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North Pacific Observer Program
2018 Annual Report

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Executive Summary

This Annual Report provides information, analysis, and recommendations based on the deployment of observers and Electronic Monitoring (EM) systems by the North Pacific Observer Program (Observer Program) during 2018.

Section 313 of the Magnuson-Stevens Act (16 U.S.C. 1862) authorizes the North Pacific Fishery Management Council (Council), in consultation with National Marine Fisheries Service (NMFS), to prepare a fishery research plan for the purpose of stationing observers and EM systems to collect data necessary for the conservation, management, and scientific understanding of the commercial groundfish and Pacific halibut fisheries of the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) management areas. Observers and EM systems collect fishery-dependent information used to estimate total catch and interactions with protected species. Managers use these data to manage groundfish and prohibited species catch within established limits and to document and reduce fishery interactions with protected resources. Scientists use fishery-dependent data to assess fish stocks, to provide scientific information for fisheries and ecosystem research and fishing fleet behavior, to assess marine mammal interactions with fishing gear, and to assess fishing interactions with habitat.

Each year, the Annual Deployment Plan (ADP) describes the science-driven method for deployment of observers on vessels in the partial coverage category (50 CFR 679.51(a)) in the halibut and groundfish fisheries off Alaska. The following year, the agency provides an Annual Report with descriptive information and scientific evaluation the deployment of observers. The ADP and Annual Report process provides information to assess whether the objectives of the Observer Program have been met and a process to make recommendations to improve implementation of the program to further these objectives.

Program Summary

- Overall, for all federal fisheries off Alaska, 4,423 trips (41.6%) and 492 vessels (45.4%) were monitored by either an observer or EM system in 2018.
- 413 individual observers were trained, briefed, and equipped for deployment to vessels and processing facilities operating in the BSAI and GOA groundfish and halibut fisheries.
- Observers collected data on board 408 fixed gear and trawl vessels and at seven processing facilities for a total of 40,512 observer days (36,729 full coverage days on vessels and in plants; and 3,783 partial coverage days).
- 27 Fisheries Monitoring and Analysis Division (FMA) staff completed 115 debriefings in Anchorage, Alaska; 1 debriefing in Dutch Harbor, Alaska; and 572 debriefings in Seattle, Washington.
- 2018 was the first year that EM was integrated into the Observer Program under regulations. NMFS approved 141 vessels in the 2018 EM selection pool and approved a Vessel Monitoring Plan (VMP) for 134 vessels (the other 7 boats in EM selection pool did not submit a VMP).

- The agency continues to find outreach to be a valuable way to share information with fishery participants, to answer their questions, and to get their input on areas of concern and potential solutions. In 2018, NMFS' outreach efforts occurred in various locations in Seattle, Washington; Alaska, and via telephone. Throughout this year, extensive coordination and collaboration continued between NMFS and the Alaska Seafood Cooperative regarding the management and implementation of the 2018 Exempted Fishing Permit evaluating the feasibility of reducing halibut mortality on designated trawl catcher processor vessels in the Bering Sea. In addition, NMFS provided ongoing outreach and coordination meetings with EM service providers.

Fees, Budget, and Costs

- The expenditures for observer deployment in 2018 in the partial coverage category was $4,425,144 for 3,207 days. These expenditures were made up of $3,742,511 in fee funding received in 2018 (from 2017 landings) and the balance in carryover of funds that had been obligated against the contract in prior years (See Table 2-1).
- Fee billing statements for 2018 were mailed to 102 processors and registered buyers in January 2019 for a total of $3,407,658 in observer fees. (Section 2.1).
- The breakdown in contribution to the 2018 observer fees by species was: 39% Pacific halibut, 35% sablefish, 10% Pacific cod, 13% pollock, and 2% all other groundfish species (Table 2-2).
- In 2018, the average cost per observer sea day in the partial coverage category was $1,380 (based on the cost of $4,425,144 to procure 3,207 observer days) (Section 2.3.2).
- In 2018, the average cost per EM sea day in the partial coverage category was between $956 and $1,527 per day depending on amortization schedules for hardware.

Deployment Performance Review

A review of the deployment of observers and EM in 2018 relative to the intended sampling plan and goals of the Observer Program is provided in Chapter 3. A set of performance metrics was used to assess the efficiency and effectiveness of observer deployment, with emphasis on the partial coverage category. These metrics provide a method to evaluate the quality of data being collected under the restructured Observer Program. The metrics fall into three broad categories:

- **Deployment Rate Metrics** that evaluated whether achieved sample rates were consistent with intended sample rates (i.e., did we get the coverage rates that we planned to get).
- **Sample Frame Metrics** that quantify differences between the population for which estimates are being made and the sample from which those estimates are derived (i.e., were the trips and vessels that we sampled similar to the rest of the fleet). If the trips and vessels that are sampled (the sample population) are not "representative" of the entire fleet (the whole population), it can result in incorrect conclusions being drawn about the population based on the sample.
- **Sample Size Metrics** analysis to determine whether enough samples were collected to ensure adequate spatial and temporal coverage.

Did We Meet Anticipated Deployment Goals?

Effort Predictions

Based on simulations of 2017 fishing data that were completed for the final 2018 ADP, NMFS expected to observe 4,394 fishing days in 2018. The actual number of observer days in 2018 was 3,207, which was 27% lower than predicted. This over-prediction of effort was especially impacted due to over-prediction of effort in the trawl strata, which is a large strata and has relatively high selection rates (Table 3-1).

Observer Declare and Deploy System (ODDS) Performance

Random selection of trips in the trip selection stratum is facilitated by the ODDS. Users of the system are given flexibility to accommodate their fishing operations; up to three trips may be logged in advance of fishing and trips can be cancelled to accommodate changing plans.

- Logged trips can be either closed (marked as complete) or cancelled. Of the 5,734 total trips logged, 1,125 were selected, and 179 were cancelled: two by ODDS (0.18%) and 177 by users (15.7%). The cancellation rate for selected trips ranged from 3.8% for in the EM hook-and-line stratum to 37.5% for Trawl Tender stratum.
- If a trip is selected for observer coverage and cancelled, then the vessel's next logged trip is automatically selected for coverage. The "inherited" trips impact selection rates and means that final selection rates were greater expected. As the result of the inherit process, selected trips are being delayed and there is a greater number of selected trips later in the year (Section 3.6.2).

Evaluation of At-sea Deployment

- There were 11 deployment strata evaluated in 2018, including one full coverage stratum, two zero coverage strata, and eight partial coverage strata: five strata defined by gear and tender designation, one regulated EM stratum (where data were used for inseason management), and two pre-implementation EM strata for pot vessels (Section 3.6.3).
- Coverage rates met expected values in the full coverage and five of the eight partial coverage strata. Rates were higher than expected tender trawl strata (Table 3-5) and NMFS is investigating if this is a result of the inherit process in ODDS.
- Rates were lower than expected in the hook-and-line stratum. This was the first year in which the coverage rates for trip-selected partial coverage strata were lower than expected rates.
- The EM hook-and-line stratum had realized coverage rates lower than expected, based on the number of trips where video was reviewed or partially reviewed. However, not all 2018 video was reviewed; at the end of 2018, there were 62 hard drives that had not yet been reviewed and NMFS requested PSMFC prioritize review of 2019 instead finishing the remaining trips from 2018.

A summary of the number of vessels and trips in each strata and realized coverage rates in 2018 are as follows:

Coverage category	Strata	Total vessels	Total trips	Sampled trips	Expected coverage rate	Realized coverage rate	Met expectations? *
Full coverage	Full	159	3,400	3,400	100.0	100.0	Yes
Partial coverage	Hook-and-Line	364	1,990	309	17.3	15.5	No, lower than expected
	Pot	73	626	97	15.5	12.7	Yes
	Tender Pot	15	31	9	17.4	29.0	Yes
	Trawl	76	1,864	378	20.2	20.3	Yes
	Tender Trawl	18	40	14	16.7	35.0	Higher than expected
	EM Hook-and-Line	120	767	174	30.0	22.7	Lower than expected, but not all EM trips were reviewed
	EM Pot	17	163	41**	30.0	25.2**	Yes
	EM Tender Pot	1	1	1**	30.0	100.0**	Yes
No selection	Zero Coverage	361	1,725	0	0.0	0.0	Yes
	Zero Coverage-EM Research	3	23	0	0.0	0.0	Yes

*Coverage levels were within the 95% confidence intervals of the expected value.

**Values for sampled trips and realized coverage for EM Pot strata are based on EM hard drives received, not actual data reviewed.

Dockside Monitoring

The sampling design used for dockside monitoring in 2018 remained unchanged from previous years. All vessels participating in the BSAI Pollock fisheries are in the full coverage category and dedicated plant observers monitor all deliveries to account for salmon bycatch. In the GOA, all Pollock trawl catcher vessels are in the partial coverage category and observers deployed on selected trips monitor the delivery at the shoreside processors to obtain counts of salmon caught as bycatch within the trawl Pollock fishery and to obtain tissue samples to enable stock of origin to be determined using genetic techniques. When an observed trawl vessel in the GOA delivers its Pollock catch to a tender vessel instead of a shoreside processor, the observer is unable to monitor the delivery and collect additional tissue samples. In this situation, the trip would be monitored, but there is no offload monitoring.

A total of 2,310 Pollock deliveries to shoreside processors were monitored for salmon in 2018. Of those, 2,030 occurred in ports in the Bering Sea and 280 occurred in ports in the Gulf of Alaska (Table 3-7).

Was the Coverage Representative?

