developing an EM program for compliance purposes on pelagic pollock trawl catcher vessels and tenders both delivering to shoreside processors with a defined retention requirement.*

"Cooperative Research" is a specific term in the National Marine Fisheries Service (NMFS). Cooperative research is broadly described as research that, "provides a means for commercial and recreational fishermen to become involved in the collection of fundamental fisheries information to support the development and evaluation of management options;" and more specifically defined as, "the partnering of the fishing industry, fishermen and other stakeholders with federal and university scientists to collect fundamental fisheries information" (NMFS). This document describes research plans targeted for 2019 and 2020 as well as pilot studies conducted in 2018. All research projects are aimed at collecting information to inform the development of alternatives for operationalizing EM as a compliance monitoring tool for pelagic pollock trawl catcher vessels. Some of the projects involve formal partnerships between federal and university scientists, while others do not. In this way, the trawl EM Committee Cooperative Research Plan conforms most closely to the broader aims of NMFS-defined cooperative research, while not strictly anchored within the specific definition that cooperative research relies on formal partnerships between agency/university staff and stakeholders.

2 Background

The Council created a fixed gear EM Committee in 2014 (called the EM "Workgroup" at the time). The fixed gear EM Workgroup developed a framework for implementing EM as a catch accounting tool on fixed gear vessels. EM development for pelagic trawl catcher vessels will not necessarily be identical to that of fixed gear, but key aspects may remain, including: creating the workgroup, creating this cooperative research plan, testing EM through pre-implementation, and developing regulations.

The process of EM development for fixed gear started with proof of concept → a pilot program → operational testing → pre-implementation → a mature program (Figure 1). This process will likely be similar for pelagic trawl catcher vessels but will also include lessons learned from both the fixed gear EMWG and the West Coast Pacific whiting fishery.

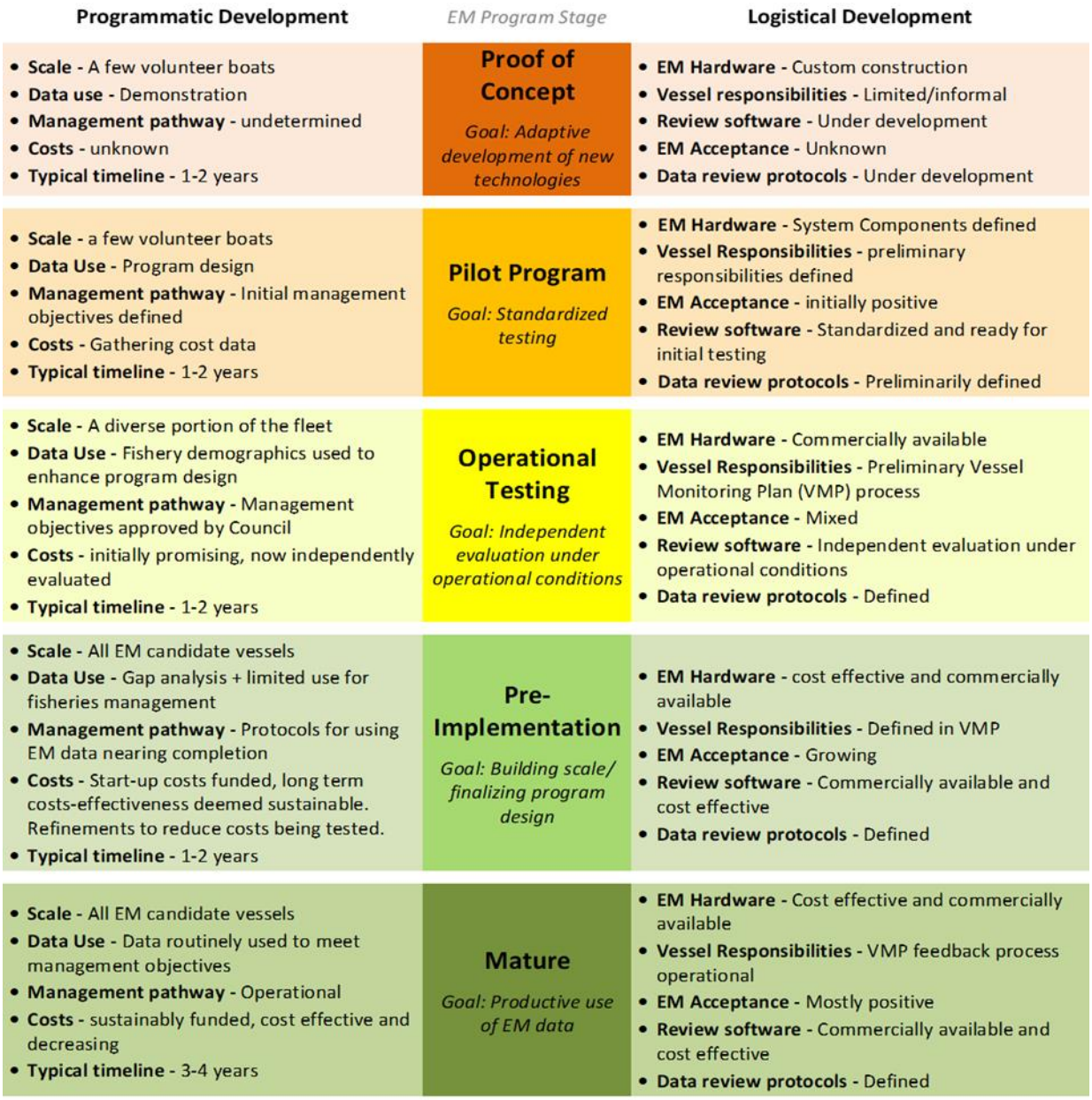
The trawl EM Committee expects EM to move more quickly for trawl vessels targeting mid-water pollock than it did for fixed gear vessels in the North Pacific. Rapid progress is expected because much is already known about the EM technology and a similar style trawl fishery in an adjacent region (West Coast Pacific whiting) is already using EM for compliance monitoring.

For each of the stages in Figure 1 the trawl EM Committee needs to determine:

- how many vessels might be involved (see Appendix C);
- how (or if) data will be used by management;
- identify costs; and,
- regulatory changes needed to implement EM for compliance monitoring.

A collaborative process between industry, agency, and the Council through all the stages of EM development promotes transparency, trust, and ensures efficient use of research dollars. The trawl EM Committee has determined its monitoring objective(s) described in the next section as a first step.

Figure 1. Stages of EM Development



3 Links to the Strategic Plan and the EM Implementation Plan

In June 2013, the Council adopted a Strategic Plan for EM prepared by the agency. The document provides 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.

This cooperative research plan is responsive to *Goal III, Objective 2* of the Strategic Plan:

Implement EM/ER technology where appropriate and cost effective to enhance compliance monitoring.

- *Strategy B: Expand use of EM in compliance applications*
    - *Action: Evaluate EM for compliance monitoring in shoreside pollock fisheries (see page 16 of the Strategic Plan).*

This trawl EM cooperative research plan is further intended to be responsive to the Alaska Region Electronic Technologies Implementation Plan (2015 Implementation Plan) and the Amendment to the Alaska Region Electronic Technologies Implementation Plan (2018 Amended Plan).

In January 2015, NMFS adopted an Implementation Plan. The document:

> *…provides information about the specific EM/ER initiatives that are currently being undertaken to work toward implementing our [NMFS's] vision where electronic monitoring and reporting technologies are integrated into NMFS North Pacific fisheries-dependent data collection program where applicable.*

In September 2018 NMFS amended the Implementation Plan to reflect the new Council priority to focus EM development on trawl catcher vessels.

The Amended Plan includes two projects that NMFS has identified as a priority for implementation that are also the focus of this cooperative research plan, including:

- full retention of salmon on CVs using EM for compliance monitoring; and,
- evaluation of alternative sampling methods for salmon.

4 Research Elements

At their meeting in August of 2018, the trawl EM Committee agreed the cooperative research plan should develop a set of common principles for pollock trawl EM, with the expectation that EM be expanded to other fisheries in the future. There are differing cost incentives across areas, but a common goal could be one regulatory package with nuances for each area but strong overlap and commonality in hardware and software requirements.

A key focus of the trawl EM cooperative research approach is to identify and resolve implementation issues associated with integrating EM on trawl catcher vessels into the Observer Program. Implementation issues will be evaluated in a Council analysis. A resulting analysis might lead to a regulatory amendment to allow the use of EM as a compliance tool on trawl catcher vessels in both the full and partial coverage categories of the Observer Program.

The intention of this work is to apply to vessels fishing using pelagic trawl gear. No matter what that vessel ends up catching, that vessel (and any tender it delivers to) would be eligible to carry an EM system for compliance monitoring under this proposed program. If an unintended pollock pelagic trawl trip were to occur by a vessel not carrying EM that vessel would have been eligible for the existing observer selection process (i.e., the observer situation would remain as it is under status quo). Any vessel that intends to use both pelagic and non-pelagic gear on a trip would not be eligible to use an EM system for compliance monitoring.

Key aspects of this cooperative research plan are to address the methods for obtaining information necessary for quality accounting for catch including bycatch and salmon PSC in a cost-effective manner, ensuring EM systems provide reliable data for compliance monitoring of a no discard requirement for salmon PSC, and exploring modifications that may be needed to the current retention and discard requirements.

Incentives to use EM

EM requires willing partners for the technology to work as intended towards the desired monitoring goals and incentives are a key mechanism to garner support. Currently, fixed gear catcher vessels over 40 feet that are part of the partial coverage sector can either opt for cameras (EM) or human observers. Coverage rates for vessels using human observers ranged from a low of 4% for pot gear to a high of 18% for longline gear for the period 2016 to 2019 - substantially lower than the 30% coverage rate required for fixed gear EM vessels yet vessels have opted for EM with the higher monitoring levels versus taking a human observer. There are perceived vessel benefits for using cameras that have offset the higher observation level: many of these vessels have limited space so prefer not to carry an extra body; the crew/skipper would rather not deal with another personality on board; they prefer to simply activate the vessel's EM system when required versus sorting out the logistics of getting an observer on board (often to remote ports) to start their fishing trip. Additionally, EM vessels are allowed to fish IFQ (halibut and sablefish) in multiple areas and can self-select EM coverage for these particular trips which creates economic efficiency for the vessel and an extra incentive to use EM.

One of the ongoing debates between NMFS and the fixed gear industry is how to select EM trips. Currently, vessels activate their EM system only when the trip is selected by the ODDS system. This selection method can create an observer effect since the vessel operator knows that the trip is being monitored which could result in the vessel fishing differently while being recorded versus when the EM system is turned off. One mechanism proposed by NMFS to eliminate the observer effect is to require EM vessels to have their EM systems activated for all trips. The trips to be reviewed would be selected randomly after the fact at the desired selection rate similar to ODDS. The fixed gear industry has pushed back saying that 100% recording of all trips will cause vessels to opt out of the EM selection pool because it slows down their fishing operations. This change in incentives could increase costs to the partial coverage sector since human observer days are more expensive than EM days once the EM systems are purchased. Vessels and their processing partners in the partial coverage sector pay 1.25% of their ex-vessel revenue in combination for monitoring costs, not a pay as you go system as in the full coverage sector. The debate is ongoing and the observer effect is evaluated annually for the different sectors within the partial coverage sector in the observer program annual reports.

For trawl gear, the incentive to use EM can be quite different depending on the management program (race vs. catch share), the ocean (BSAI and/or GOA), monitoring data needs, and the unique characteristics of the fishery and the participants (vessel size class, use of tenders, port locations).

The Bering Sea (BS) shoreside pollock fishery is a cooperative fishery management structure (American Fisheries Act) with individual vessel pollock and Chinook PSC allocations. 100% human observer coverage is required and the vessels pay their own observer costs. The salmon bycatch (PSC) is determined by counting each individual salmon at the shoreside processing facility (census count). Processors and vessels work together to maximize fish quality for the marketplace with strict delivery schedules and vessel rotations. It is not uncommon for vessels to have some significant wait time between trips which increases the number of vessel observer days. The trawl catcher vessels that participate in the BS pollock shoreside fishery are larger and have been carrying observers for decades so the perceived negative of having an additional body on board is not the same as for the smaller fixed gear vessels. The main incentive for EM for this segment of the trawl sector is to lower the vessel's monitoring costs. It is anticipated these vessels would bear the total cost of EM just as they currently pay 100% of the human observer costs. It is important to note that a subsector of these vessels participate in the Pacific coast whiting fishery and already have operational EM systems on board.

For the GOA fisheries, the pollock fleet is very diverse and can be divided into several distinct groupings: 1) vessels that also fish in the BS AFA pollock fishery; 2) vessels that also fish in the BS AFA pollock fishery and the Pacific whiting fishery; 3) vessels that also fish in the Pacific whiting fishery; and 4) vessels that participate only in the GOA pollock fishery. Typically, GOA pollock vessels that also fish

outside the GOA are larger vessels with sizes ranging in length from 80-124 feet. All these vessels pack 300,000 pounds or more. Vessels that fish exclusively in the GOA pollock fisheries are typically smaller, ranging in size from 58 feet to less than 100 feet. These vessels' packing capacity range from 100,000 pounds to more than 300,000 pounds.

Like the fixed gear catcher vessel sector, the vessels that participate in the GOA pollock fishery are in the partial coverage sector for monitoring; however, EM is not yet a regulatory option for trawl gear. Observer coverage rates have ranged from 18% to 28% for the period 2016 to 2019.

Incentives differ across the four distinct groupings. Vessels that use EM in another ocean may opt into EM for the GOA as well since they are familiar with the technology (first three categories) and activating a system is simpler than arranging for a human observer. For the fourth grouping, incentives differ by vessel size class and delivery mode. Vessels that are less than 60 feet have similar incentives as the fixed gear sector (limited space, fewer personalities in a confined space). Many of these smaller vessels deliver to tenders in the WGOA regulatory area with Chinook salmon PSC based on at-sea composition samples, not census counts at the plant; at-sea sampling for rare species such as salmon can result in imprecise and highly variable estimates - most operators (and fishery managers) would prefer to use accurate census counts. To build the needed chain of custody to ensure that salmon are not discarded at sea by vessels that deliver to tenders, 100% EM coverage would be required for both the tenders and the fishing vessels.

For GOA-only vessels that are larger and deliver exclusively to shoreside processing plants, the incentives for using EM are less clear. It is possible that regulatory relief from some discard requirements could be structured to provide additional incentives.

4.1 Trawl EM goal and objectives

The goal of this cooperative research plan is to assess the efficacy of EM for monitoring compliance with a full salmon PSC retention requirement aboard pelagic trawl catcher vessels in the Bering Sea (BS) and Gulf of Alaska (GOA) and identify key decisions related to operationalizing EM for compliance monitoring in a strategic manner.

To reach this goal, the trawl EM Committee identified the following objectives:

Objective 1: Improve salmon accounting - to provide stable salmon accounting against the PSC hard cap for WGOA and CGOA pelagic pollock trawl catcher vessels as well as the PSC performance standard for BS pelagic pollock catcher vessels

Objective 2: Reduce monitoring costs

a) Develop cost efficiencies and free up money for other priorities

    i. Partial coverage: free up money for use elsewhere; perhaps savings if decreases fee [by shifting how funds are spent in the partial coverage category]

    ii. Bering Sea full coverage: decrease costs for full salmon accounting

Objective 3: Improve overall monitoring data for catch accounting and compliance

a) Explore innovative methods to account for TAC limited PSC species and bycatch species that have small TACs (MRA and PSC status) that could limit participation in a program that requires high retention of catch

b) Explore innovative methods to account for protected species

c) Achieve more comprehensive coverage

Objective 4: Examine current retention and discard requirements as necessary to achieve Objectives 1-3.

4.2 Research questions to be answered through the Cooperative Research Plan

At their meeting in August of 2018, the trawl EM Committee agreed on some key issues for initial investigation:

- Determine appropriate method for recording compliance information (e.g., should the cameras be turned on 100% of the time for compliance? Will the fleet support that?)
    - The North Pacific region has experience with EM for compliance monitoring on catcher processors. Furthermore, the hotspot bycatch avoidance system facilitated through SeaState in the Bering Sea functions well to alert fishing vessels of areas to avoid for minimizing incidental catch. Both examples serve as valuable sources of information that may inform development of EM for compliance with a retention requirement on pelagic pollock trawl catcher vessels.
- Clarify agency interests in estimating salmon bycatch at area/time level versus fleet interest in understanding of individual and group accountability for salmon bycatch that is offloaded to tenders. In the Western Gulf is there value in the fleet knowing where hot tows of salmon originate?
    - <placeholder for additional updates>
- Estimate variable costs for EM dependent on the percent of time the systems get used or reviewed
    - progress has not yet been made on this
- Clarify what is meant by full/maximized/optimized retention
    - progress has not yet been made on this

Additional questions include:

1. Will EM systems function reliably on the diverse groups of pollock trawl catcher vessels, tender vessels, and in shoreside processing plants functioning in the GOA and BS (i.e., diverse configurations)?
2. What level of participation is expected from catcher vessels and tenders (all vessels, most, some and few?) as well as shoreside processing plants?
3. What type and amounts of bycatch and PSC are encountered that must be discarded?
4. With an EM-for-compliance approach, will it be necessary to replace any information collected at-sea for catch accounting? If so, how will that be accomplished? Three options have been identified to date:
    a. Logbook/e-Logbook audit model (including on vessels <60 ft. not currently required to keep Logbooks)
    b. EM review for catch accounting of discards (to determine a discard rate to be applied to EM vessels)
    c. Some level of observer coverage and rate applied to EM vessels?
5. What type(s) of spatial information is needed and may be lost to the Observer Program with EM for compliance only? What may be necessary to replace the information collected at-sea for spatial biological information, marine mammal and seabird interaction? What type of resolution will be expected? Three options have been identified to date:
    a. Some level of observer coverage
    b. Vessel crew collects information

c. Alternative ways to collect information (e.g., shoreside)

6. How will observer duties at shoreside facilities be addressed in both full and partial coverage categories? How will observers be funded?
    a. Salmon accounting
        i. EM in processors with audit of fish tickets and EM (compliance role)
        ii. compliance monitoring for census counts of salmon for tender deliveries to shoreside plants
    b. Biological sampling
7. How can requirements be met for data stream timeliness (for EM review, maintaining data integrity, and considering time lags and differing needs) for:
    a. Industry
    b. Agency
8. What are the operational and economic costs for vessels, tenders and shoreside processing plants associated with using EM versus carrying human observers (both full coverage and partial coverage)?
    a. If some level of human coverage continues at-sea in the fishery for data needs, how does this impact vessel's efficiencies?
    b. Are there operational costs to EM vs. human observers (and vice versa)?
9. What do catcher vessels, tenders, and shoreside processing plants need in order to be prepared prior to beginning each season?
10. What does (full-ish) retention mean in the context of our work?
11. What is it that may need to be exempted from in terms of fishing regulations in order to complete this work?

4.3 Methods

The goals and objectives of trawl EM cooperative research may be achieved through:

1) field trials testing methods to provide data from fisheries which can be used to support compliance monitoring on trawl vessels with a defined maximized/optimized retention requirement; and
2) analysis of information from these field trials and past EM research where appropriate.
3) evaluation of field trial findings, including identifying data source transference

This cooperative research will inform evaluation of multiple EM program design options and consider various EM integration approaches to achieve management needs. Research will: assess the functionality of EM for compliance monitoring on trawl catcher vessels, evaluate operational costs for implementation of EM technology on different types of trawl catcher vessels operating under different management regimes, identify implementation needs (e.g., people, training, infrastructure), and identify what self-reported data is required from trawl vessel operators for data validation, accountability, and compliance monitoring.

Information produced on costs, data quality, risks, operational procedures, and vessel compatibility will inform decisions on implementation phases, future investments in technology, and the combination of tools that will best meet NMFS, Council, and stakeholder objectives for EM on trawl vessels.

This document functions as a roadmap for how the Council might consider moving forward with EM for compliance monitoring on pelagic pollock trawl catcher vessels. The research presented in section 5 describes how the trawl EM Committee intends to go about accomplishing the goals and answering the questions described above. The trawl EM Committee will provide updates for the Council at regular intervals and at each major decision point throughout the research and development process of EM for compliance. A basic timeline and milestones table is presented below, which will be updated throughout 2019.

Key milestones in 2019 include conducting research and applying for an Exempted Fishing Permit (EFP) to exempt vessels from certain regulations (i.e., observer coverage, discard requirements). An EFP is expected to be the primary formal permission required in order for this cooperative research to move forward. However, the EFP application will be shared with the Alaska Department of Fish and Game (ADFG) and the International Pacific Halibut Commission (IPHC), to ensure compliance and information flow across agencies.

ADFG and IPHC will receive regular updates about progress of this work and will have the opportunity to work with EM Committee members to address potential challenges should any arise. One existing challenge is that in some instances definitions/interpretations of terms may differ (e.g., defining 'bycatch' in the Council as opposed to at the IPHC). Therefore, strong ongoing communication across agencies and industry partners is expected to be a key part of supporting the successful completion of this cooperative research.

4.4 Projected Timeline and Milestones

Year	Fieldwork / Pre-implementation Timeline
2018	Collect EM footage on a handful of trawl CVs during pollock fishing.
2019	Install & operationalize EM on a large variety of trawl pollock CVs in both the GOA and BS.
2020	Develop an Exempted Fishing Permit to exempt vessels from certain regulations (i.e., observer coverage, discard requirements)
2021	

5 Cooperative Research Case Studies

5.1 Phase I: Initial Testing

5.1.1 Bering Sea Pollock Shoreside Catcher Vessels Voluntary EM Pilot Project

Organization: United Catcher Boats and Mid-Water Trawlers Cooperative

EM Development Stage: PILOT PROGRAM

Period: Bering Sea Pollock B Season 2018

Project Abstract: This voluntary project is being conducted to help inform whether utilizing EM camera systems proves operationally effective for the Bering Sea pollock catcher vessel (CV) fleet for 100% compliance monitoring of catch and discards per Council and NMFS requirements. It is anticipated that the voluntary video data being collected by the vessels participating in this pilot project will help lay a foundation and inform future discussions and direction on EM development for trawl CVs. Ultimately, BS pollock CVs are hopeful that the use of camera systems (in lieu of human observers) and EM data will serve compliance monitoring purposes required for individual accountability of catch and bycatch by

accurately capturing discard events (i.e., whether a discard has occurred), the amount of discard (i.e., estimated volume in weight), and any rare events (e.g., large animals, gear failure) that may occur.

Fishing operations (area fished, effort, gear used) are not expected to change under this pilot project; current fishing strategies and practices are expected to continue. Vessels fishing in the Bering Sea pollock fishery will have 100% observer coverage, per regulation, while simultaneously operating the EM systems currently aboard their vessels.

On-board Camera Operations: Under this pilot project, vessels will employ their EM systems for the entirety of all trips taken during the 2018 Bering Sea pollock B season.[2] The vessel captain will be responsible for keeping the electronic monitoring system continuously powered during the entirety of those trips selected to be recorded; for regularly cleaning the camera to ensure sharp image resolution; for conducting periodic inspections of the system components and conducting regular system checks to ensure the EM system is performing properly; for ensuring that camera view areas are adequately lit during night operations; for immediately recording if the EM system stops performing; and for maintaining contact with the video review service provider for data retrieval.

For those trips which are recorded, a participating vessel's captain will record the date, set time, depth, time of net retrieval, latitude and longitude, an estimated amount of catch, and an estimated amount of discards in the vessel logbook as is currently required. In addition, the vessel logbook shall contain sections for the captain to record any EM system concerns or malfunctions. For a recorded trip, the EM camera system will be powered on at the dock before leaving with the cameras triggered by hydraulic pressure sensor once a set is initiated. The cameras are to remain on when the vessel returns to port throughout the entirety of the offload.

Post-trip Transmission and Video Review: Upon completion of a recorded trip by a participating CV, normal logbook information transmissions to NMFS (via the existing shoreside catch monitor) will be conducted. In addition, EM video data, along with copies of both the vessel and observer logbooks, will be transmitted to the Pacific States Marine Fisheries Commission (PSMFC) for review via similar methods utilized during the Pacific Whiting fishery. PSMFC will review 100% of the EM video data taken. Video from the camera systems will be used to validate the vessel and observer logbook reporting of all discard events that may have occurred.

List of Participating Vessels:

- F/V Bering Rose
- F/V Leslie Lee
- F/V Nordic Star
- F/V Sea Dawn

Project Outcomes: The trawl EM Committee received an update on this project at their November 2018 meeting. An EM reviewer from the Pacific States Marine Fisheries Commission provided descriptive feedback as well as three short video clips to demonstrate the successes and challenges experienced during the review process for this pilot project. Overall, the EM hardware and systems functioned as expected, but some of the catch compositions were varied enough to present important challenges during the review process. The EM Committee saw one video clip demonstrating a simple discard event with clear estimation methods. Then they saw two different video clips portraying examples where a reviewer of the EM footage would not be able to identify the species or amount of each species in a timely or cost-efficient fashion. These findings are of critical importance at this early stage of EM development for compliance with a retention requirement. While pelagic pollock trawl vessels in the North Pacific share many characteristics with the west coast whiting fleet, this research demonstrated some key differences

[2] The F/V Bering Rose is the single vessel participating in the pilot program that will have had their EM camera system operating during the 2018 Bering Sea pollock A season. This vessel will also have their video data reviewed separately.

and some added challenges that will need to be addressed prior to implementing any EM program for compliance with a retention requirement in the North Pacific.