Temporal Patterns

Section 3.7.1 evaluated the possibility for temporal bias in each observed stratum. Overall, there appeared to be less temporal bias in 2018 than in 2017. At the end of the year, the number of observed trips achieved in 2018 was not outside of the expected number in the pot, tender pot, and trawl strata (Figure 3-3). However, the number of observed trips was outside of 95% confidence intervals in three of the six partial coverage strata: EM hook-and-line (for 25.8% of the year); hook-and-line (for 23.8% of the year); and tender trawl (for 33.2% of the year). In the case of the tender trawl stratum, the observation rate was greater than expected and this likely a result of the ODDS inherit process, where selected trips were delayed creating a greater number of selected trips later in the year. In the EM hook-and-line stratum, the temporal bias was a result of hard drives that were received but unable to be reviewed due to a backlog at the end of the year.

Spatial Representativeness

Section 3.7.2 evaluated the spatial distribution of observed trips to determine if they reflect the spatial distribution of all trips. The expected number of trips was compared with the observed number of trips in each NMFS Reporting Area and stratum combination (Figure 3-4). Overall, the magnitude of the spatial clustering of observed trips was low and does not indicate a large source of bias for the 2018 deployment. In most cases, the sampling result is close to the expected result; larger differences tend to be associated with lower numbers of trips within a NMFS Area.

Trip Metrics

Section examined six trip metrics including the following: the number of NMFS areas visited in a trip, trip duration (days), the weight of the landed catch (in metric tons[mt]), the vessel length (m), the number of species in the landed catch, and the proportion (0 to 1) of the landed catch that was due to the most predominant species (pMax). The trip metrics were used to evaluate observer effects to determine if observed trips are similar to unobserved trips (Table 3-9):

- In the EM hook-and-line stratum, one metric had low p-value; observed trips in this stratum landed 9.7% (0.4) more species than unobserved trips.
- In the hook-and-line stratum, two metrics had low p-values; observed trips were 14.3% (0.8 days) shorter in duration and had 15.6% (1.0 mt) less landed catch than unobserved trips.
- In the pot stratum, one had a low p-value: observed trips landed 14.3% (0.3) more species than unobserved trips.

- In the trawl stratum, two metrics had low p-values; observed trips in this stratum occurred in 3% (0.0) fewer areas and were 9.4% (0.3 days) shorter in duration than unobserved trips.

In most cases the effect size of the metrics with low p-values is small. However, an evaluation has not been conducted to relate these metrics to at-sea information to determine if the magnitude of the differences (the effect size) are meaningful in the context of the overall data.

Was There an Adequate Sample Size?

In a well-designed sampling program, the observer coverage rate should be large enough to reasonably ensure that the range of fishing activities and characteristics are represented in the sample data. The Catch Accounting System (CAS) post-stratifies data into groups of fishing activities with similar trip characteristics such as gear, trip targets, and NMFS Area (Cahalan et al. 2014). At low numbers of trips and low sampling rates, the probability of no observer data within a particular post-stratum is increased and may result in expansions of bycatch rates from one type of fishing activity against landings for a different type of fishing activity. This will result in biased estimates of bycatch. For this reason, it is important to have a large enough sample (observed trips and vessels) to have reasonable expectation of observing all types of fishing.

The results in 2018 were similar to previous years and illustrated that 1) the likelihood of at least one observation is increased with fishing effort and 2) is also increased with an increase in the selection rate (Figure 3-13). Given the 2018 sampling rates for the six partial coverage trip-selection strata, the probability of having no observed trips in a NMFS Reporting Areas increases quickly above 0.05 when there are fewer trips in a given stratum and area than the following:

- 11 trips in the EM hook-and-line stratum.
- 18 trips in the hook-and-line stratum.
- 17 trips in the pot stratum.
- 7 trips in the tender pot stratum.
- 13 trips in either the trawl stratum.
- 6 trips in the tender trawl stratum.

Compliance and Enforcement

The Office of Law Enforcement, Alaska Division (AKD), works closely with the U.S. Coast Guard (USCG), Alaska Wildlife Troopers (AWT), industry, Observer Program, and observer providers to address incidents that affect observers and observer work environments, safety, and sampling. In 2018, AKD received 898 statements filed by observers. Each statement is evaluated and prioritized, and most are forwarded for investigation. AKD also utilizes observer statements to track compliance trends. Trend analysis helps focus and prioritize enforcement efforts, outreach, education, and compliance assistance.

NMFS Recommendations for the 2020 ADP

Trip-selection Pool

- NMFS recommends that the observer trip selection strata based on gear (trawl, hook-and-line, and pot) which were implemented in 2016 remain the same for 2020. This follows the Observer Science Committee (OSC) and the NPFMC Scientific and Statistical Committee (SSC) recommendation to try to stabilize the sampling design across years.
- NMFS agrees with the OSC recommendation that the draft 2020 ADP include a re-examination of tendering strata (tender pot and tender trawl). This could be accomplished in a variety of ways and should not be limited to eliminating tendering strata altogether nor holding selection rates the same between tendered and non-tendered strata within a gear type.
- NMFS continues to recommend maintaining a single trawl gear stratum (i.e., non-pelagic trawl (NPT) and pelagic trawl (PTR) in a single stratum). NMFS supports the focus of the Council's Electronic Monitoring Committee to expand EM applications to monitor pelagic trawl vessels and tenders, complemented by shoreside observers.
- Within budget constraints, NMFS recommends continuing to allocate observer deployment using a 15% hurdle plus optimization based on discarded groundfish, Pacific halibut PSC, and Chinook salmon PSC. This allocation strategy provides a balance between minimizing the variability of discard estimates, prioritization of PSC-limited fisheries, and the need to reduce gaps in observer coverage in the partial coverage category.

ODDS

- Chapter 3 of this report (and previous Annual Reports) highlight several consequences of differential cancellation rates that were observed in ODDS including a temporal bias in the tender trawl stratum. NMFS recommends modifying ODDS to reduce the impact of inherited trips while allowing flexibility to the fleet and accommodate changes to fishing plans.
- NMFS also recommends continuing to automatically release vessels 40-57.5 ft in length from observer coverage if the two previous trips were observed trips (i.e., if two trips in a row were observed and a third trip is selected, then the third trip will be released from coverage).

Performance Metrics

In the 2017 Annual Report, NMFS recommended evaluating the suite of trip metrics that are used in Chapter 3 to evaluate an observer effect. Recognizing that this analysis competes with other priorities for analytical staff time, NMFS recommends adding an item to 'Explore alternative approaches to evaluate observer effects' to the list of analytical priorities related to the Observer Program that is reviewed by the Council during staff tasking.

EM Selection Pool

- NMFS recommends continuing trip-selection in the EM pool where trips will be selected prior to departure, so the vessel will only be required to use the EM system on selected trips.
- The number of vessels allocated to the EM selection pool will be based on analysis of EM costs and the amount of available funding that is available. If there are insufficient funds to support all the vessels that opt into the EM selection pool, NMFS recommends that priority be given to 1) vessels that are already equipped with EM systems and 2) vessels 40-57.5 ft length overall (LOA) where carrying a human observer has been problematic due to bunk space or life raft limitations.
- We recommend that EM review rates are set to ensure that the entire year is sampled and review is timely enough so that data from EM can be used for catch accounting and fisheries monitoring as envisioned by the Council.

Dockside Monitoring and Tendering

- NMFS supports the EM Committee's priority to test and evaluate longer-term solutions for monitoring salmon bycatch in the trawl fisheries, including using EM on tender vessels to enable shoreside data collection from these deliveries.
- In 2020, NMFS recommends maintaining the status quo for dockside monitoring. An Exempted Fishing Permit for EM-approaches in the pelagic trawl catcher vessel Pollock fishery may require NMFS to re-assess this recommendation and increase shoreside monitoring to complement expanded EM tests in 2020.

No Selection Pool

Recognizing the challenging logistics of putting observers on small vessels, NMFS recommends maintaining status quo and placing vessels less than 40 ft in the no selection pool for observer coverage. However, since there is no monitoring data from this segment of the fleet, NMFS does continue to recommend that vessels less than 40 ft LOA could be considered for the EM selection pool in the future. The agency recognizes that the Council's priority for EM research is on trawl vessels, so the evaluation of data collected on fixed-gear less than 40 ft will not begin immediately

1. Introduction

This annual report provides information, analysis, and recommendations based on deployment of observers and Electronic Monitoring (EM) systems under the North Pacific Observer Program (Observer Program) during 2018. Section 313 of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1862) authorizes the North Pacific Fishery Management Council (Council), in consultation with National Marine Fisheries Service (NMFS), to prepare a fishery research plan for the purpose of stationing observers and EM systems to collect data necessary for the conservation, management, and scientific understanding of the commercial groundfish and Pacific halibut fisheries of the Bering Sea and Aleutian Islands (BSAI) and Gulf of Alaska (GOA) management areas. Observers and EM systems collect fishery-dependent information used to estimate total catch and interactions with protected species. Managers use these data to manage groundfish and prohibited species catch within established limits and to document and reduce fishery interactions with protected species. Scientists use fishery-dependent data to assess fish stocks, provide data for fisheries and ecosystem research and fishing fleet behavior, assess marine mammal interactions with fishing gear, and characterize fishing impacts on habitat.

All vessels and processors that participate in federally managed or parallel groundfish and halibut fisheries off Alaska (except catcher vessels delivering unsorted codends to a mothership) are assigned to one of two categories: 1) the full observer coverage category (full coverage), or 2) the partial observer coverage category (partial coverage). Vessels and processors in the full coverage category have at least one observer present during all fishing or processing activity. Vessels and Processors in the partial coverage category are assigned observer or EM coverage according to the scientific sampling plan described in the Annual Deployment Plan (ADP) developed by NMFS in consultation with the Council. Since 2013, observers have been deployed in the partial coverage category using established random sampling methods to collect data on a statistically reliable sample of fishing vessels in the partial coverage category. Some vessels and processors may be in full coverage for part of the year and partial coverage at other times of the year depending on the observer coverage requirements for specific fisheries.

Observer coverage in the full coverage category is industry-funded through a pay-as-you-go system whereby fishing vessels procure observer services through NMFS-permitted observer service providers. Observer coverage in the partial coverage category is funded through a system of fees based on the ex-vessel value of groundfish and Pacific halibut. On 8 August 2017, NMFS published a final rule to integrate EM into the Observer Program (82 FR 36991). Beginning in 2019, NMFS plans to use a portion of the fees collected under Section 313 of the Magnuson-Stevens Act to deploy EM systems on vessels in the EM selection pool of the partial coverage category. The observer fee is assessed on landings by vessels not included in the full coverage category. The system of fees fairly and equitably distributes the cost of observer coverage among all vessels and processors in the partial coverage category.

The following regulatory and Fishery Management Plan (FMP) amendments have been implemented since 2013 to make specific modifications to observer coverage requirements under the Observer Program:

- BSAI Amendment 112 and GOA Amendment 102 revised observer coverage requirements catcher/processors (81 FR 17403, 29 March 2016). This rule allowed small, non-trawl catcher/processor that met specific criteria to choose to be in the partial observer coverage category. Effective 29 March 2016.
- BSAI Amendment 109 revised observer coverage requirements and placed catcher vessels less than or equal to 46 ft LOA when groundfish fishing under a Community Development Quota (CDQ) into the partial coverage category (81 FR 26738, 4 May 2016). Effective 3 June 2016.
- A regulatory amendment (81 FR 67113, 30 September 2016) revised observer coverage requirements for BSAI trawl catcher vessels and allows the owner of a trawl catcher vessel to request, on an annual basis, placement in the full observer coverage category for all directed fishing for groundfish using trawl gear in the BSAI for 1 year. Effective 31 October 2016.
- BSAI Amendment 114 and GOA Amendment 104 integrated EM into the North Pacific Observer Program (82 FR 36991, 7 September 2017). The rule established a process for owners or operators of vessels using non-trawl gear to request to participate in the EM selection pool and the requirements for vessel owners or operators while in the EM selection pool.

1.1. Observer Coverage Categories and Coverage Levels

1.1.1. Full Coverage

Vessels and processors in the full observer coverage category must comply with observer coverage requirements at all times when fish are harvested or processed. Specific requirements are defined in regulation at 50 CFR § 679.51(a) (2). The full coverage category includes the following:

- Catcher/processors (with limited exceptions).
- Motherships.
- Catcher vessels participating in programs that have transferable prohibited species catch (PSC) allocations as part of a catch share program.
- Catcher vessels using trawl gear that have requested placement in the full coverage category for all fishing activity in the BSAI for 1 year; and
- Inshore processors receiving or processing Bering Sea Pollock.

Independent estimates of catch, at-sea discards, and PSC -- among other data -- are collected aboard all catcher/processors and motherships in the full observer coverage category. Requiring at least one observer on every catcher/processor means that at-sea discards and PSC estimates are not based on self-reported data or extrapolated observer data from other vessels. Catcher vessels participating in programs with transferable PSC allocations as part of a catch share program also are included in the full coverage category. These programs include Bering Sea Pollock (both American Fisheries Act and CDQ programs), the groundfish CDQ fisheries (CDQ fisheries other than Pacific halibut and fixed gear sablefish), and the Central GOA Rockfish Program.

Independent observer data are important under these catch share programs because quota share recipients are prohibited from exceeding any allocation, including, in many cases, transferable PSC allocations. Allocations of exclusive harvest privileges can create increased incentive to misreport as compared to open-access or limited-access fisheries. Transferable PSC allocations also present challenges for accurate accounting because these species are not retained for sale and they represent a potentially costly limitation on the full harvest of the target species. To enforce a prohibition against exceeding a transferable target species or PSC allocation, NMFS must demonstrate that the quota holder had catch that exceeded the allocation. Supporting a quota overage case for target species or PSC that could be discarded at sea from an unobserved vessel requires NMFS to rely on either industry reports or estimated catch based on discard rates from other similar observed vessels. These indirect data sources create additional challenges to NMFS in an enforcement action. In addition, the smaller the pool from which to draw similar observed vessels and trips, the more difficult it is to construct representative at-sea discard and PSC rates for individual unobserved vessels.

Inshore processors receiving deliveries of Bering Sea Pollock are in the full coverage category because of the need to monitor and count salmon under transferable PSC allocations.

1.1.2. Partial Coverage

The partial observer coverage category includes the following:

- Catcher vessels designated on a Federal Fisheries Permit when directed fishing for groundfish in federally managed or parallel fisheries, except those in the full coverage category.
- Catcher vessels when fishing for Halibut individual fishing quota (IFQ) or Sablefish IFQ (there are no PSC limits for these fisheries).
- Catcher vessels when fishing for Halibut CDQ, fixed-gear Sablefish CDQ, or groundfish CDQ using pot or jig gear; or catcher vessels less than or equal to 46 ft LOA using hook-and-line gear fishing for groundfish.;
- Catcher/processors that meet criteria that allows assignment to the partial coverage category.
- Shoreside or stationary floating processors, except those in the full coverage category.

Each year, the ADP describes the science-driven method for deployment of observers on vessels in the partial coverage category (50 CFR 679.51(a)) in the Pacific halibut and groundfish fisheries off Alaska. The 2018 ADP (NMFS 2017b) is summarized in Section 1.3.

1.2. Annual Planning and Reporting Process

Amendments 86/76 established an annual process of 1) developing an ADP that describes plans and goals for observer deployment in the partial coverage category in the upcoming year, and 2) preparing an annual report providing information and evaluating performance in the prior year.

The Annual Deployment Plan (ADP) describes how observer coverage and EM will be assigned to vessels and processors in the partial observer coverage category in the upcoming year. NMFS develops each ADP in consultation with the Council after reviewing an evaluation of deployment performance for the previous year. NMFS and the Council created the ADP process to provide

flexibility in the deployment of observers and EM to gather reliable data for estimation of catch in the groundfish and halibut fisheries off Alaska. The ADP process ensures that the best available information is used to evaluate deployment, including scientific review and Council input, to annually determine deployment methods. The 2018 ADP is summarized in Section 1.3 of this report.

The Annual Report provides descriptive information, analysis, and recommendations based on observer deployment in the previous year. An important component of the annual report is Chapter 3, the "deployment performance review" chapter, which statistically evaluates the deployment of observers and EM in the previous year. The purpose of the deployment performance review is to evaluate whether observer deployment and monitoring goals detailed in regulation and the ADP were achieved and to identify recommendations for observer deployment in order to promote the collection of data necessary to conserve and manage the groundfish and halibut fisheries. The annual report is an important source of information in developing the proposed ADP for the next year and informing potential regulatory changes to the Observer Program.

The annual planning and reporting process is described below:

- **February – May**: NMFS staff compile the annual report for the previous year. Chapter 3 (the deployment performance review) is prepared by the Observer Science Committee, which is described in more detail in Chapter 3.
- **May – June**: NMFS presents the annual report to the Council (including the Council's Monitoring Committee, Advisory Panel, and Scientific and Statistical Committee) and to the public. The Council may recommend adjustments to observer deployment to prioritize data collection based on conservation and management needs. The Council and public provide input to NMFS on the annual report. This input may be factored into the draft ADP, the next annual report, or other reports or analyses for the Council.
- **June – August**: Using information from the prior year's annual report and Council recommendations, NMFS prepares a draft ADP for the upcoming year.
- **September**: NMFS releases the draft ADP in early September each year to allow review by the Groundfish and Crab Plan Teams. The Council's Monitoring Committee also reviews the draft ADP prior to the Council's October meeting and provides written recommendations to the Council.
- **October**: The Council and its Advisory Panel and Scientific and Statistical Committee review the analysis used to prepare the draft ADP as well as Plan Team and Monitoring Committee recommendations and any input from the public. NMFS reviews and considers comments made by the Council and its committees, however extensive revisions to the analysis used to prepare the draft ADP are not feasible between October and December.
- **December**: NMFS finalizes the ADP by computing the selection rates for the upcoming year using a refined estimate of the total budget and expected fishing effort. Ideally the final ADP will be released to the public prior to the December Council meeting. NMFS also evaluates whether the Environmental Assessment (EA) prepared for Observer

Program Restructuring (NPFMC 2011) needs to be supplemented for the ADP. In 2014, NMFS prepared a Supplementary Information Report explaining why the EA did not need to be supplemented. In 2015, NMFS prepared a Supplemental Environmental Assessment (NMFS 2015c) in response to a Court Order to consider whether the restructured Observer Program would yield reliable, high-quality data given likely variations in costs and revenues.

1.3. Summary of the 2018 Annual Deployment Plan

The 2018 ADP outlined the sampling plan for 2018 (NMFS 2017b). The most important goal of the ADP is to randomize observer deployment in the partial coverage category. Sampling that incorporates randomization is desirable at all levels of the sampling design because 1) sampling theory dictates that randomization at all levels allows for unbiased estimation, and 2) sampling is generally preferential over a census because it is more cost-efficient, is less prone to bias than an imperfectly implemented census (one subject to logistical constraints), and can result in greater data quality (Cochran 1977).

Since 2008 the Observer Program has employed a hierarchical (nested) sampling design (Cahalan et al. 2014). Starting in 2013, randomization of samples occurs at all levels of sampling. The ADP sets forth the sampling plan with the goal of randomization of observer deployment at the first level of the sampling design — the trip or vessel level. Since 2017, trip-selection has been the sole method to deploy observers into the fishery. The other sampling levels, including sampling the haul (or set) for species composition, and sampling individual fish to collect lengths, weights, and tissue samples, are achieved through observer sampling methods described in the observer sampling manual (AFSC 2017).