5.1.2 Development and testing of EM in plants and how it will answer research questions

Project Title: Develop and Test Image Analysis Tools to Monitor Salmon Bycatch Recording by Alaska Groundfish Processors

EM Development Stage: PROOF OF CONCEPT

Project Abstract: Alaska fish processing plants are responsible for reporting all catch and bycatch components on state fish tickets. However, the lack of independent checks on the sampling and accounting process leading to these statistics has restricted their use for managing bycatches of prohibited species (e.g., salmon, halibut, crab). Electronic monitoring of delivered catches and catch sorting processes could be used to assure compliance, providing sufficient confidence in the validity of these reported values to allow their use for bycatch management. This potential would require development and testing of EM tools and processes. Automated detection and identification tools would greatly increase the efficiency and scope of the monitoring process. Initial tests during the 2018 GOA rockfish fishery indicated feasibility for such monitoring processes and tools. We propose expanding EM testing to other fisheries, particularly those targeting pollock.

Project Activities:

1) During the first half of 2019, more than 300 sequences of salmon in unsorted pollock catches will be collected from camera systems installed for the existing rockfish fishery project in at least two Kodiak plants. Numbers will be augmented by marked salmon from previous deliveries that are repeatedly introduced into the catch flow. Additional salmon images will be collected from a modified chute camera for species identification. Both conveyor and chute imaging systems will be improved based on 2018 experience.
2) Annotated salmon sequences will be provided to collaborators with the AFSC EM Innovation project at the University of Washington Electrical and Computer Engineering Department to trial development and estimate efficiency of a salmon detection algorithm. Imagery from the salmon identification device will be similarly tested for separating chinook from other salmon species.
3) Proposals will be submitted to the AFSC Cooperative Research Program and the Catch Share Program for implementation testing at a broader range of delivery situations. These would fund EM systems and collections at additional plants in the Gulf of Alaska and Bering Sea and further algorithm improvements.

Expected Project Outcomes:

1) Collecting sufficient EM imagery of salmon in pre-sorted pollock catches for trial development of automated tools to detect salmon passage.
2) Modifying camera chute technology to indicate species of salmon (Chinook, non-chinook) passed though by sorting personnel.
3) Developing processing of collected information to confirm whether the proportion of detected salmon correctly handled by sorting staff (e.g., exposure to identifying tool) approaches 100% and comparison of machine identifications to those reported on fish tickets.
4) Reporting capabilities and limitations of monitoring technologies to decision-makers to facilitate choices for appropriate applications and combination with observer sampling.
5) Determine implementation standards and procedures for remote monitoring to ensure accurate accounting of PSC.

5.2 Phase II: Larger Scale Test under existing requirements

5.2.1 Current NFWF grant proposal for WGOA and how it will answer the research questions

Project Title: Current NFWF Proposal: Implementing EM in the Western Gulf of Alaska Trawl Catcher Boat Fleet and Associated Tenders (submitted by the Aleutians East Borough on behalf of the Peninsula Fishermen's Coalition and catcher and tender vessel operators of the Western Gulf of Alaska)

EM Development Stage: PILOT PROGRAM/OPERATIONAL TESTING

Award Amount: $434,733

Project Abstract: Accurate discard data is essential for fishery managers to administer catch limits, including a "hard cap" for salmon in the Western Gulf of Alaska (WGOA). Trawlers that fish in the WGOA are some of the smallest in Alaska, fishing with small crews in remote areas. Under the current monitoring plan, under 60' pollock trawlers are monitored by observers on selected trips (approximately 20% of trips), and counts of salmon bycatch are extrapolated from observer basket samples. Industry, NMFS, and the NPFMC are interested in improved monitoring of this fishery due to concerns over salmon accounting, observer safety, and the cost of onboard observers.

In June 2018 the NPFMC identified EM for compliance monitoring in the WGOA pollock fishery as one of their top five priorities. This project will place EM systems on catcher boats and associated tenders so that unsorted catch can be tracked from the net to the shoreside plant where full counts of discards and biological samples will be taken. Catch handling protocols will be defined with NMFS to ensure quality data capture. Data will be collected on 100% of the trips, and system performance will be tracked. Findings from this initial trial will be shared with all stakeholders and will support further development of EM implementation in Gulf of Alaska fisheries.

Project Activities:

1. Engage stakeholders in developing an implementation plan for testing EM in the WGOA fishery. Conduct outreach and coordinate volunteers (catcher vessels and tender vessels) so that unsorted catch can be monitored from the CV to the plant. Coordinate with NMFS on conducting census counts of salmon bycatch in the plant.
2. Install EM systems and develop Vessel Monitoring Plans to monitor compliance with retention regulations for participating catcher boats and tenders. Work with industry and NMFS to define approved catch handling procedures. Track EM system performance and data quality and provide both remote and in-port servicing of the EM systems as needed throughout the project.
3. In collaboration with NMFS develop protocols for EM data review and transmission. Review EM data and provide feedback reports to NMFS and individual vessels after each trip. Refine protocols for integrating EM data into the NMFS database.
4. Develop and test tools to increase the efficiency of data management including tools to reduce the cost of EM data review, provide satellite reporting, and ensure the verity of EM data. Track costs and provide information to assist in determining how EM can most effectively be deployed in this fishery.
5. Provide regular updates to the trawl EM Committee, the Council, and industry members on project performance.

Expected Project Outcomes:

1. An EM deployment plan and compliance monitoring protocols are developed and tested for WGOA catcher vessels and tenders in 2019.

2. At least 10 catcher vessels and two tenders volunteer to test EM systems during the 2019 fishing year. CV volunteers are matched with tender volunteers as appropriate so that catch can be monitored from the boat to the plant. Vessel monitoring plans are completed and approved for all vessels. Protocols for catch handling are developed, EM system performance is good, and compliance monitoring of retention regulations proves to be reliable.
3. Protocols for EM data review are developed, and review is completed in a timely manner. Open source software is used to review data, and templates specific to the pollock fishery are developed. Timely data review and feedback memos enhance industry "buy-in" and NMFS understanding of the data. Protocols for data transmission ensure a secure chain of custody and allow for integration of EM data into NMFS' database.
4. A cost-effective model for data management includes local data review and integrating observers into the EM program broadens the infrastructure for long term EM implementation in Alaska. Tools to reduce review time are developed and tested. Costs to implement EM are tracked and reported to assist in development of cost-effective deployment of EM in the WGOA.
5. Project results are communicated to industry members, the trawl EM Committee, and the Council and support further development of EM in Alaska.

5.2.2 Current NFWF grant proposal for BS/GOA and how it will answer the research questions

Project Title: Implementing Electronic Monitoring for Pollock Trawl Catcher Vessels in the Bering Sea and Gulf of Alaska (submitted by United Catcher Boats, Alaska Groundfish Data Bank, and Alaska Whitefish Trawlers Association)

EM Development Stage: PILOT PROGRAM/OPERATIONAL TESTING

Award Amount: $353,400

Project Abstract: Electronic monitoring systems will be deployed on 31 catcher vessel participants in the Bering Sea and Gulf of Alaska pelagic pollock trawl fisheries for compliance monitoring and will include 13 existing and 18 new EM systems. Deploying and testing these systems is an essential first step towards implementing EM to improve data quality, timeliness, and cost-efficiency for salmon PSC accounting and detecting and quantifying any discards in these maximized retention fisheries. EM will be used to monitor compliance with retention regulations in the pelagic pollock trawl fisheries delivering shoreside. Federal regulations require that all salmon caught incidentally in directed pollock fisheries be retained and that any discards be recorded in logbooks. Accurate mortality data of salmon for PSC accounting and pollock for BS and GOA stock assessments are vital for conservation and management. Currently, fisheries data are collected by human observers (on vessels and in processing plants) - this project will assess EM quality data, timeliness, and costs as compared to data collected by human observers and those associated costs.

Project Activities: Electronic monitoring data obtained under a compliance monitoring approach do not feed into catch accounting management systems. Instead, EM utilized under this approach is typically used to support data collection through other methods, including industry self-reported data combined with the use of EM to verify compliance with record keeping and reporting requirements. To this end, participating vessels will have camera systems and a third-party contractor will review video footage after landing to validate compliance with discard requirements. This will be used in conjunction with a comprehensive dockside-monitoring component to generate salmon PSC estimates during offload.

1. Engage Stakeholders in developing and testing EM on 31 pelagic pollock catcher vessels and sustain stakeholder engagement with the trawl EM Committee and Observer Program throughout the process while working towards trawl EM implementation.
2. Install 18 EM systems on pelagic trawl catcher vessels (6 BS only vessels; 6 GOA only vessels; 6 BS-GOA crossover vessels) and develop 31 Vessel Monitoring Plans.

3. Review data collected through EM systems, monitor and evaluate project performance, and assess cost efficiency of EM systems.
4. Actively communicate EM results to stakeholders and the North Pacific Fishery Management Council.

Expected Project Outcomes:

1. A total of 18 vessels will be equipped with fully integrated EM Systems including video cameras, associated sensors, and vessel logbooks suitable for compliance monitoring.
2. A total of 31 participating vessels will have individual Vessel Monitoring Plans.
3. Proper functionality of the EM systems throughout the project will be ensured through continual monitoring and timely communication between vessel operators, the project team, and the EM provider.
4. The costs to employ EM systems on different size pelagic pollock trawl vessels, operating in different areas and under different fishery management plans, will be documented and better understood. This information will help stakeholders and the Council better understand how EM can most effectively be employed in the pelagic pollock fisheries.
5. EM compliance throughout the project will be monitored and ensured. This will include specific focus on the 300,000 pound trip limit in the Gulf of Alaska and the way in which the regulatory trip limit affects the efficacy of EM.
6. Stakeholders, including industry members, NMFS, and the Council, will be informed via regular updates about project performance, outcomes, and next steps.

5.3 Phase III: Larger Scale Testing Placeholder

1. Identify levels of observer coverage
2. What retention requirements might need to change?
3. Innovative Salmon Accounting methods?

Appendix A. Discard White Paper

WHITE PAPER ON DISCARDS IN THE BERING SEA AND GULF OF ALASKA MID-WATER POLLOCK FISHERIES

November 13, 2018[3]

Introduction

At their August 2018 meeting in Seattle, the trawl EM Committee tasked members with composing a white paper to explore existing retention rules, as well as opportunities and challenges related to implementing full, maximized, or optimized retention on pelagic pollock trawl catcher vessels. During the August meeting, EM Committee members discussed developments in the West Coast whiting fishery to allow for a system of increased retention to facilitate EM coverage with shoreside catch accounting. A system of full retention would mean not allowing discards for safety purposes or mechanical failures. A maximized or optimized retention system similar to what is used in the whiting fleet is more likely to be feasible in the North Pacific. The details of some maximized or optimized retention system will be informed by outcomes from research in 2019 and 2020.

This white paper aims to provide information to allow the trawl EM Committee to address options for full, maximized, or optimized retention as part of the trawl EM *Cooperative Research Plan for developing an EM program for compliance purposes on pelagic pollock trawl catcher vessels and tenders both delivering to shoreside processors with a defined retention requirement.* This is intended to be a living document, updated at regular intervals throughout the multi-year course of EM development for pelagic pollock trawl catcher vessels.

Current Management Measures

On an annual basis, NMFS determines how much of the total allowable catch (TAC) for each groundfish species in the Bering Sea (BS) and Gulf of Alaska (GOA) is needed for incidental catch in other groundfish fisheries. From there, the remainder of the TAC is made available as a directed fishing allowance. Directed fishing is defined in regulation as "any fishing activity that results in the retention of an amount of a species or species group onboard a vessel that is greater than the maximum retainable amount (MRA) for that species or species group."

During a fishing year, NMFS routinely closes directed fishing for specified groundfish species. Directed fishing closures occur because a fishery has reached a salmon, halibut, or crab bycatch allowance; the directed fishing allowance for a target groundfish species has been reached; or because of overfishing concerns for another groundfish species taken as bycatch. When directed fishing for a species is closed for any of these reasons, incidental catch amounts of a species may still be retained onboard a vessel up to the specified percentage of other retained groundfish catch open to directed fishing.