Stratified random sampling, such as is described in the ADP, requires that sample units (such as trips), be assigned to a single stratum and that within a stratum a single sampling design and estimation process is used. Hence, the partial coverage strata are separate from each other and separate from the full coverage stratum and estimation calculations will reflect this. By definition, each trip must be assigned to a stratum before any fishing occurs, the probability of selection must be based on the stratum, and this probability must be known for all observed and unobserved trips.

In their 9 June 2017 motion, the Council recommended that the 2018 ADP continue deploying partial coverage observers into strata that are defined by gear type. The Council recommended that the 2018 ADP evaluate whether or not to separate gear-based strata by tender status. The 2018 ADP ultimately allocated observer effort to at-sea deployments on trips belonging to five strata that were defined by gear type and tender delivery status (Table 1-1). In contrast to 2017, there was one hook-and-line stratum for observers in 2018 that contained both tendered and non-tendered trips.

In 2018, EM was integrated into the North Pacific Observer Program under a regulated program and NMFS approved the 141 eligible vessels in the EM selection pool. The EM data from hook-and-line vessels were incorporated into the CAS and used for management in 2018. In contrast,

the EM data from pot vessels was still in "pre-implementation" while NMFS developed the methods to use the EM pot data in catch estimation.

To determine the 2018 selection rates for observed strata, NMFS used an anticipated budget of 4,394 days as the basis for generating cost estimates under a variety of sampling rates, stratification schemes, and optimization targets (NMFS 2017b). NMFS and the Council supported a five strata design for observers, with an optimal allocation strategy based on discarded groundfish and halibut and Chinook PSC (NMFS 2017b).

The selection rates described in the 2018 ADP and programmed into the Observer Declare and Deploy System (ODDS) application were as follows:

- No selection (*zero coverage*) – 0%.
- Electronic Monitoring (*EM*) – 30%.
- Trawl (*TRW – No Tender*) – 20%.
- Hook-and-line (*HAL*) – 17%.
- Pot (*POT – No Tender*) – 16%.
- Tender trawl (*TRW - Tender*) – 17%.
- Tender pot (*POT - Tender*) – 17%.

Evaluation of deployment in each strata is described in Chapter 3 (note that the strata naming convention utilized in Chapter 3 is listed above in italics).

As in 2017, NMFS did not grant conditional releases in 2018 because of the expanded opportunity for vessels to participate in the EM selection pool with no requirement to carry an observer. The ODDS continued to automatically release a trip from observer coverage for vessels 40-57.5 ft length overall (LOA) if the two previous trips were observed trips, (i.e., two trips in a row were observed, resulting in the third trip being released from coverage).

Under regulations published in 2016, 34 catcher vessels were placed in the full coverage category for all directed fishing for groundfish using trawl gear in the Bering Sea and Aleutian Islands management area (BSAI) for the 2017 calendar year.

1.4. Changes Since the 2018 ADP

Although the focus of this Annual Report is on performance in 2018, changes have been made to the partial observer coverage sampling plan that are being implemented in 2018 (Table 1-1). Here we provide a summary of the changes that have been made since the 2018 ADP.

Notable changes to observer deployment on vessels in the partial coverage category for 2019 include the expansion of the EM selection pool. Based on recommendations from the Council in June 2018, NMFS evaluated allocation strategies in the draft 2019 ADP (NMFS 2018b). NMFS ultimately adopted the following stratification scheme with sample sizes allocated according to the 15% plus optimization based on discarded groundfish, Pacific halibut, and Chinook salmon for the 2019 ADP (NMFS 2018a):

- No selection – 0%.
- EM – 30%.
- Trawl – 24%.
- Hook-and-line – 18%.
- Pot – 15%.
- Tender trawl – 27%.
- Tender pot – 16%.

The definition of the "no selection pool" in 2019 is similar to that used in starting in 2015 and includes fixed-gear vessels less than 40 ft LOA, all vessels fishing with jig gear (which includes handline, jig, troll, and dinglebar troll gear), and vessels participating in the NMFS-sponsored EM research and development (R&D). Three vessels volunteered to carry R&D stereo camera equipment and were also included in the no selection pool.

EM deployment in 2019 continues to be funded through a combination of federal funding and additional sources such as from the National Fish and Wildlife Foundation. NMFS placed 168 vessels in the EM selection pool for 2019.

Table 1-1. -- Sampling strata and selection pools in the partial coverage category from 2013 to the present. The partial coverage selection rates set through the Annual Deployment Plan since 2013 are noted and the realized coverage rates evaluated in the Annual Report are noted in parentheses. CP = catcher/processor vessel; CV = catcher vessel; H&L = hook-and-line gear; LOA = vessel length overall.

<table>
<tr><th>Year</th><th colspan="6">Observer trip selection pool
Observer coverage required on all randomly selected trips</th><th colspan="2">EM trip selection pool
EM required on randomly selected trips</th><th>Observer vessel selection pool</th><th colspan="2">No selection pool
Observer coverage not required</th></tr>
<tr><td>2019</td><td>Trawl: 24%</td><td>Trawl Tender: 27%</td><td>H&L: 18%</td><td>Pot: 15%</td><td>Tender Pot: 16%</td><td colspan="2">Fixed gear EM: 30%</td><td rowspan="5">n/a</td><td colspan="2" rowspan="6">Vessels <40’ LOA and Jig gear</td></tr>
<tr><td>2018</td><td>Trawl: 20% (20.3)</td><td>Trawl Tender: 17% (35.0)</td><td>H&L: 17% (15.5)</td><td>Pot: 16% (15.5)</td><td>Tender Pot: 17% (29.0)</td><td>H&L EM: 30%</td><td>Pot EM Pre-implementation: 30%</td><td>EM Innovation Research 4 vessels</td></tr>
<tr><td>2017</td><td>Trawl: 18% (20.7)</td><td>Trawl Tender: 14% (18.8)</td><td>H&L: 11% (12.0)</td><td>H&L Tender: 25% (0)</td><td>Pot: 4% (7.7)</td><td>Pot Tender: 4% (5.3)</td><td colspan="2" rowspan="4">n/a</td><td>Voluntary EM Pre-implementation ~90 vessels</td></tr>
<tr><td>2016</td><td colspan="3">Trawl: 28% (28.0)</td><td colspan="2">H&L: 15% (15.0)</td><td>Pot: 15% (14.7)</td><td>Voluntary EM Pre-implementation 60 vessels</td></tr>
<tr><td>2015</td><td colspan="3">Large Vessel: 24% (23.4)
Trawl CVs, Small CPs, H&L/Pot CVs ≥ 57.5’</td><td colspan="3">Small Vessel: 12% (11.2)
H&L/Pot CVs >40’ and <57.5’</td><td>Voluntary EM Pre-implementation 12 vessels</td></tr>
<tr><td>2014</td><td colspan="6">All Trawl CVs and H&L/Pot vessels ≥ 57.5’: 16% (15.1)</td><td>H&L/Pot CVs >40’ and <57.5’: 12% (15.6)</td><td>Voluntary EM</td></tr>
<tr><td>2013</td><td colspan="6">All Trawl CVs and H&L/Pot vessels ≥ 57.5’: 14.5% (14.8)</td><td colspan="2">H&L/Pot CVs >40’ and <57.5’: 11% (10.6)</td><td colspan="2">Vessels <40’ LOA and Jig gear</td></tr>
</table>

2. Fees and Budget

2.1. Budget for Partial Coverage Category in 2018

Section 313(d) of the Magnuson-Stevens Act authorizes the creation of the North Pacific Fishery Observer Fund ("Observer Fund") within the U.S. Treasury. This was the sixth year that fees were collected from the partial coverage fleet. The following section provides information on the amount of fees that accrued on landings made in 2018 that are anticipated to be collected in 2019, as well as the amount of fees collected in 2018 that were obligated to the partial coverage contract to pay for sea days in 2018.

Fee billing statements for 2018 were mailed to 102 processors and registered buyers in January 2019. All but five bills were paid in full by 15 February 2019. A total of $3,407,658 in observer fees will be collected once all bills are paid. At the time of this publication, two processors had not yet paid observer fees totaling $2,679. In order to collect delinquent fees, four 30-day notices were mailed in March. Additional notices will be mailed as needed. Processors or registered buyers submitting late fee payments were charged an administrative fee of $25 plus interest on the observer fees with each notice.

The sequestration of funds initiated under the 2011 Budget Control Act continues to affect the Observer Fund. Each year, the Observer Fund is subject to sequestration, meaning a percentage of the fee revenue is held in the Fund. However, each year we also receive the sequestered funds from the previous year.

A total authorized transfer from the Observer Fund of $3,742,510 was made to the Alaska Fisheries Science Center (AFSC) to be used to support the final option of the observer deployment contract in fiscal year 2018 from 17 June 2018 to 16 June 2019.

In fiscal year 2018, no additional federal funds were obligated to the observer contract, but we were able to carryover some federal funds to support this need in fiscal year 2019 (Table 2-1). While 2019 contract obligations are outside the time scope of this report, they are included to show the carryover into 2019 fishing year which is encompassed by the final option year of the contract.

Table 2-1. -- Summary of the fees and Federal funding for partial coverage observer sea days from 2013 to 2019.