NMFS attempts to manage groundfish TACs so that directed fishing closures are implemented in a timely manner, thereby providing sufficient portions of the TAC to allow for incidental catch in other fisheries. When the harvested amount of a species approaches or reaches the TAC, NMFS may place the species on "prohibited species" status, and any catch of that species must be discarded. If the harvest amount approaches the overfishing level, then NMFS may close those directed fisheries which take the species as bycatch in order to prevent overfishing.

[3] Prepared by: Julie Bonney, Ruth Christiansen, Elizabeth Figus (NPFMC), Heather Mann, Katy McGauley, and Jennifer Watson (NMFS)

Maximum Retainable Amounts (MRAs)

Maximum Retainable Amounts (MRAs) are a management tool used in both the BS and GOA to slow catch of a species so that total harvest can be managed up to, but not over, the TAC by the end of the year. MRAs apply at the vessel level when a groundfish species is closed for directed fishing; when NMFS prohibits directed fishing for a groundfish species, retention of the catch of that species is allowed up to an MRA.

An MRA is calculated as the percentage of the retained catch of a species closed for directed fishing (incidental catch species) to the retained catch of a species open for directed fishing (basis species). A directed fishery closure limits the allowable retention of the incidental catch species. MRAs themselves do not require a vessel to retain a species or lower discard rates, but instead lead to *a discard requirement* if/when catches of incidental species subject to MRAs exceed the allowable amount at a given time.

The MRA tables (Tables 10 and 11 to 50 CFR part 679) show allowable retainable proportions of incidental catch species relative to retained basis species open to directed fishing. The MRA tables are a matrix of proportions representing a range of rates of expected or accepted incidental catch of species closed to direct fishing, relative to target species. As a management tool, MRAs rely on the ability of the vessel operator to selectively catch a particular groundfish species. *The MRA percentages are intended to slow the rate of harvest of a species when insufficient TAC amounts are available to support a directed fishery.*

MRA regulations at § 679.20(e) establish the calculation method and set individual MRAs for groundfish species or species groups, when directed fishing for that species is closed. *Amounts that are caught in excess of the established MRA percentage must be discarded.* NOAA Office of Law Enforcement (OLE) may confiscate the overage amount and assesses a fine for the overages delivered in the same calendar year.

When NMFS prohibits directed fishing for a groundfish species, MRAs buffer the amount of catch of that species occurring in directed groundfish fisheries that remain open. *Ideally, the application of an MRA slows catch of a species, so that harvest can be managed up to the TAC by the end of the year.* Beyond management of a TAC to obtain optimum yield, MRA calculations perform two additional functions. *First, MRAs limit retention to a species expected or accepted incidental catch rate. Second, the MRA functions as a trip limit for retention of incidental catch of a species.* This function allows for limited targeting of a species up to the MRA. This is known as topping off. The MRA tables assign an MRA percentage for species not open for directed fishing to each species that is open to directed fishing. If a vessel does not catch its MRA while directed fishing for a target species open for directed fishing before the end of a fishing trip, the vessel may be able to make some target sets on the incidental catch species and still not exceed its MRA.

The incentive for vessel operators to top off is directly related to the value of, and available market for, the incidental catch species in relation to the species being targeted. From a management perspective, limiting the amount of incidental catch a vessel operator is allowed to retain is a tool to slow down harvest rates. This does not necessarily reflect an "intrinsic" incidental catch rate but rather reflects a balance between the recognized need to slow harvest rates, minimize the potential for undesirable discards, and, in some cases, provide an increased opportunity to harvest available TAC.

For those species where restricting catch to a particular incidental rate is not necessary, regulations establish a default MRA rate of 20 percent. For many groundfish species, current regulations establish a relatively high MRA for particular species. For example, the highest MRA of 35 percent for arrowtooth flounder as an incidental species is applied to other groundfish species open for directed fishing as basis species. A higher MRA would allow for increased indirect targeting on a species.

MRAs can be challenging to understand since rates for the different species vary depending on the target fishery as well as the area in which a vessel is fishing.

Prohibited Species Catch (PSC)

In general, a species designated as PSC cannot be retained by a vessel and must be discarded as soon as practicable. The North Pacific Fishery Management Council (NPFMC) and NMFS have adopted measures to limit the catch of species taken incidentally in groundfish fisheries. Certain species are designated as "prohibited species" in the Bering Sea and Gulf of Alaska fishery management plans because they are the target of other fully utilized domestic fisheries. *Full-time prohibited species include Pacific halibut, Pacific herring, Pacific salmon, steelhead trout, king crab, and Tanner crab.* Pacific salmon is the one exception for the mandatory at-sea discard requirement and must be retained.

For other species, when the harvest amount approaches or reaches the TAC, in order to avoid overfishing, regulations at 50 CFR 679.20(d)(2) require prohibiting retention and any catch of that species must be discarded. When this occurs, NMFS publishes a notification in the Federal Register requiring that target species be treated in the same manner as a prohibited species, for the remainder of the year. Species that often go to PSC status during the year are those that have small TACs. These include blackspotted/rougheye, shortraker, thornyhead, other rockfish, skates (big and longnose in the GOA), sculpins, octopus, and sharks. Other species that may reach PSC during the year include Pacific Ocean Perch, northern rockfish, dusky rockfish and Pacific cod. Finally, there is a limited trawl allocation of sablefish that when met requires sablefish to be placed in PSC status.

PSC status determinations affect all gear types (except sablefish) and different gear types drive the particular species catches (not necessarily mid-water pollock fisheries). This can make it lengthy to describe to precisely which area(s) (BS, GOA, or both) or gear(s) a given PSC designation applies.

Gulf of Alaska Pollock Trip Limits

The GOA pollock trip limit was initially implemented in December 1998 when the Council took emergency action to implement measures consistent with NMFS' proposed Reasonable and Prudent Alternatives (RPAs) to reduce impacts to Steller sea lions. That action for the GOA included: creating four pollock seasons with limits on the percentage of the TAC which could be taken from any one season; expanding the closure areas around rookery and haul-out sites; and establishing a 300,000 pound trip limit for pollock in the western and central Gulf management areas. In response to Council recommendation, on January 22, 1999, NMFS implemented an emergency action to apply Steller sea lion protection measures, including the action described above, to the 1999 fishing season. The reason for the emergency trip limit action was defined in the Federal Register notice to temporally or spatially disperse pollock harvests in the GOA.

The second part of regulation § 679.7(b)(3) stipulated that tender vessels cannot retain on board at any one time more than 272 mt (600,000 pounds) of pollock. The Alaska Board of Fisheries, following the action of the Council, implemented similar regulations within State waters on July 27, 1999. The State trip limit regulation is worded similarly to the NMFS regulation above (see 5 AAC 28.073). The area incorporated into the State trip limit regulation includes State waters adjacent to the Federal management areas 610, 620 and 630, between 147 and 170 degrees west longitude. It should be noted that there is a small discrepancy between the State and Federal regulations. The Federal regulations include management area 640 (between 140 and 147 degrees west longitude) whereas the State regulation cited above extends to the eastward boundary of management area 630 at 147 degrees west longitude. Therefore, State regulations do not currently include management area 640. There is a small pollock fishery in the Prince William Sound area that is currently managed by the State to include the 300,000 pound trip limit, so the regulation discrepancy does not result in different State and Federal management

approaches; however, Federal regulations require discards above the 300,000 pound trip limit in contrast to State regulations that require retention above the 300,000 pound trip limit.[4]

The 1999 GOA pollock trip limits were analyzed in the November 2001 Steller Sea Lion Protection Measures, Final Supplemental Environmental Impact Statement (SEIS), and the pollock trip limit was determined to be one of several necessary Steller sea lion protection measures for the Federal groundfish fisheries off Alaska at the time (in the 2001 biological opinion).

GOA trip limit regulations were revised and implemented May 25, 2009. The revised GOA pollock trip limit regulation prohibited catcher vessels from retaining more than 136 mt (300,000 lb.) of unprocessed pollock during a calendar day and landing more than 136 mt (300,000 lb.) of pollock during a fishing trip. NMFS also prohibited a vessel from landing a cumulative amount of unprocessed pollock from any GOA reporting area that exceeds 136 mt (300,000 lb.) times the number of days the pollock fishery is open to directed fishing in a season. *The objective of this rule was to prevent certain pollock catch and delivery practices that allowed some vessels to circumvent the intent of the original trip limit regulations.* Trip limits were implemented in 1999 (until they were amended in 2009) had become less effective as multiple trips during a day and partial offloads of pollock product during a trip had allowed for increasing amounts of pollock to be caught in some areas of the GOA. These delivery practices caused seasonal pollock quotas to be exceeded and potentially could have been in conflict with Steller sea lion protection measures under Endangered Species Act (ESA) intended to disperse pollock catches in the GOA.

Increased Retention/ Improved Utilization Program Requirements

[Placeholder-Add fishery effects to this section]

Amendment 49 was approved by the Council in September 1996. The proposed rule was published on June 26, 1997 (62 FR 34429). The final rule was published December 3, 1997 (62 FR 63880). Effective date of implementation was January 3, 1998. Amendment 49 to the GOA FMP was implemented as separate rulemaking.

To reduce discards, the Council adopted an improved retention and utilization program (IR/IU) for all groundfish target fisheries. This action was deemed necessary to address one of the Council's comprehensive fishery management goals, adopted in 1984, to "minimize the catch, mortality, and waste of non-target species and reduce the adverse impacts of one fishery on another." The Council also recognized that fish caught as bycatch in one fishery represent an allocation away from any target fishery for the bycatch species. In addition, a priority objective of the FMP is to "provide for the rational and optimal use, in a biological and socioeconomic sense, of the region's fisheries resources as a whole."

The IR/IU program was intended to improve utilization and effective control/reduction of bycatch and discards in the fisheries off Alaska (including the BS and GOA) to address the following problems:

1) bycatch and discard loss of groundfish, crab, herring, salmon, and other non-target species;
2) economic loss and waste associated with the discard mortality of target species harvested but not retained for economic reasons;
3) inability to provide for a long-term, stable fisheries-based economy due to loss of fishery resources through wasteful fishing practices;

[4] Under 5 AAC 28.070 (e) – state regulations - a vessel participating in the walleye pollock fishery shall bring on board the vessel all walleye pollock caught while operating the vessel; the permit holder or a crewmember may not take any action intended to discard or release walleye pollock before the fish is brought on board the vessel; and all walleye pollock shall be retained. Any pollock landed in excess of the trip limit will be reported as a trip limit overage on an ADF&G fish ticket.

4) the need to promote improved retention and utilization of fish resources by reducing waste of target groundfish species to achieve long-term sustainable economic benefits to the nation.

Beginning in 1998, 100% retention of pollock and Pacific cod was required, regardless of how or where it was caught. Only fish not fit for human consumption can be legally discarded. This measure has dramatically reduced overall discard of groundfish. For example in 1997 (the year prior to implementation), about 22,100 mt of cod (8.6% of the cod catch) and 94,800 mt of pollock (8.2% of the pollock catch) were discarded. In 1998 (the year after implementation), discard amounted to only 4,300 mt of cod (2.2%) and 16,200 mt of pollock (1.6%).

MRAs and Discard Requirements for State Managed Groundfish

In addition to lingcod, dark, blue, and black rockfish are the only species solely under state management authority. The state has management authority both in state waters and the EEZ. A global groundfish emergency order is published effective January 1st of each year that sets out state bycatch rules for these species for the year, which can be superseded by subsequent emergency order if necessary. Rules are set for each state management area – Kodiak, Chignik, South Alaska Peninsula, and Bering Sea-Aleutian Islands. Blue rockfish are rarely found north or west of SE Alaska.

Dark and black rockfish species bycatch rates in the Kodiak area are typically set at 5% and in the Bering Sea-Aleutian Islands are typically set at 20%. In Chignik and South Alaska Peninsula, black rockfish has a bycatch rate of 5% and 20% for dark rockfish.

Lingcod retention regulations are unique in the Kodiak and Chignik areas and are only retainable beginning July 1st until December 31st and only fish 35 inches and greater may be retained up to the bycatch limit; 5% in Kodiak and 20% in Chignik. In South Alaska Peninsula and Bering Sea–Aleutian Islands there is no closed seasons or size limits and bycatch rates are set at 20%.

There are no mandatory retention regulations for any of these species. If landed catches are in excess of the established bycatch amount, the excess must be weighed and reported as a bycatch overages on an ADF&G fish ticket. All proceeds from the sale of excess bycatch shall be surrendered to the state.