Calendar year	Funding category	Funds sequestered (% of fees received)	Observer fees received	Observer fee collections received late	Prior year sequester funds received	Funds obligated to contract	Observer sea days at the start of the year	Observer sea days purchased during the year	Total observer sea days used during the year
2013	Fees						4,535	1,913	3,533
	Federal Funds					$1,885,166			
2014	Fees	$306,047 (7.2%)	$4,251,451			$3,044,606	2,915	4,368	4,573
	Federal Funds					$1,892,808			
2015	Fees	$350,400 (10.2%)	$3,456,458		$306,047	$3,058,036	2,710	5,330	5,318
	Federal Funds					$2,700,000			
2016	Fees	$231,200 (6.8%)	$3,897,938	$370,915	$350,400	$5,144,983	2,722	5,277	4,749[1]
	Federal Funds					$ 390,800			
2017	Fees	$273,930 (7.9%)	$3,592,750	$151,606	$231,200	$3,542,196	3,322	5,285	2,591
	Federal Funds					$1,398,531			
2018	Fees	$304,356 (7.9%)	$3,468,580		$273,930	$2,396,040[2]	5,858	2,350	3,207
	Federal Funds								
2019[3]	Fees					$997,845	5,001		
	Federal Funds					$412,307			

[1] This is a correction to the 2018 Annual Report. The calculation of "sea days used" in 2017 did not account for 157 option days.

[2] The difference in funds obligated against the contract for the 2018-2019 calendar years were held to obligate against a new observer contract expected to be awarded in the summer of 2019.

[3] Although 2019 information exceeds the scope of this report, this is included to show the carryover funds from 2018 being used in the 2019 fishing year.

2.2. Fees Collected from 2018, Summarized by Species, Gear, and Area

Observer coverage for the partial coverage category is funded through a system of fees based on the ex-vessel value of groundfish and Pacific halibut, with potential supplements from Federal appropriations. The observer fee is assessed on landings accruing against a Federal total allowable catch (TAC) for groundfish or a commercial halibut quota made by vessels that are subject to Federal regulations and not included in the full coverage category. Therefore, a fee is only assessed on landings of groundfish from vessels designated on a Federal Fisheries Permit or from vessels landing IFQ or CDQ Halibut or IFQ Sablefish. Within the subset of vessels subject to the observer fee, only landings accruing against the Federal TAC are included in the fee assessment.[4]

A fee equal to 1.25% of the ex-vessel value is assessed on the landings of groundfish and halibut subject to the fee. Ex-vessel value is determined by multiplying the standard price for groundfish by the round weight equivalent for each species, gear, and port combination, and the standard price for halibut by the headed and gutted weight equivalent. The standard ex-vessel prices used for 2018 fee assessments were published in the *Federal Register* on 22 December 2017 (82 FR 60704)[5]. Table 2-2, Table 2-3, and Table 2-4 summarize the observer fees that accrued for 2018.

[4] A table with additional information about which landings are and are not subject to the observer fee is in NMFS regulations at 679.55(c) (CFR 679.55 Observer Fees) and shown on page 2 of an informational bulletin available online at: Observer Fee Collection

[5] Available online in the Federal Register at: 82 FR 60704.

Table 2-2. -- Observer fees[6] in 2018 by gear, vessel size category, and species or species group for *all areas combined*.

Vessel length category	Halibut	Sablefish	Pacific cod	Pollock	All other groundfish	Total all species
HOOK AND LINE						
<40	$232,678	$29,220	$1,881	$10	$621	$264,410
40 - 57.5	$511,777	$417,774	$12,498	$39	$9,082	$951,170
>57.5	$565,162	$574,156	$4,786	$8	$7,426	$1,151,539
Gear Subtotal	$1,309,617	$1,021,150	$19,165	$57	$17,129	$2,367,119
JIG						
<40	$203				$65	$269
40 - 57.5	$690		$448		$194	$1,332
Gear Subtotal	$893		$448		$259	$1,601
POT						
<40			$144		$49	$194
40 - 57.5	$252	$23,226	$12,185		$311	$35,974
>57.5	$3,775	$157,684	$205,312	$5	$1,743	$368,519
Gear Subtotal	$4,027	$180,909	$217,641	$5	$2,103	$404,687
TRAWL						
40 - 57.5			$2	$10,677	$39	$10,717
>57.5		$5,326	$114,319	$447,998	$55,892	$623,535
Gear Subtotal		$5,326	$114,321	$458,675	$55,931	$634,252
TOTAL ALL GEAR						
	$1,314,537	**$1,207,385**	**$351,575**	**$458,738**	**$75,422**	**$3,407,658**
PERCENT BY SPECIES						
	39%	**35%**	**10%**	**13%**	**2%**	**100%**

Rounding error sometimes results in slight differences in row and column totals.

[6] The unpaid portion of the observer fees are included. Administrative fees and interest charged for late fee payments are not included.

Table 2-3. -- Observer fees[7] in 2018 by gear, vessel size category, and species or species group in the *Gulf of Alaska*.[8]

Vessel length category	Halibut	Sablefish	Pacific cod	Pollock	All other groundfish	Total all species
HOOK AND LINE						
<40	$175,566	$28,116	$1,646	$10	$569	$205,908
40 - 57.5	$426,103	$408,764	$8,644	$39	$8,981	$852,530
>57.5	$443,314	$557,214	$2,448	$8	$7,176	$1,010,159
Gear Subtotal	$1,044,983	$994,094	$12,737	$57	$16,726	$2,068,597
JIG						
<40	$203				$65	$269
40 - 57.5	$690		$2		$194	$886
Gear Subtotal	$893		$2		$259	$1,155
POT						
<40			$144		$49	$194
40 - 57.5	$252	$22,860	$2,187		$3	$25,302
>57.5	$3,775	$120,770	$30,001	$5	$1,041	$155,592
Gear Subtotal	$4,027	$143,630	$32,332	$5	$1,094	$181,088
TRAWL						
40 - 57.5			$2	$10,677	$39	$10,717
>57.5		$5,326	$21,530	$447,031	$55,817	$529,703
Gear Subtotal		$5,326	$21,531	$457,707	$55,855	$540,420
TOTAL ALL GEAR						
	$1,049,903	**$1,143,050**	**$66,603**	**$457,770**	**$73,935**	**$2,791,261**
PERCENT BY SPECIES						
	38%	**41%**	**2%**	**16%**	**3%**	**100%**

Rounding error sometimes results in slight differences in row and column totals.

[7] The unpaid portion of the observer fees are included. Administrative fees and interest charged for late fee payment are not included.

[8] The Gulf of Alaska includes Pacific Halibut regulatory areas 2C, 3A, and 3B; and Sablefish regulatory areas Western GOA, Central GOA, West Yakutat, and Southeast Outside

Table 2-4. -- Observer fees[9] in 2018 by gear, vessel size category, and species or species group in the *Bering Sea/Aleutian Islands*.[10]

Vessel length category	Halibut	Sablefish	Pacific cod	Pollock	All other groundfish	Total all species
HOOK AND LINE						
<40	$57,112	$1,104	$236		$51	$58,502
40 - 57.5	$85,673	$9,010	$3,854		$102	$98,639
>57.5	$121,849	$16,942	$2,338		$250	$141,379
Gear Subtotal	$264,634	$27,056	$6,428		$403	$298,521
JIG						
40 - 57.5			$446			$446
Gear Subtotal			$446			$446
POT						
40 - 57.5		$365	$9,998		$308	$10,672
>57.5		$36,914	$175,311		$702	$212,927
Gear Subtotal		$37,279	$185,309		$1,009	$223,598
TRAWL						
>57.5			$92,789	$967	$75	$93,832
Gear Subtotal			$92,789	$967	$75	$93,832
TOTAL ALL GEAR						
	$264,634	**$64,336**	**$284,972**	**$968**	**$1,488**	**$616,397**
PERCENT BY SPECIES						
	43%	**10%**	**46%**	**<1%**	**<1%**	**100%**

Rounding error sometimes results in slight differences in row and column totals.

[9] The unpaid portion of the observer fees are included. Administrative fees and interest charged for late fee payment are not included.

[10] The Bering Sea/Aleutian Islands includes Pacific halibut regulatory areas 4A, 4B, 4C, and 4D; and Sablefish regulatory areas Bering Sea and Aleutian Islands

2.3. Costs

2.3.1. Program Structure

The Fisheries Monitoring and Analysis Division (FMA) at the Alaska Fisheries Science Center (AFSC) oversees the Observer Program and is responsible for a suite of activities that support the overall observer data collection in the groundfish and Halibut fisheries in Alaska. FMA has staff located in Seattle, Washington, and in Anchorage, Kodiak and Dutch Harbor, Alaska. The AFSC allocates a budget to FMA each fiscal year to support these activities. FMA staff are responsible for training, briefing, debriefing, and oversight of observers who collect catch data on board fishing vessels and at shoreside processing plants. FMA is also responsible for quality control/quality assurance of observer data, conducting research and development of fishery monitoring technologies, and providing a host of fishery-dependent data products and services.

The FMA Division is organized into four programs: Observer Training and Curriculum Development; Debriefing and Data Quality Control; Application Development and Data Presentation; and Division Management and Analytic Services.

Observer Training and Curriculum Development ensures that observers are properly trained and equipped for their deployments. Observers are trained to follow FMA's established data collection procedures while deployed on commercial fishing vessels or stationed at processing facilities. Training materials are regularly updated and created in response to changes in regulations and data needs for stock assessment and ecosystem-based fishery modeling efforts. Training methods are routinely updated to best convey the complex topics and concepts to the observer work force. Program staff also manage FMA's extensive gear inventory to ensure a sufficient supply for observers throughout the year at all FMA office locations and develop inventory control systems and policies to maintain safety equipment, provide sampling equipment readiness, and monitor equipment losses.

Debriefing and Quality Control assures FMA's established data collection procedures were properly followed during observer deployments to commercial fishing vessels and processing facilities. Staff members assist at-sea observers through communications (referred to as in-season advising) available through custom software for answering questions, correcting data errors, and ensuring safety concerns are addressed. Data quality control activities, both in-season and post-deployment include data entry, data validation, and observer support, as well as industry, interagency, and interdivisional support. Staff members install and maintain custom software which is used to transmit observer information and data, ensure observers are trained on the use and configuration of software, and provide near real-time data quality control and guidance for observers using these systems. In addition, they document and evaluate each observer's data collection methodologies through interviews, electronic vessel surveys, and written descriptions submitted the observer. Staff conduct data quality control checks on data collected by fishery observers by verifying the accuracy of recorded data, identifying errors, and ensuring observers make the necessary corrections.