Enforcement of MRAs and Discard/Retention Requirements

Note on Penalties

As with all allegations of potential violations, NMFS Office of Law Enforcement (OLE) has several options. For minor penalties, OLE has the discretion to notify the captain of an allegation and ensure they are aware of the regulation (i.e. compliance assistance). OLE may issue a written warning. This may be appealed by the captain. If not, it counts as a prior violation should another violation occur. Next, OLE may issue a Summary Settlement—a fixed amount or formula (e.g. value of the overage) based on predetermined conditions decided by NOAA General Counsel. Lastly, a violation may be referred to General Counsel for issuance of a Notice of Violation and Assessment (NOVA). General Counsel may decline to prosecute the case, issue a written warning, or issue a NOVA that takes into account more factors than the Summary Settlement schedule can consider. How a violation is handled may change from year to year based on management concerns, OLE workload, and other issues.

GOA Pollock Trip Limits

The pollock trip limit is 300,000 pounds per delivery and only applies to the Gulf of Alaska. Vessels are required to retain pollock up to the trip limit due to improved retention improved utilization (IRIU) regulations but must discard pollock catches above the trip limit amount. Many of the Kodiak vessels pack more than 300,000 pounds and some vessels deliver deck loads and/or codend bags. With all the variables in terms of what a fish weighs, roe/non-roe season pollock condition, and the vessel packing

capacity itself, it makes it difficult to always be under the 300,000 pound trip limit. *Enforcement of the trip limit has changed in the last year or so with steeper penalties.*

If a vessel delivers more than 300,000 pounds, the processor may process the fish and is allowed to pay the boat for any pollock over the 300K limit. The processor must inform NMFS Office of Law Enforcement (OLE) of the overage and NMFS OLE will charge the vessel for the value of the overage (via a Summary Settlement) for the first three overages in a year; and subsequent overages are handled through a Notice of Violation and Assessment (NOVA) - imposing a fine is decided on a case-by-case basis (some the processors pay on behalf of the vessel which is considered acceptable as long as the fine is paid). For minimal overages, vessels first receive warnings with a maximum of three warnings within a calendar year before triggering a NOVA consideration..

Prohibited Species Catch (Halibut, Crab, and Herring) and Groundfish Species on PSC Status

Bering Sea and Gulf of Alaska trawl catcher vessels are required by law to discard all halibut, crab (king, tanner, opilio) and herring caught in all their fisheries with minimal harm to these PSC species; groundfish species when on PSC status must be treated in the same manner. Because it is at times difficult to sort out and discard every single PSC species at sea, it is expected that some will end up in the vessel's fish hold and delivered to the shoreside processor. In this case, the landed PSC species is required to be recorded on the vessel's fish ticket. NOAA Office of Law enforcement monitors these landings and, if deemed excessive, can issue a written warning or issue a violation to a vessel. Processors can send the landed PSC to the communal Kodiak fishmeal plant or process and donate the PSC (only halibut and salmon) to Sea Share for distribution to food banks. In the Bering Sea, landed PSC is returned to the vessel at the end of the offload to be discarded back at sea or process and donate the PSC (only halibut and salmon) to Sea Share for distribution to food banks.

All vessels participating in the BSAI pollock fishery are required to use pelagic gear. The presence of 20 or more of any species of crab indicates the vessel was non-pelagic fishing, or "fishing the bottom". When more than 20 crab occur in a pollock haul, observers are asked to do the following: 1) count and measure any crab in the composition samples, regardless of species and 2) measure all the crab found. Only those crab found within the species composition sample are used for managing the fishery. The total amount of crab in a pollock haul that had more than 20 crab is reported to the NOAA Office of Law Enforcement.

Salmon Retention Requirements

Pelagic pollock trawl vessels are required to retain all salmon species in the BS and Central and Western GOA in the pollock fisheries. The number and weight of landed salmon by species is required to be recorded on each vessel's fish ticket. The means to determine if a vessel is discarding salmon at sea occurs through at-sea observer compliance reports.

According to the North Pacific Observer Program Annual report for 2017 for the Bering Sea pollock fishery, *complaints received from observers involved handling of salmon during processing:* occurrences of salmon passing the sorting point, no sorters present, failure to place all salmon in the salmon storage bin and removing salmon from the salmon storage bin before the observer had an opportunity to count and sample. No concerns were raised about salmon being discarded at sea. It should be noted that this report does not separate the catcher processor sector from the shoreside sector although both have similar salmon retention requirements. About one third of these complaints can be attributed to the shoreside sector. For the Gulf of Alaska some complaints include observers witnessing salmon discard at sea, inconsistent salmon numbers (observer numbers vs. shoreside processor), failure to sort all salmon at the shoreside processors, and at sea discard of catch before the observer had an opportunity to sample or to determine if salmon were in the catch.

The Summary Settlement penalty for discarding a salmon prior to sampling by an observer is $2,500 per fish. This penalty recognizes the incentives to discard salmon: it is usually an intentional violation; it is relatively easy to do; and because observer salmon counts are extrapolated (in the GOA), one salmon may have a large influence in calculating the final amount.

Enforcement of Maximum Retainable Amounts (MRAs)

Maximum retainable allowance by target fishery is based on tables 10 and 11 to 50 CFR part 679. OLE acknowledges it is difficult for a vessel to always be within the allowable percentages. In the Bering Sea, it is less common for vessels to exceed an MRA amount, so direct comparisons between overages in the Bering Sea and those that occur in the GOA are difficult to make. Vessel skippers are made aware of any MRA overages from the fish ticket information generated at the time of delivery. For minimal overages vessels typically receive three warnings before monetary penalties are imposed. In most cases, the ex-vessel value for the overage amount is paid directly by the processor to NMFS or by the vessel owner via a Summary Settlement for the first two overages per year. The Summary Settlement for a third MRA overage is the value of the overage plus $1,000. If the overage is considered egregious or the vessel has exceeded the three-overage threshold, a monetary fine is imposed on the vessel owner. For repeat offenders, a Notice of Violation (NOVA) can be issued with substantially higher penalties. Processors are required to log the entire delivery amount and notify OLE that a vessel has an overage. The entire MRA species delivery amount can be processed and is allowed to enter commerce.

Logbook Requirements

Recordkeeping and reporting (R&R) regulations are detailed at § 679.5 for shoreside processors, tender vessels, and trawl vessels. R&R requirements include, but are not limited to, paper and electronic documentation, logbooks, forms, reports, receipts, computer printouts, and requests for inspection described in this section. Trawl catcher vessels less than 60 ft. are exempt from R&R (logbook) requirements.

Observer Coverage and Calculating Discard Rates

Bycatch amounts and discard rates for the pollock trawl fisheries are based on information extrapolated from observer data for all species except for salmon in the Bering Sea. If an observer is present on a vessel, the species composition sample is used to establish the type and amount of bycatch species relative to the amount of pollock caught. Observers also estimate the percentage of all the groundfish caught that is retained. The type and amount of bycatch and the percentage of retention are used to establish a bycatch rate. This rate is then applied to the fishery to determine the incidental catch amount that is debited from the TAC. Observers conduct a census at the shoreside processor in the Bering Sea pollock fishery to obtain the species, count, and weight of all salmon in the catch. This amount accrues against established salmon bycatch caps.

In the Bering Sea, all catcher vessels targeting pollock are required by regulation to have full (100 percent) observer coverage.[5] In the Gulf of Alaska, the data used to determine the predominant (target) species retained during a trip depends on the amount of observer coverage and the type of vessel (mothership, catcher processor (CP), or catcher vessel (CV)). If a groundfish vessel is in the full coverage stratum, then observer data are used to determine the trip target. For all other vessels not in the full coverage stratum, a landing report is used to determine trip target. Determining the trip target is a three-step process that is implemented within the catch accounting system:

1. if 95% or more of the retained catch is pollock, then a pelagic pollock target is assigned;

[5] Under the American Fisheries Act (AFA), all vessels allowed to harvest pollock are specifically designated whether they are catcher vessels, catcher processors, or motherships.

2. if the sum of all flatfish is greater than the amount of any other species, then flatfish is assigned as the trip target;
3. if neither pollock nor flatfish is determined as the target, then the groundfish species that has the highest proportion of the retained catch is assigned as the target (inclusive of bottom pollock target).

A challenge with using observer data for determining trip target is that the observer must determine which sampling method to employ for a specific target before the target fishery is determined at offload. For example, in the GOA pollock fishery observers collect species composition samples at sea and monitor offloads to collect biological information and counts from the salmon in encountered. In all other GOA fisheries, the observer collects species composition samples at sea and does not monitor the offload. If an observer makes the wrong assumption about the target fishery, data may not be collected for salmon. This has potential implications for the use of EM for pelagic pollock trawl, as a vessel may not have EM coverage for a trip that had a target of pelagic pollock and vice versa. This could have important management and cost implications.

The Gulf of Alaska (GOA) pelagic pollock fishery is in the partial coverage observer category.

In the Bering Sea and the GOA, observers must make an independent estimate of at-sea discards for all sampled hauls. The vessel skipper and observer may discuss which incidental species are intended to be discarded prior to any catch being brought on board. The vessel observer records his/her best estimate of "percent retained" for each species encountered in the observer at-sea species composition samples.

The follow tables demonstrate the average groundfish discard rates for the pollock trawl catcher vessels fleet. These vessels include the catcher vessel harvest sector using pelagic trawl gear and receive either a bottom pollock or midwater pollock trip target code. The GOA GHL pollock fishery has been excluded from this table. Retained groundfish catch does include other species in addition to pollock. The groundfish discard rate is a weighted average of the amount of discarded groundfish estimated at each rate to the amount of retained groundfish catch. The overall groundfish discard rate is low in both the BS and the GOA. While the overall discard rate may be low, certains species discarded may be difficult to identify but have limiting allocations so even small amounts of discard can be limiting.

Table 1. Average Discard Rates in the Bering Sea pollock trawl fishery

YEAR	DISCARDED_GROUNDFISH	RETAINED_GROUNDFISH	DISCARD_RATE
2013	996	664,183	0.0015
2014	837	672,166	0.0012
2015	1,597	693,093	0.0023
2016	740	706,479	0.001
2017	1,624	713,441	0.0023

Table 2. Average Discard Rates in the Gulf of Alaska pollock trawl fishery

YEAR	DISCARDED_GROUNDFISH	RETAINED_GROUNDFISH	DISCARD_RATE
2013	456	83,143	0.0055

2014	1,176	130,266	0.009
2015	1,044	156,946	0.0067
2016	1,125	170,653	0.0066
2017	1,573	177,350	0.0089

Calculating Discard Rates for Salmon

A key data concern relating to the GOA pelagic pollock fishery is that catcher vessel observers follow different sampling protocols when vessels deliver to a tender as opposed to a shoreside processing plant. On observed trips where the vessel is targeting GOA pelagic pollock and delivers to a tender, the observer does not have an opportunity to census the offload to account for all the salmon bycatch that has been intercepted and take systematic genetic samples, as would be done if delivery were made at a shoreside plant. Since pelagic pollock trawl deliveries to tenders represent a significant portion of pollock deliveries in some areas of the GOA, the inability to census salmon has the potential to create high variance in total Chinook salmon bycatch estimates.

In addition, not taking a census from the tender vessels may lead to bias in the analysis of the genetic stock composition of GOA salmon bycatch (and subsequently the understanding of the Chinook salmon bycatch stock of origin), if there is a difference in the salmon populations encountered by catchers delivering to a tender and those delivering shoreside. In recent years, the Council has prioritized implementation of a robust sampling protocol for Chinook salmon in the GOA pelagic pollock trawl fisheries to better understand the stock composition of salmon taken as bycatch; however, stock of origin estimates have been stable over the past 5 years in the GOA so this may no longer be a pressing data concern.

A related concern for vessels is that the offload census of salmon bycatch, which an observer conducts shoreside, provides more precise data for managing the Chinook salmon PSC limit in the GOA pollock fishery. Because of the configuration of tender vessels, a census of the delivery is not an option. When offload data are not available, NMFS estimates Chinook salmon PSC using at-sea samples and extrapolates samples to the delivery of the sampled haul. Observers strive to take multiple, equal-sized samples from throughout the haul to obtain the largest sample proportion possible. However, even with large sample sizes that reduce detectability issues, Chinook salmon is a relatively uncommon species and is characterized by many small and zero counts with occasional large counts. There is a relationship between the abundance of given species in a haul, sample size, and the level of precision in the resulting estimate of species catch from sampling.

In general, managers can have very high precision in the catch estimate for common (target species) with very small samples of the haul. Conversely, even large samples of a haul provide relatively imprecise estimates of catch for very rare species, like Chinook salmon. *Since Chinook salmon bycatch limits in the trawl fishery are fully utilized, imprecise estimates have the potential to shut down the fishery and cause fishermen to forgo pollock harvest opportunities.*

Potential Areas of Concern with Increased Retention

[Placeholder for information about agency constraints on discard requirements-what is off the table for discards (i.e., impossible to ID on EM)?]

Changes in Fishing Practices Due to Changes in Incentives

All vessels fishing for pollock in the BS and GOA are required by regulation to retain all pollock in order to improve the retention and utilization of the fish resource (reducing waste of target groundfish species). Currently there is no sorting by size of pollock. Some ancillary bleeding of pollock from a trawl net may and often does occur during the course of fishing operations and this information is generally not recorded by either the observer or the vessel captain. In extremely rare circumstances, the intentional discard of a partial bag (deckload) of fish may occur due to safety and stability concerns. When this happens, a vessel skipper will confer with the observer and both will estimate and record the species and amount of discard.

GOA Pollock Trip Limits

Pollock trip limits for the PWS state fishery and the GOA federal fisheries are managed differently. Under the federal system vessels are required to discard all pollock catches above 300,000 pounds and these vessels can be severely penalized when they exceed this limit. In contrast, under the PWS state fishery vessels are required to keep all pollock they catch even if their catches are above the 300,000 pound trip limit. For these trips, vessels do not get paid for any catches above the limit and enforcement actions only occur when vessels are repeat offenders and/or overages are egregious. *The differences between these two management systems may provide a good case study to determine changes in vessel behavior between the two systems when considering a different pollock trip limit management system for the GOA federal fisheries when utilizing EM for compliance monitoring.*

After reviewing e-landings records for both state PWS pollock deliveries and Central GOA federal pollock deliveries, there seemed to be little difference in the frequency of overages between the two management systems. As such, additional investigation was conducted. Full pollock retention has been required for many years within the PWS state fishery; however, the first year that the PWS pollock fishery registration packet explicitly included language requiring full retention of pollock was in 2018. After polling several vessel operators that participated in both the 2018 PWS fishery and the federal CGOA pollock fishery, it became clear that operators where confused about the different requirements between the two management systems. While the state PWS pollock management system may be a reasonable approach for allowing increased retention within a pelagic pollock EM monitoring environment in the GOA, it will likely need to be tested within an Exempted Fishery Permit since the available data does not elucidate changes in vessel behavior.

Prohibited Species Catch (PSC)

Halibut PSC

The discard mortality rate (DMR) methodology for halibut taken in groundfish fisheries was revised starting in 2017. The assumed DMR for catcher vessels employing pelagic (mid-water) trawl gear in both the GOA and BSAI is now assumed to be 100% (all halibut taken incidentally are dead). Before the change, DMRs ranged from 65%to 76% in the GOA midwater pollock fishery and 81% to 89% in the BS. As a PSC species, by regulation pollock vessels encountering halibut should be discarding them; however, given the de minimis encounters of halibut, it is almost operationally impractical to sort this species from the catch of pollock. Halibut are rarely discarded at sea since halibut bycatch rarely occurs and the operations of pelagic pollock trawl fishing where catch is dumped directly from the cod end into refrigerated sea water (RSW) tanks makes it extremely difficult to sort incidental halibut from the pollock

catch while at sea. *In practice, retention of halibut is not generally enforced as a violation. Shoreside processors then discard the landed halibut at sea, send the landed halibut to a communal fish meal plant, or donate the landed halibut to Sea Share for distribution.*

If pelagic pollock trawl vessels using EM for compliance were exempted (via NMFS/IPHC regulations) from discarding halibut within the pelagic pollock trawl fishery, the result is the same – 100% of the halibut would be dead whether discarded at sea (as intended by regulation) or delivered to the processing plant under a specific exemption.

Tables 1 and 2 below show the annual amount of halibut mortality attributed to pelagic pollock trawl gear for both the bottom pollock and pelagic pollock targets in the GOA and BSAI over the years 2009 - 2018. The data reported in Tables 1 and 2 are from the NMFS catch reports and include several caveats. For both the GOA and BSAI, some data are not available due to confidentiality constraints. In the BSAI, from 2009 to 2015, only data from catcher vessels delivering to shoreside processors is included; from 2016 to 2018 the data includes catcher vessels delivering to both motherships and shoreside processors. On average, 11.9 mt of halibut mortality occurred in the GOA pelagic pollock trawl gear fisheries annually (low of 0.1 mt and a high of 26.1 mt). In the BSAI, on average 61.5 mt of halibut morality occurred annually (low of 9.9 mt and a high of 150 mt).

Table 1 Annual halibut mortality usage Pelagic trawl, pelagic pollock and bottom pollock targets GOA-wide (610, 620, 630, 640) – catcher vessels only

Year	Groundfish* (mt)	Halibut* (mt)	Rate	Halibut PSC (mt)
2009	37,161.00	3.2	0.01%	2.2
2010	70,776.20	25.2	0.04%	17.9
2011	69,923.10	24.6	0.04%	14.9
2012	94,518.00	11.3	0.01%	8
2013	80,430.50	28.9	0.04%	19.2
2014	127,959.50	0.1	0.00%	0.1
2015	154,546.70	15.3	0.01%	10.1
2016	170,221.20	19.2	0.01%	11.4
2017	175,665.10	7.8	0.00%	9.2
2018	147,164.00	22.1	0.02%	26.1
Avg	**112,836.50**	**15.8**	0.01%	**11.9**

*some groundfish and halibut catch not included due to confidentiality constraints

Table 2 Annual halibut mortality usage for pelagic trawl gear, pelagic pollock and bottom pollock targets BSAI - 2009 thru 2015 catcher vessels delivering to shorebased processors and 2016 - 2018 catcher vessels delivering to motherships and shorebased processors. halibut mortality usage pelagic trawl, pelagic pollock and bottom pollock targets GOA-wide (610, 620, 630, 640) – catcher vessels only

Year	Groundfish* (mt)	Halibut* (mt)	Rate	Halibut PSC (mt)
2009	353,741.00	161.2	0.05%	127.9
2010	356,095.90	105.9	0.03%	82.8
2011	515,955.90	119	0.02%	103.3
2012	524,312.20	177	0.03%	150
2013	541,628.90	28.3	0.01%	24.3
2014	549,873.20	61.8	0.01%	52.5

2015	571,120.90	32.6	0.01%	28.3
2016	693,380.00	21.4	0.00%	18.9
2017	687,074.40	16.7	0.00%	17
2018	702,235.00	9.9	0.00%	9.9
Avg	**549,541.70**	**73.4**	0.01%	**61.5**

*some groundfish and halibut catch not included due to confidentiality constraints

Herring/Crab PSC

Like halibut, herring and crab (king, tanner, opilio) are PSC species required by regulation to be discarded. Similar to encounters with halibut, herring and crab taken by pollock catcher vessels are encountered in very small amounts (see table 3 and 4) and *it is operationally impractical to sort out each animal from the pollock catch.* In rare cases when a vessel does encounter a large school or 'ball' of herring, vessels are able to discard as described in the rockfish section below. Additionally, for the AFA fishery in the Bering Sea, when herring interactions do occur, Sea State, Inc. provides updates to catcher vessel fleet notifying them of where encounters take place so they can avoid the specific locations where interactions are happening. In the GOA, when large encounters of herring occur, vessels communicate on the fishing grounds to inform each other of areas to avoid. For crab, these are generally mixed in the pollock catch. *Vessel crew are able to remove and discard those animals on the outside of the net as it is being brought aboard, but these numbers are typically not recorded by the vessel observer. Crab PSC delivered to a processing plant are counted and weighed and then discarded.*

Table 3 Pacific Herring PSC in the pollock targets, PTR gear, shoreside sector, BSAI and GOA, 2009-2018

Year	BSAI Herring	GOA Herring
2003	622	12
2004	905	253
2005	508	12
2006	395	9
2007	322	21
2008	33	1
2009	63	8
2010	11	1
2011	238	11
2012	1605	1
2013	191	10
2014	136	5
2015	1106	78
2016	725	147
2017	670	5
2018	422	27
Total	7952	601
Total 2009-2018	5167	293
Avg 2009-2018	516.7	29.3

Source: Mary Furuness, NMFS

Table 4a King, tanner, and opilio crab PSC in the pollock targets, pelagic gear, PTR gear, shoreside sector in GOA, 2009-2018.

Year - GOA	Blue King Crab	Bairdi Tanner Crab	Golden King Crab	Opilio Tanner Crab	Red King Crab	TOTAL
2009	0	54	0	0	0	54
2010	0	31	0	0	0	31
2011	0	0	0	0	0	0
2012	0	372	0	0	0	372
2013	0	1,349	0	0	0	1,349
2014	0	0	0	0	0	0
2015	0	0	0	0	0	0
2016	0	0	51	27	0	78
2017	0	0	0	0	0	0
2018*	0	426	0	0	0	426
Total	0	2,232	51	27	0	2,310
Avg 2009-2018	0	223	5	3	0	231

*Through Oct 27, 2018; Source: NMFS

Table 4b King, tanner, and opilio crab PSC in the pollock targets, pelagic gear, PTR gear, shoreside sector in BSAI, 2009-2018.

Year - BSAI	Blue King Crab	Bairdi Tanner Crab	Golden King Crab	Opilio Tanner Crab	Red King Crab	TOTAL
2009	0	372	0	963	40	1,375
2010	0	521	0	881	20	1,422
2011	0	1,952	0	1,907	0	3,859
2012	0	321	0	536	0	857
2013	0	1,134	0	1,293	0	2,427
2014	0	129	0	546	0	675
2015	0	734	0	0	0	734
2016	0	0	0	0	0	0
2017	0	0	0	0	1	1
2018*	0	638	0	0	9	647
Total	**0**	**5,801**	**0**	**6,126**	**70**	**11,997**
Avg 2009-2018	**0**	**580**	**0**	**613**	**7**	**1,200**

*Through Oct 27, 2018; Source: NMFS

Federal Groundfish MRAs and Problem Species

Many incidental species are encountered by pelagic pollock trawl catcher vessels. The amount of diversity of species shifts from year to year. Furthermore, different incidental species have differing implications, related to MRA restrictions, PSC status, and a variety of other issues. Some examples are described below:

Rockfish (primarily Pacific Ocean Perch, or POP)

Managed as an MRA with an allowable rate of 5% when targeting pollock. In the Bering Sea, POP is most often encountered as a large school that is taken as a cohesive aggregation within a specific portion of the trawl net allowing for ease of sorting at the discretion of the vessel. In the GOA, POP can be in cohesive aggregations as in the BS and thus relatively easy to discard or be incidental catch throughout the haul. However, if the POP taken incidentally is mixed throughout the bag, it makes it extremely difficult to sort and discard this POP catch at sea.

Sablefish

When directed fishing for sablefish is closed, they are managed under an MRA of 1% when targeting pollock. In the GOA, sablefish is always a bycatch species, never open for directed fishing by trawl gear

except when checked into the Rockfish Program. PSC status for sablefish in the GOA is usually triggered by sablefish catch in the non-pollock trawl fisheries, not from incidental catch in the pollock fishery. Until recently, it was uncommon to encounter a high number of sablefish in the pollock fishery but small sablefish have recently been caught in higher numbers in the pollock target due to large recent year classes. In the BS, vessels typically do not receive compensation for sablefish delivered with their pollock due to their small size. In the GOA, vessels have been paid for their incidental catches of sablefish with two caveats: the size is greater than two pounds and the sablefish is of food grade quality. Since the amount of sablefish encountered is minimal and mixed throughout the catch, sorting is difficult and unlikely to occur.

Large Items (primarily salmon sharks and Pacific sleeper sharks)

These occurrences are relatively rare but because of their large size are easily sorted out of the catch and discarded at sea. Sorting is desirable since these large sharks don't easily go down into the tanks and if they do go into the tanks, plug the processor's fish pumps while offloading at the dock.

Forage Fish

Additional incidental species specific to the GOA pollock fishery are forage fish with an MRA of 2%. Forage fish includes eulachon, smelt, and capelin. Forage fish are very small in size, the catch is minimal and mixed throughout the catch making sorting difficult and thus unlikely to occur.

Groundfish When on PSC Status

In the Bering Sea and in the GOA, if and when sablefish goes on PSC status, vessels encountering sablefish are required to slow their fishing operations to remove and discard sablefish from their catch. This slow dumping is challenging as it results in a loss of time and can be dangerous for a vessel and its crew. While sorting, a full bag is typically trailing behind a vessel (due to limited deck space) and has the potential to cause safety and stability issues due to potential rough weather and increased time on deck. Additionally, pollock fish quality is sacrificed since the bag can be in the water for several hours with the fish being rolled around from wave action versus hauled back quickly and dumped into the tanks within 30-60 minutes. If and when POP goes on PSC status, vessels are able to discard POP when in cohesive aggregations or be in a similar situation as sablefish if incidental catches are throughout the haul.