Application Development and Data Presentation develops custom software that supports the recording of fishing effort, location, species composition and biological data collected by fishery observers from North Pacific commercial fisheries. This software enables the transmission, validation, and loading of those data, the editing and reporting of current and vetted data sets; observer logistics and contract management; and the recording of bird and marine mammal data collections for both internal and external use. In collaboration with FMA analysts, staff working under this activity developed and continue to support ODDS which allows vessel owners to register, edit, and close fishing trips. This application was developed with independent modules for FMA management and the observer coverage services provider, which includes the ODDS call center, and each vessel owner.

Division Management emphasizes coordinating and prioritizing resources across programs and activities, as well as managing links between the programs and overall costs. In addition, overall management and supervision of staff, budget, and contracting is required to ensure resources are appropriately allocated and staff understand their responsibilities and priorities. Staff provide advice to support policy development, decision-making, and regulatory and program development by NMFS and the Council. They also provide guidance and advice on policy issues, monitoring programs, and related topics at the regional, national, and international level.

Analytic Services collaborates with scientists throughout the AFSC to ensure that observer data meet the needs of stock assessment and ecosystem-based fishery modeling efforts. In addition, analysts perform independent research aimed at identifying bias and variances associated with fishery-dependent sampling. Analysts work closely with the Alaska Regional Office and Council staff to ensure that FMA provides relevant, high-quality information for fisheries management and in support of requests from the Council and other constituents.

Division Management also oversees the partial coverage deployment and funding to ensure the infrastructure and contracts are in place to meet the observer deployment requirements of BSAI Amendment 86 and GOA Amendment 76. FMA staff provide oversight of the fishery observer services provider contract, serving as the primary point of contact for the contract provider and FMA. The contract provider and FMA staff coordinate with industry, schedule vessel inspections as needed, and participate in decision- making for partial coverage vessels that are selected for coverage but request a release from the requirement.

EM was formed as a unique activity within FMA under Division Management starting in 2013 and has continued to dedicate staff time to the development and integration of electronic technologies in Alaska fisheries. In April 2014, the Council convened an EM Workgroup to develop alternatives for EM in the small hook-and-line fleet. Several FMA staff participated in the workgroup and have a lead role in planning and executing coordinated research activities that will advance the science of EM and increase efficiencies in interpreting resulting data. In 2018 a total of $2,300,677 in NMFS funds were obligated towards EM in Alaska supporting both operational and innovation programs. Additional funds were also provided by the National Fish and Wildlife Foundation (NFWF) in support of EM deployment.

Program Field Offices

The Anchorage Field Office ensures FMA's established data collection procedures were properly followed during observer deployments to commercial fishing vessels and processing facilities as well as provides observers with support in the field during their deployment. Staff assist at-sea observers through in-season advising and mid-cruise debriefings. In addition, they document and evaluate each observer's data collection methodologies through interviews, electronic vessel surveys, and written descriptions submitted by observers, as well as conduct data quality control checks to verify data accuracy by identifying errors and ensuring the observer makes the necessary corrections. Staff conduct one- and two-day briefings at this field office and maintain an inventory of complete sampling and safety gear sets for observers redeploying directly from the Anchorage office.

The Kodiak Field Office provides support to observers primarily assigned to vessels in the GOA. Support includes conducting pre-cruise briefings with vessel representatives and observers prior to the observer's first trip aboard, conducting mid-cruise debriefings with observers to address any safety concerns on their vessels, reviewing their data collection methodology and recorded data, providing in situ problem resolution, and issuing sampling and safety equipment. In addition, staff receive, track, and ship biological samples that are collected by observers in support of resource management, scientific research, and observer training. Staff also serve as the primary FMA contact for observed vessels and processing facilities in the GOA.

The Dutch Harbor Field Office provides support primarily to observers assigned to vessels in the Bering Sea and Aleutian Islands. Support includes conducting pre-cruise briefings with vessel representatives and observers prior to the observer's first trip aboard, conducting mid-cruise debriefings with observers to address any safety concerns on their vessels, reviewing data collection methodology and recorded data, providing in situ problem resolutions, and issuing sampling and safety equipment. In addition, staff conduct observer sample station and scale inspections on board commercial fishing vessels to ensure the sample stations meet the standards required in federal regulations. Staff also serve as the primary FMA contact for observed vessels and processing facilities in the Bering Sea and Aleutian Islands.

2.3.2. Contract Costs for Partial Coverage

NOAA's Acquisition and Grants Office (AGO) secures and administers contracts for NMFS. FMA staff participate in contracting by initiating requirements documents, providing funding, and participating in the contract review and award process through formal source evaluation boards. The processes for Federal contracts follow the Federal Acquisition Regulations (FAR) and Commerce Acquisition Regulations (CAR). NMFS receive legal guidance on the FAR and CAR through NOAA contract attorneys and AGO staff.

After NOAA awards a contract, FMA staff participate by assigning a Contracting Officer Representative (COR) to the contract. The COR provides direct technical oversight of the contract by monitoring contract performance, identifying and resolving operational issues, and reviewing and approving invoices. While FMA is directly involved in day-to-day contract management through its assigned COR, NOAA retains full authority over the contract through

their appointed Contract Officer (CO). The NOAA CO can modify, extend, cancel, and award contracts.

The observer coverage for the first 2 years (2013 and 2014) of the program was procured through a two-year contract awarded to AIS Inc. A second contract was awarded for the subsequent 5 years of the program to AIS, Inc. in April 2015.

Table 2-1 provides a summary of funds expended and observer days used since 2017. Note that past Annual Reports used funds obligated instead of funds expended to calculate an average sea day cost. An obligation of funds is a legal liability to disburse funds upon receiving the service – in this case the provision of observer coverage. Obligations of funds therefore reflect the potential quantities of service, not the cost of the realized service. Expenditures are the disbursement of funds and are directly related to the service.

In 2018, the average cost per observer sea day in the partial coverage category was $1,380 (based on the cost of $4,425,144 for 3,207 observer days). The average cost per observer sea day is a combination of a daily rate, which is paid for the number of days the observer is on a vessel or at a shoreside processing plant, and reimbursable travel costs. The contractor also needs to recoup their total costs and profit through the daily sea day rate, which includes costs for days the observers are not on a boat. These days include training, travel, deployment in the field but not on a boat, and debriefing.

The average annual cost per sea day in partial coverage have ranged between $895 and $1,380 since 2014 (Table 2-5). Much of this variation is associated with number of sea days used each days, as the cost of "optional" sea days are less expensive than "guaranteed" sea days under the federal contract. Additionally, there is variation from year-to-year in travel costs which, for Alaska, tend to be higher per trip than other regions of the country.

While past Annual Reports have included observer sea day costs from other federal observer programs around the nation, this information was not available for 2018. The National Observer Program has convened a small working group comprised of regional observer program managers to better describe observer sea day costs – or other metric – such that cost comparisons can be made not just year-over-year in one region, but among regions with similar cost models.

Table 2-5. -- Average annual observer coverage sea day costs from 2014 to 2018.

Year	Funds expended	Number of observer sea days realized	Average sea day cost
2014	$4,937,414	4,573	$1,080
2015	$5,758,268	5,318	$1,083
2016	$4,186,303	4,677	$895
2017	$3,146,111	2,749	$1,144
2018	$4,425,144	3,207	$1,380

2.3.3. Costs for Full Coverage

The costs associated with the full coverage category are paid by the commercial fishing industry directly to certified observer providers. This cost structure is sometimes referred to as "pay as you go." The services carried out by observer providers include paying observers, deploying observers to vessels and shoreside processors, recruiting, training and debriefing. There are currently four active certified providers in Alaska.

Since 2011, certified observer providers have been required to submit to NMFS copies of all of their invoices for observer coverage. The regulations require the submission of the following:

- vessel or processor name,
- dates of observer coverage,
- information about any dates billed that are not observer coverage days,
- rate charged for observer coverage in dollars per day (the daily rate),
- total amount charged (number of days multiplied by daily rate),
- the amount charged for air transportation, and
- the amount charged for any other observer expenses with each cost category separated and identified.

The invoices data were used to calculate the average cost of observer coverage in the full coverage category for 2018. The observer invoice data are confidential under section 402(b)(1) of the Magnuson-Stevens Act. Therefore, summarized information may be provided in this report only when the data used in the summary statistic derives from invoices submitted by at least three observer providers. This confidentiality requirement limits the detail of the average cost data that may be reported to the public, as noted below.

The total cost billed to 167 vessels and processing facilities for observer coverage in the full coverage category in 2018 was $14,030,339. The total number of observer days represented by these invoices was 36,692. Based on this information, the average cost per day of observer coverage in the full coverage category in 2018 was $382. This average combines invoiced amounts for the daily rate per observer day (variable cost) plus all other costs for transportation and other expenses (fixed costs). The average cost per day in 2018 compares with an average cost of $385 in 2017 and $383 in 2016.

Figure 2–1 summarizes the average costs to fishing and processing vessels in the full coverage category by sector and gear type in 2018. These sector and gear type categories are fixed gear catcher/processors, trawl catcher/processors, and trawl catcher vessels. Invoice data for hook-and-line and pot catcher/processors are combined into a fixed gear category to protect confidentiality. Shoreside processors that take deliveries of Bering Sea pollock are in the full observer coverage category, however, they are not included in Figure 2–1 to protect confidentiality. Days may include days by more than one observer in a year, and person days of coverage for an operation may exceed 365 days in a year if multiple observers were present.