Innovative solutions to the above challenges have been developed in other fisheries. For example, a Council action to require full retention of rockfish species by all fixed gear CVs is scheduled for final action in April 2019. The preferred alternative implements a maximum commerce allowance (MCA) to constrain vessels from increasing rockfish incidental catch under a full retention regulation, while allowing vessel operators to sell most of the rockfish catch that is truly incidental. A system of MCAs or some similar system could be applied in the pollock trawl CV fleets. While incentives are likely different in the pollock trawl CV fleet and the exact same approach may not be tenable for an EM program, MCAs provide an example of an innovative solution to MRA and PSC challenges.

How Did the West Coast Deal with These Challenges in the Whiting Fishery?

[Placeholder for summary document to include:]

A. Regulations before implementation of EM
B. Current discard rules and monitoring requirements with EM in place
C. Effects on vessels and processors
D. Lessons learned that are applicable in the NP

What are the Challenges Associated with Requiring Increased Retention for Vessels and Processors?

[Develop a (living) table of the challenges and where these may be able to best be addressed (through EM/logbook information or regulatory changes)]

Pollock Trip Limits

The most probable change in vessel behavior if the penalty for overages are removed or diminished is for more trips to be at or above the trip limit even if the vessel does not get paid for the overages. This behavior would maximize the value of each trip since each trip would be closer to, at or over the limit. However, it is important to note that pollock delivered over the trip limit is considered illegal catch and would therefore not count towards any future historical catch share program. Processors receive the same economic return for any pollock delivered regardless if the trip is at or below the 300,000 limit - all processed pollock can enter commerce. This may create an economic incentive for processors to encourage vessels to exceed the trip limit. However, when processors are at maximum processing capacity this incentive is removed since vessel rotation and turnaround time is paramount for both the processor's fleet and the processing facility.

Species Management

Requiring increased or full retention of incidental groundfish could potentially result in the TAC/ABC being reached sooner during the course of the fishing year. It could also potentially make staying within a species ABC more challenging which may result in managers taking a more conservative/cautious management approach when deciding on fishery closures.

Inefficiency in Fishing Operations

It generally takes 2-3 tows to fill a Bering Sea pollock catcher vessel and 1-3 tows to fill a GOA pollock vessel. In the GOA, after completion of the first tow and perhaps even during the first tow it can be extremely difficult to be precise about the amount of fish needed to fill the vessel hold to capacity without going over the trip limit. In the BS AFA pollock fishery, vessels have individual pollock allocations so any type of system where some pollock is restricted from being discarded could incentivize vessels to not fill their bags/vessel holds prior to returning to port for delivery. *This would result in vessels having to take extra trips in order to catch their available pollock quota. It could also result in a vessel keeping their overages as partial deckloads when returning to port for delivery.* This is a practice vessels actively try to avoid and want to prevent. In the GOA, which operates as a race for fish, vessels want to maximize each trip meaning they are more likely to bring in deckloads or full cod ends versus coming in with partial trips.

In the Bering Sea, full retention of incidental species such as rockfish equates to a certain percentage of a vessel's capacity not being occupied by pollock, which could result in a loss of revenue for a vessel. Further, not all processing facilities pay a pollock vessel for the rockfish they retain resulting in increased loss of revenue and time. In the GOA POP prices can be equal to or even higher than pollock and most all processors buy and process POP if processing capacity is available.

Enforcement

Enforcement would become easier with a full retention rule but has the potential to become more complicated/difficult with some version of optimized or maximized retention. The EM Committee should work closely with OLE to ensure enforcement issues are addressed early and often in the process of developing recommendations to change existing discard regulations.

Next Steps

The EM Committee requested this White Paper so that it might inform progress on a Cooperative Research Plan for 2019. This paper is intended to be a living document. As such, it will continue to be used to flag areas that will require different regulatory approaches, specific methods (e.g., for logbooks), or shifting incentives. Future additions to this paper may include identifying challenges that emerge during the course of 2019 research projects, and determinations about whether those challenges might be best addressed through a regulatory framework to accommodate a trawl EM program, through the EM program itself, or both.

Appendix B. Data Streams Paper

Data Sources and Their Uses for Pollock Catcher Vessels[6]

November 14, 2018[7]

This document describes the different data sources collected from pollock catcher vessels in the Bering Sea (BS) and Gulf of Alaska (GOA) used to manage groundfish catch, monitor Prohibited Species Catch (PSC) limits, and track incidental take of protected species. These data generally rely on at-sea and shoreside observer data collection as well as landing reports, also known as fish tickets, created by the shoreside processors. Other data sources also exist in this fishery, such as VMS and paper or electronic logbooks, but these data are currently used for compliance monitoring and not for fisheries management. If Electronic Monitoring (EM) is implemented to monitor full retention of salmon PSC, replacement data sources will be needed to manage the fishery. Considerations of other observer data uses such as the collection of biological information and spatial catch information for species are not part of this document.

Currently, the time from when an observer collects data aboard a pollock catcher vessel and when that data is available for inseason management of the fishery or to the cooperative managers varies between two days and on rare occurrences up to a week. If an observer is able to transmit the data electronically when the offload is complete and a landing report is created before the vessel embarks on another trip, the data is available within two to three days. If the observer embarks on another trip prior to receiving the landing report and transmitting the data, the data may not be available for up to a week. An additional delay in the data availability may occur when the shoreside processor has a backlog of vessels to offload, sort, and create landing reports. Because the GOA pollock fishery has shorter seasons and limited catch amounts, inseason management to track catch and close fisheries is essential to fully harvest the fishery. Inseason managers attempt to minimize the delays by working closely with the Observer Program and industry stakeholders to ensure observer data is available as quickly as possible.

The tables at the end of this document describe the type of catch, the data sources uses to determine the amount of that catch, how the data is used, identifies gaps in data if EM is implemented for pollock catcher vessels in the BS and GOA, and explores potential alternative sources of those data gaps. This document aims to provide supporting information for the trawl EM Committee *Cooperative Research Plan for developing an EM program for compliance purposes on pelagic pollock trawl catcher vessels and tenders both delivering to shoreside processors with a defined retention requirement.* This is intended to be a living document, updated at regular intervals throughout the multi-year course of EM development for pelagic pollock catcher vessels.

Delivering to Shoreside Processors in the Bering Sea

All AFA pollock catcher vessels have an observer aboard the vessel for any pollock trip in the BS. Shoreside processors generate landing reports and record all landed groundfish and PSC. At-sea discard estimates are obtained from the observer estimates of discard by species for that trip and other similar trips applied to the landed weight on the landing report. The retained catch from the landing report and the at-sea discard estimates together create the total groundfish catch for that trip. This accrues against several accounts including the AFA inshore sector season allocations and seasonal Stellar sea lion conservation area (SCA) limits.

Shoreside processor observers conduct a census of all salmon at the shoreside processor. For Chinook salmon, these counts accrue against several limits including the season BS pollock trawl PSC limit and

[6] Future paper may include: 1) considerations of other observer data uses (e.g., collection of biological info and spatial catch information) and 2) description of timeliness landscape for data sources, including current turnaround time for data availability
[7] Prepared by Cathy Tide and Jennifer Watson (NMFS)

the season AFA inshore cooperative limit. Census counts of non-chinook salmon are tabulated in the Catch Accounting System (CAS) and monitor Bering Sea and Aleutian Islands (BSAI) trawl PSC, BSAI trawl catcher vessel operation area (CVOA) limit and the Chum salmon savings area.

For halibut PSC, the weight obtained from the vessel observer's samples for a trip extrapolated to the total weight on the landing report is applied to the BSAI halibut PSC limit. A fleetwide mortality rate of 100% is applied to the weight of the halibut.

The weight of herring in the vessel's observer samples for the trip is expanded and a rate is applied to the trip's landing report to obtain the PSC estimate for herring. This accrues against the BSI trawl limit for herring.

Crab numbers in the observer samples for the trip are expanded and a rate is applied to the trip's landing report to obtain the PSC estimate for crab. These numbers accrue against limits in special areas. Crab weights from vessel observer samples are used to monitor overfishing levels. Obtaining crab weights and number is difficult for observers because the crab caught in trawl nets are usually no longer whole crab.

Seabirds found in observer samples at sea are extrapolated and applied to the trip's landing report to estimate counts for each seabird species, if the species can be determined. This information is stored in the CAS and is used to track incidental catch of threatened and endangered seabirds and to compile the Alaska Region's seabird bycatch report.

Marine mammal mortality and serious injury associated with fishing activity are also tracked by the observer. Observers write out a description of the interaction and include information such as date, time, species and condition of the marine mammal. The Marine Mammal Laboratory (MML) obtains target fishery information from trips with a marine mammal mortality or serious injury event from the CAS. Serious injuries are converted to prorated mortalities using a national standardized protocol where the proration value assigned is dependent on the severity of the injury. MML then calculates an annual mortality rate for each marine mammal stock by fishery using the observer data and, where possible, includes estimates where the mortality has been extrapolated to the unobserved portion of the fleet using landings as a metric of effort.

Observers also collect additional biological information about the marine mammal caught and collect specimen data and photographs if possible. This information is provided to MML directly by the Observer Program.

If EM is used to monitor full retention of salmon PSC, replacement data sources will be needed for observer's at-sea samples used to estimate at-sea discard, crab, herring and halibut PSC, and seabird bycatch. Alternative methods to monitor marine mammal mortality or serious injury will need to be determined.

Delivering to Shoreside Processors in the Gulf of Alaska

Pollock catcher vessels in the GOA that deliver to shoreside processors are in the partial coverage category and only have an observer aboard their vessel a portion of their trips. No observers are assigned to shoreside processors in the GOA.

For both observed and unobserved trips, retained groundfish catch is obtained from the shoreside processor's landing report for that trip.

For at-sea discards aboard observed trips the at-sea observer data of that trip and similar observed trips are applied to the landing report to obtain a discard estimate for groundfish species. For unobserved trips, the at-sea discard rate from other observed trips is applied to the vessel's landing report for that trip.

If an observer is aboard when the pollock catcher vessel delivers to a shoreside processor, the observer conducts a census of all salmon found at the shoreside processor. If an observer is unable to complete a census at the shoreside processor for any reason, the observer's at-sea samples are used to determine the salmon PSC rate for that trip. The salmon PSC rate for unobserved trips is derived from other observed trips' census or at-sea observer data and applied to that trip's landing report. For Chinook salmon, the compilation of these estimated counts accrue against annual CGOA or WGOA pollock trawl PSC limits. Estimated counts for non-Chinook salmon are used to monitor GOA trawl catch amounts for each salmon species.

For halibut, herring, crab PSC and seabird bycatch on observed trips, the same methodology described in the previous section is used. For unobserved trips, the PSC rates and discard rates are derived from other observed trips applied to weight from the vessel's landing report for that trip. For crab and herring, these estimated counts and weights are used to monitor catch amounts for these PSC species in the GOA trawl fisheries. For halibut, the estimated weights combined with a fleetwide mortality rate of 100% accrues against the GOA shallow-water complex seasonal trawl PSC limit and annual GOA trawl PSC limit with Rockfish Program catch amounts removed.

Marine mammal mortality or serious injury events on observed trips are recorded in the same manner as described in the previous section. Serious injuries are converted to prorated mortalities using a national standardized protocol where the proration value assigned is dependent on the severity of the injury. MML then calculates an annual mortality rate for each marine mammal stock by fishery using the observer data and, where possible, includes estimates where the mortality has been extrapolated to the unobserved portion of the fleet using landings as a metric of effort.

Delivering to Tender Vessels in the Gulf of Alaska

The tender vessel generates a landing report for each catcher vessel that delivers to it. Since tender vessels do not have extensive sorting areas, bycatch is not recorded on these landing reports. Once the tender delivers the catch from several vessels to a shoreside processor, the shoreside processor generates a landing report for each catcher vessel using the weight generated from the tender vessel's landing report and apportions bycatch encountered during the shoreside delivery. These apportioned landing reports are used to generate the retained catch for each catcher vessel.

The data sources and uses for pollock catcher vessels delivering to tender vessels in the GOA use the same methods as those used for GOA pollock catcher vessels delivering shoreside for at-sea discard estimates, crab, herring, and halibut PSC, seabird bycatch estimates and marine mammal takes.

For salmon bycatch on observed trips, the counts from the observer's at-sea samples for a trip are extrapolated to the total groundfish weight on the landing report to obtain the salmon PSC estimate. For unobserved trips, the observer data from other trips is applied to the landing report to obtain the salmon PSC estimate. For Chinook salmon estimated counts accrue against the annual CGOA or WGOA pollock trawl PSC limit. For non-Chinook, estimated counts are used to monitor annual GOA trawl catch amounts for each salmon species.