Figure 2–1, part (a) shows the average number of observer days per vessel in the three vessel categories,[11] the average cost per day of observer coverage,[12] and the average daily rate observer providers charged for observer coverage.[13] The average daily observer rate (variable costs only) was $345.42 (up from approximately $345.15 in 2017), and was similar across all gear and sector categories. Figure 2–1, part (b) shows the estimated average variable and fixed costs for observer coverage for vessels and processors. Variable costs equal the product of the daily rate for an observer and the number of days of observer coverage. Fixed costs equal total invoiced expenses minus the variable costs, and are primarily costs of transporting observers to and from their stations. Across gear and sector categories fixed costs as a percentage of total costs are similar at approximately 10%.[14] More information about the comparison of costs per observer day for full and partial coverage is described in Section 2.4.3.

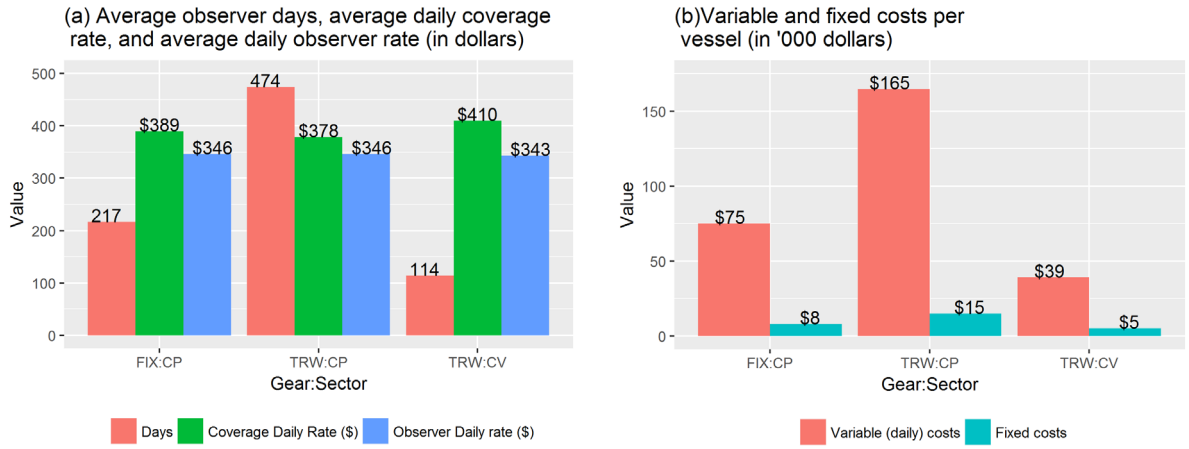


Figure 2–1. Full coverage costs by variable costs (a, b) and fixed costs (b) to vessels and processors for observer coverage in the full coverage category in 2018, by gear type (FIX = fixed gear which includes hook & line and pot gear, TWL = trawl) and sector (CP=catcher processor, CV = catcher vessel, note the costs for shoreside processing sector is excluded from this figure for confidentiality.)

[11] The average number of observer days per vessel is calculated by dividing total observer days in each vessel category by the total number of vessels in that category.

[12] For a vessel within a gear and sector category, the vessel's annual daily coverage rate is calculated by dividing the total cost for observer coverage (inclusive of costs paid for observers, airfare, and other incidental costs; i.e., both variable and fixed costs) by the number of observer days. The average daily coverage rate is calculated as a simple average of each vessel's annual daily coverage rate.

[13] For a vessel within a gear and sector category, the vessel's annual daily observer rate is calculated by dividing the costs paid for observers (excluding airfare and other incidental costs) by the number of observer days. The average daily observer rate is calculated by as a simple average of each vessel's annual daily observer rate.

[14] Calculated as total fixed costs divided by the total cost of coverage.

2.3.4. Costs for Electronic Monitoring

The Council has tasked NMFS with implementing EM technology for the purposes of catch estimation on fixed gear vessels 40-57 ft in length and actively participates in its development through the EM Workgroup and EM Pre-Implementation plans. An important component of the new EM program is evaluating costs. Table 2-6 reflects the costs of the fixed gear EM program in 2018. Much of the cost structure was designed by the EM Workgroup and categorizes one-time, amortized (for infrastructure, equipment, and capacity building, where the benefit extends over several years and the cost is proportioned among each of those years), and recurring costs. Amortized costs are largely the cost of installed EM equipment and assumes a 5-year life, recognizing that the actual equipment life may be longer. Both Saltwater and Archipelago Marine Resources (AMR) conduct research and development work in addition to conducting the implemented EM program. Where these costs were evident in their reporting, it was removed from these totals. Similarly, both Saltwater and Pacific States Marine Fisheries Commission (PSMFC) review imagery to create useable data, but NMFS only uses data provided by PSMFC, so Saltwater's review costs have been removed from these totals so as not to overestimate costs. In 2018, a simplified fully-loaded daily rate was calculated for the EM program that included amortized equipment costs, recurring operational costs, and video review. Combined, the fully loaded EM daily rate in 2018 using total costs was $1,535,130 (for 1,005 days or $1,527/day). Using amortized costs, the total was $961,131 (for 1,005 days or $956.35 per day.)

EM costs are dependent on the number of vessels participating in the EM program, the number of systems that need to be purchased and/or replaced on an annual or recurrent basis deployment rates, field support services, video review, and other factors.

Table 2-6. -- Costs of the 2018 Fixed Gear EM Program

Cost category	One time	Recurring	Amortized	2018 Total	Prior years amortized	Adjusted annual cost
Project Coordination	$70,483	$246,439		$316,922		$ 246,440
Data Review, Processing, and Analysis	$294	$191,961		$192,255		$192,255
EM Equipment Services		$36,019	$684,853	$720,872	$171,553	$344,542
Field Technical Services		$118,690	$186,391	$305,081	$21,926	$177,894
Project Totals	$70,777	$593,109	$871,244	$1,535,130	$193,479	$961,131

2.4. Cost Savings and Efficiencies

2.4.1. Partial Coverage

The current observer service provider contract was awarded on 22 April 2015. The rates that NMFS currently pays the observer services contractor were established through a competitive bidding process. This contract has several components designed to improve efficiency and reduce costs. For example, the new contract requires that a partially observed sea day (i.e., a day that begins after 1200 (noon) or returns to port before 1201) is paid at an amount equal to one-half the daily rate. The lower rate applies to all days completed by the contractor in which an observed vessel leaves or arrives in port before or after the designated times.

Similar to the last contract, NMFS included the provision for observers to participate in NMFS fishery-independent surveys using funds made available through AFSC. This allows AIS, Inc. to provide additional work to their employees during the summer season when observer opportunities as part of the ADP are more limited. This provides their employees continuity in employment, additional experience, and may help to reduce employee turnover, thereby increasing overall efficiency. NMFS benefits from trained observers with sea experience to help to conduct their survey fieldwork.

The current observer services contract expires 16 June 2019. NMFS published a solicitation for a new contract on 14 November 2018.[15] The partial federal government shutdown delayed work on this award, but NMFS still intends to have the contract awarded during the summer of 2019.

2.4.2. Full Coverage

NMFS has implemented regulations that govern the terms of observer deployment (e.g., limiting deployment the duration, setting minimum qualifications, requiring specific experience for observers assigned to certain deployments, etc.). Efficiencies could potentially be gained by increasing competition, reducing constraints, or increasing efficiency of activities supported by NMFS.

The majority of business is conducted by three of the four NMFS-permitted observer providers. The most recent newly permitted observer provider was AIS, Inc., which received a permit to deploy observers in the full coverage category in August 2016. This pool is down from a high of ten permitted providers in 1991. It is NMFS' understanding that the pool was reduced due to competition, so it is uncertain if additional providers could be competitive, or if the impact would result in substantial increases in efficiency.

[15] Contract solicitation is available online at: https://www.fbo.gov/?s=opportunity&mode=form&id=798ef0e72013db7c7b5031487cd2dd05&tab=core&_cview=1

2.4.3. Comparing Costs Between the Full and Partial Coverage Categories

There are several factors that impact how comparable the average observer coverage costs per day are between in the partial coverage category and the full coverage category.

- The partial coverage contract is a federal contract between NMFS and the observer provider company, whereas the full coverage observer providers do not operate under a federal contract. Instead, full coverage observer providers are permitted by NMFS and contract observer services directly with vessels.
- Federal contracts are subject to Federal Acquisition Regulations, Fair Labor Standards Act, and Service Contract Act requirements, and applicable Department of Labor Wage Rate Determination which establish, among other things, minimum wage and benefits for observers, including overtime. Some of these same regulations and requirements can also apply to full coverage observer providers depending on the size of the companies.
- All travel costs and expenses incurred in partial coverage are reimbursed in accordance with the Government's Travel Regulations. These include specified per diem rates which are paid regardless of actual expenses.
- The costs associated with the partial coverage component are a daily fee NMFS pays for each sea day, and a reimbursable cost for travel as defined in the NOAA contract. Because NMFS only pays for sea days, the daily rate charged to NMFS must factor in an estimate for the contractor's fixed costs for unobserved days. Increasing the proportion of time spent at sea would increase the efficiency of the overall program since it would lower fixed costs to the contractor and allow for a newly negotiated lower daily rate charged to NMFS. Higher coverage rates equate to greater efficiency and lower costs per day, while lower coverage costs equate to lower efficiency and greater costs per day.
- Observers in the partial coverage category are often deployed out of many small, remote port locations which increases travel and lodging costs.
- Observers in the partial coverage category are often only deployed on a vessel for one trip which is significantly shorter (1 to 5 days) than the typical vessel deployment for full coverage observers (60 to 90 days), requiring more travel between vessels.
- Partial coverage by its very nature is inefficient on a cost per unit basis compared to full coverage. This is because partial coverage samples the fleet, such that gains are made in overall costs in monitoring. However, predicting where observers will be deployed and in what amount is difficult with random selection procedures. The risk and uncertainty regarding the number of observed days is borne solely by the partial coverage observer provider and increase costs on a per unit (daily rate) basis.