If EM is used to monitor full retention of salmon PSC, replacement data sources will need to be found for observer's at-sea samples used to estimate at-sea discard, crab, herring and halibut PSC, and seabird bycatch. Additionally, methods to monitor marine mammal mortality or serious injury events will need to be determined. In the GOA, new methods to obtain salmon PSC rates or census counts will need to be found.

Table 1 AFA Pollock Catcher Vessels

	Observed or Unobserved	Groundfish		Prohibited Species Catch (PSC)		Seabirds Bycatch	Marine Mammals
		Retained Catch	At-Sea Discards	Chinook and Non-Chinook Salmon	Crab, Herring, and Halibut		
Data Sources	Observed	Landing Report	At-sea discard rate from **observer data** from trip and other trips applied to landing report.	**Salmon census** taken during offload by shoreside plant's observer	PSC rate from trip's **observer data** applied to landing report.	At-sea discard rate from trip's **observer data** applied to landing report.	At-sea **observer data** and trip target fishery from CAS catch data
Data Uses	Total groundfish catch (retained + at-sea discard estimates) accrue against accounts. Pollock: BS Pollock TAC - AFA Inshore sector season allocation - Season AFA Inshore cooperative; or - Season AFA open access (OA) sector - Seasonal Stellar sea lion conservation area (SCA) limit - AFA BS Pollock Inshore co-op <99 SCA limit; or - AFA BS Pollock Inshore co-op >99 SCA limit; or - AFA BS Pollock SCA Inshore OA limit Incidental catch of other groundfish species: - Species' BS or BSAI TAC - non-exempt AFA CV sideboard limits			Chinook: Counts accrue against limits. Non-Chinook: Counts used to monitor BSAI trawl PSC, BSAI trawl CVOA limit and the Chum salmon savings area.	Crab: Counts accrue against special area limits for Opilio, Bairdi, and Red King Crab. Weights are used to determine overfishing levels. Herring: Weights accrue against BSAI trawl limited access limit Halibut: Weights with a fleet-wide mortality rate (100%) are applied to BSAI limited access PSC limit	Estimated counts accrue in CAS and track incidental catch of threatened and endangered seabirds.	Estimates mortality/serious injury by fishery converted to prorated mortalities using a national standardized protocol. The proration value assigned is dependent on the severity of the injury.
Data source replacement needed with EM	Observer's at-sea sample and estimated discard rate			Ensuring no salmon are discarded at sea	Observer's at-sea sample	Observer's at-sea sample	Observer's recording of marine mammal mortality/serious injury
Potential solutions for data replacement with EM	*To be completed by EMC*			*To be completed by EMC*	*To be completed by EMC*	*To be completed by EMC*	*To be completed by EMC*

Table 2 GOA Pollock Catcher Vessels Delivering to Shoreside Processors

	Observed or Unobserved	Groundfish		Prohibited Species Catch (PSC)		Seabirds Bycatch	Marine Mammals
		Retained Catch	At-Sea Discards	Chinook and Non-Chinook Salmon	Crab, Herring, and Halibut		
Data Sources	Observed	Landing Report	At-sea discard rate from **observer data** from trip and other trips applied to landing report.	PSC rate from **salmon census** taken during vessel's offload and trip's at-sea **observer data** applied to landing report	PSC rate from trip's **observer data** applied to landing report.	At-sea discard rate from trip's **observer data** applied to landing report.	At-sea **observer data** and trip target fishery from CAS catch data
	Unobserved	Landing Report	At-sea discard rate from **observer data** of other observed trips applied to landing report.	PSC rate from **salmon census** taken during other trip's offloads and other trips' **observer data** applied to landing report.	PSC rate from **observer data** of other trips applied to landing report.	At-sea discard rate from **observer data** of other trips applied to landing report.	N/A
Data Use	Total groundfish catch (retained + at-sea discard estimates) accrue against accounts. Pollock: - WGOA or CGOA area season allocations; or - WYK area apportionment Incidental catch of other groundfish species: - Species' GOA TAC; or - Species' area TAC			Chinook: Estimated counts accrue against annual CGOA or WGOA pollock trawl PSC limit Non-Chinook: Estimated counts used to monitor annual GOA trawl non-Chinook catch amounts	Crab: Estimated counts used to monitor catch amounts for GOA trawl. Estimated weights used to determine overfishing levels. Herring: Estimated counts used to monitor catch amounts for GOA trawl Halibut: Estimated weights with a fleet-wide mortality rate (100%) applied to GOA shallow-water complex seasonal trawl PSC limit and annual GOA trawl PSC limit (minus RPP).	Estimated counts accrue in CAS and track incidental catch of threatened and endangered seabirds.	Estimates mortality/serious injury by fishery. converted to prorated mortalities using a national standardized protocol. The proration value assigned is dependent on the severity of the injury. For unobserved vessels, extrapolated using CAS catch data.
Data source replacement needed with EM	Observer's at-sea sample and estimated discard rate			Ensuring no salmon are discarded at sea and salmon census collection	Observer's at-sea sample	Observer's at-sea sample	Observer's recording of marine mammal mortality/serious injury
Potential solutions for data replacement with EM	*To be completed by EMC*			*To be completed by EMC*	*To be completed by EMC*	*To be completed by EMC*	*To be completed by EMC*

Table 3 GOA Pollock Catcher Vessels Delivering to Tenders

	Observed or Unobserved	Groundfish		Prohibited Species Catch (PSC)		Seabirds Bycatch	Marine Mammals
		Retained Catch	At-Sea Discards	Chinook and Non-Chinook Salmon	Crab, Herring, and Halibut		
Data Sources	Observed	Landing Report	At-sea discard rate from **observer data** from trip and other trips applied to landing report.	PSC rate from trip's **observer data** applied to landing report.		At-sea discard rate from trip's **observer data** applied to landing report.	At-sea **observer data** and trip target fishery from CAS catch data
	Unobserved	Landing Report	At-sea discard rate from **observer data** of other trips applied to landing report.	PSC rate from **observer data** of other trips applied to landing report.		At-sea discard rate from **observer data** of other trips applied to landing report.	N/A
Data Use	Total groundfish catch (retained + at-sea discard estimates) accrue against accounts. Pollock: - WGOA or CGOA area season allocations; or - WYK area apportionment Incidental catch of other groundfish species: - Species' GOA TAC; or - Species' area TAC			Chinook: Estimated counts accrue against annual CGOA or WGOA pollock trawl PSC limit Non-Chinook: Estimated counts used to monitor annual GOA trawl catch amounts	Crab: Estimated counts used to monitor catch amounts for GOA trawl. Estimated weights are used to determine overfishing levels. Herring: Estimated counts used to monitor catch amounts for GOA trawl. Halibut: Estimated weights with a fleet-wide mortality rate (100%) are applied to GOA shallow-water complex seasonal trawl PSC limit and annual GOA trawl PSC limit (minus RPP).	Estimated counts accrue in CAS and track incidental catch of threatened and endangered seabirds.	Estimates mortality/serious injury by fishery. converted to prorated mortalities using a national standardized protocol. The proration value assigned is dependent on the severity of the injury. For unobserved vessels, extrapolated using CAS catch data. Estimates mortality/serious injury by fishery.
Data source replacement needed with EM	Observer's at-sea sample and estimated discard rate			Ensuring no salmon are discarded at sea and observer's at-sea samples	Observer's at-sea sample	Observer's at-sea sample	Observer's recording of marine mammal mortality/serious injury
Potential solutions for data replacement with EM	*To be completed by EMC*			*To be completed by EMC*	*To be completed by EMC*	*To be completed by EMC*	*To be completed by EMC*

Appendix C. Pelagic pollock trawl vessel list

[Placeholder: add distinction for whiting only vessels]

This is a work in progress. The following list presents the number of fisheries in which each vessel participates and highlights in yellow vessel lengths under 60 ft. loa[8] and different vessel configuration types (methods for storing or sorting catch). This list will inform identification of potential pelagic pollock trawl EM program scale, differences between types of fishing configurations, and under 60 ft. vessels that do not currently have a logbook requirement.

Vessel Name	Whiting	Pelagic Pollock GOA	Pelagic Pollock BSAI
Collier Brothers	Yes	Yes	Yes
Leslie Lee	Yes	Yes	Yes
Lisa Melinda	Yes	Yes	Yes
Northern Ram	Yes	Yes	Yes
Pacific Challenger	Yes	Yes	Yes
Pacific Ram	Yes	Yes	Yes
Arctic Ram		Yes	Yes
Arctic Wind		Yes	Yes
Cape Kiwanda		Yes	Yes
Columbia		Yes	Yes
Elizabeth F		Yes	Yes
Excalibur II		Yes	Yes
Gold Rush		Yes	Yes
Half Moon Bay		Yes	Yes
Hickory Wind		Yes	Yes
Majesty		Yes	Yes
Marcy J		Yes	Yes
Miss Sarah		Yes	Yes
Ocean Hope 3		Yes	Yes
Sunset Bay		Yes	Yes
Topaz		Yes	Yes
Vanguard		Yes	Yes
Viking Explorer		Yes	Yes
Walter N		Yes	Yes
Arctic Fury	Yes		Yes
Mark I	Yes		Yes
Miss Berdie	Yes		Yes
Muir Milach	Yes		Yes
Nordic Star	Yes		Yes
Ocean Hunter	Yes		Yes
Raven	Yes		Yes
Seadawn	Yes		Yes
Seeker	Yes		Yes
Traveler	Yes		Yes
Western Dawn	Yes		Yes
Bay Islander	Yes	Yes	
Chellissa	Yes	Yes	
Marathon	Yes	Yes	
Sea Storm	Yes	Yes	
Alaska Rose			Yes
Alaskan Defender			Yes
Aldebaran			Yes
Alsea			Yes
Alyeska			Yes
American Beauty			Yes
American Eagle			Yes
Anita J			Yes
Arctic Explorer			Yes
Arcturus			Yes
Argosy			Yes
Auriga			Yes
Aurora			Yes
Bering Defender			Yes
Bering Rose			Yes
Bristol Explorer			Yes
Caitlin Ann			Yes
Chelsea K			Yes
Commodore			Yes
Defender			Yes
Defender 2			Yes
Destination			Yes
Dominator			Yes
Fierce Allegiance			Yes
Gladiator			Yes
Golden Dawn			Yes
Golden Pisces			Yes
Great Pacific			Yes
Margaret Lyn			Yes
Messiah			Yes
Morning Star 2			Yes
Nordic Fury			Yes
Northern Defender			Yes
Northern Patriot			Yes
Northwest Explorer			Yes
Ocean Explorer			Yes
Ocean Leader			Yes

[8] All the <60ft boats have LOA of 58 ft except Anthem (57 ft) and Karen Evich (59 ft).

Oceanic			Yes
Pacific Explorer			Yes
Pacific Fury			Yes
Pacific Prince			Yes
Pacific Viking			Yes
Patricia L			Yes
Progress			Yes
Providian			Yes
Royal American			Yes
Royal Atlantic			Yes
Sea Wolf			Yes
Sovereignty			Yes
Starfish			Yes
Starlite			Yes
Starward			Yes
Storm Petrel			Yes
Viking			Yes
Westward 1			Yes
Adamant		Yes	
Advancer		Yes	
Alaska Dawn		Yes	
Alaskan		Yes	
Alaskan Lady		Yes	
Anthem		Yes	
Cape Reliant		Yes	
Cape St. Elias		Yes	
Caravelle		Yes	
Celtic		Yes	
Courtney Noral		Yes	
Dawn		Yes	
Decision		Yes	
Enterprise		Yes	
Equinox		Yes	
Evie Grace		Yes	

Heather Margene		Yes	
Icy Mist		Yes	
Just in case		Yes	
Karen Evich		Yes	
Lady Joanne		Yes	
Lady Lee Dawn		Yes	
Laura		Yes	
Mar Del Norte		Yes	
Mar Pacifico		Yes	
Marauder		Yes	
Michelle Renee		Yes	
Miss Courtney Kim		Yes	
Miss Leona		Yes	
New Life		Yes	
Nichole		Yes	
Ocean Storm		Yes	
Pacific Star		Yes	
Pacific Storm		Yes	
Primus		Yes	
Rosella		Yes	
Sea Mac		Yes	
Shawna Rae		Yes	
Stella		Yes	
Temptation		Yes	
Tern		Yes	
Excalibur	Yes		
Grumpy J	Yes		
Jamie Marie	Yes		
Miss Sue	Yes		
Pacific Future	Yes		
Pegasus	Yes		
Perseverance	Yes		
Predator	Yes		
Sea Clipper	Yes		