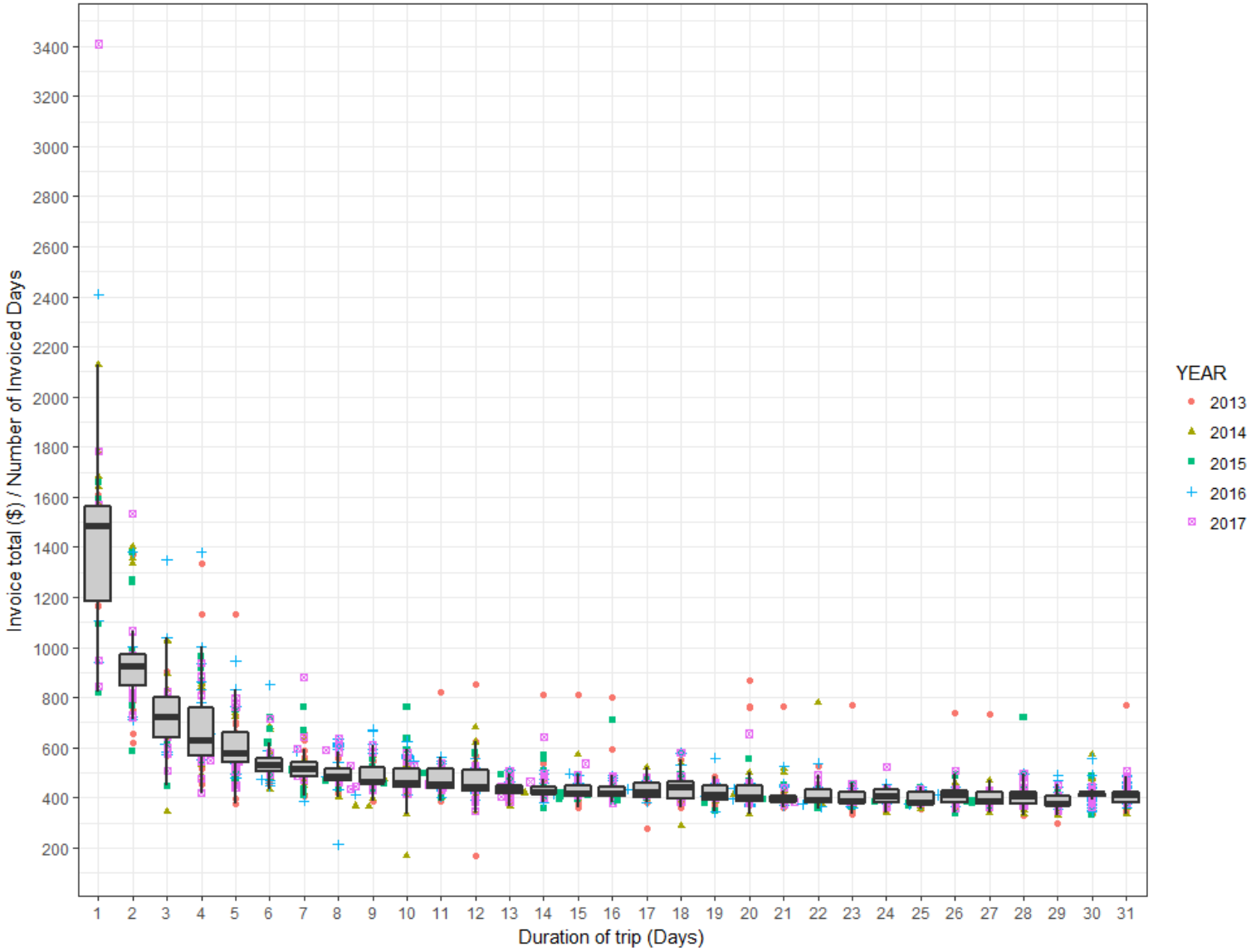
Due to the inherent differences between the full and partial coverage categories, the most salient comparison of costs is a "fully loaded" daily rate, which is calculated as the total funds expended divided by the number of observed days.

The fully loaded rate for each year of the partial coverage contract is show in Table 2-5. For example, in 2018, the fully loaded rate was $4,425,144 ÷ 3,207 days = $1,380 per day. This

calculation is appropriate for partial coverage since most trips in this category have a similar duration ranging between one and 5 days.

The average daily observer rate (variable costs only) for full coverage was similar across all gear and sector categories at approximately $382 per day. Compared to a partial coverage observer that may be deployed onto multiple vessels for one to five days at a time, an observer deployed onto a full coverage vessel boards once and may stay on that vessel for a month or more. Assuming the costs of paying an observer for a day and maintaining an observer provider infrastructure are constant, the fixed costs are likely to be dominated by travel and temporary housing. These fixed costs as a proportion of the total cost for an observer deployment will decline with increased deployment duration. Therefore, the fully loaded rate of an observer day will also decline with an increase in the number of invoiced days for a given vessel in a given month. We can illustrate this phenomenon using the full coverage invoice database maintained by FMA. The per-day base rate for observer coverage per permitted provided is known. Therefore, this value multiplied by the total number of invoiced days yields the total base invoice cost. Since the total invoice amounts are known, a subtraction of the total base invoice from the total invoice amount will either yield a zero, or a positive value. Only those invoices that included travel costs and therefore "fully loaded" and were considered further. The fully loaded invoice value was divided by the number of days on the invoice, yielding a fully loaded daily rate for each invoice. The fully loaded rate as a function of the total number of observed days in the invoice does in fact decline as expected.

Figure 2-2. -- Relationship between the fully loaded cost per day for full observer coverage as a function of the duration of the trip.



3. Deployment Performance Review

3.1. Introduction

Each year the Alaska Fisheries Science Center's (AFSC) Fisheries Monitoring and Analysis (FMA) Division establishes an *ad hoc* Observer Science Committee (OSC) for the North Pacific Observer Program. The OSC provides scientific advice in the areas of regulatory management, natural science, mathematics, and statistics as they relate to observer deployment and sampling in the groundfish and Halibut fisheries of the BSAI and the GOA. The OSC members have analytical and scientific expertise relating to observer sampling of groundfish and Halibut fisheries of the BSAI and GOA and use of the collected data. If possible, the OSC is represented by at least one member of the AFSC/FMA (Observer Program) Division, one member of the AFSC/Stock Assessment and Multispecies Assessments Program, one member of the Alaska Regional Office (AKRO) Sustainable Fisheries Division, and one member of the International Pacific Halibut Commission (IPHC).

This chapter contains the OSC review of the deployment of observers in 2018 relative to the intended sampling plan and goals of the 2018 Annual Deployment Plan (ADP, NMFS 2017a). This review identifies where possible biases exist and provides recommendations for further evaluation, including potential improvements to the observer deployment process that should be considered during the development of the 2020 ADP.

The goal of the Observer Program is to achieve a random deployment of observers and EM into fisheries to collect representative data used to estimate catch and bycatch, assess stock status, collect fishery-dependent biological information used in population and ecosystem modeling efforts, and make salmon bycatch stock-of-origin determinations, among other objectives. Therefore, this evaluation focuses on the randomization of observer and EM deployments into primary sampling units, and how departures from a random sample affect data quality. This is the first Annual Report in which any EM trips are analyzed as part of the regulated program used for catch accounting. Only EM trips that used hook-and-line (HAL) gear were part of the regulated program in 2018. Both HAL and pot (POT) EM trips will be part of the regulated program in 2019.

3.2. The Sampling Design of the Observer Program

Since 2013, the Observer Program has used a stratified hierarchical sampling design with randomization at all levels. Stratification is used to increase the efficiency of sampling by observers and to address logistical issues associated with deployment. By grouping similar fishing activities into strata and sampling those strata appropriately, the variance of resulting estimates may also be decreased. Sampling strata are defined in the ADP and are designed such that a unit of deployment (trip) is generally unique to a stratum.

Within a stratum, observers are deployed randomly to either vessels for a predetermined period of time (termed vessel-selection), or to individual fishing trips (termed trip-selection). In both cases, this initial deployment to the fishery is the first level of the sampling hierarchy and defines

the primary sampling unit (PSU; either vessel-periods or individual trips). The list of all PSUs in a stratum defines the sampling frame and should equate to the population of interest for that sampling stratum (e.g., all trips taken by trawl vessels fishing in the Alaska EEZ). In cases where the sampling frame (list of PSUs) for a stratum does not include all the elements of the stratum (i.e., where some fishing occurs in the stratum but is not captured by the sample frame), the resulting information from sampling may not represent the population of trips. The magnitude and direction of the bias will depend on how different the fishing activities in the sample frame are from actual fishing activity.

For each observed trip, if all hauls cannot be sampled for logistical reasons, hauls are randomly selected to be sampled. This is the next level in the hierarchy; the secondary sampling units are defined as hauls within a trip. Randomization of haul selection is designed to allow observers to record and transmit data, attend to other non-sampling responsibilities, and to allow observers time to sleep and eat. Randomization of haul selection also gives EM video reviewers the ability to optimize the amount of video that can be reviewed from each trip. Haul selection is determined using the random sampling tables and random break tables provided by NMFS. For each haul, fishing location and effort (e.g., number of hooks) are recorded, while marine mammal and seabird interactions are primarily recorded on randomly selected hauls. The ability of EM to capture marine mammal and seabird interactions is less than that of observers due to the fixed location in which EM equipment is placed.

For the randomly selected hauls for each trip, a random sample of the catch is collected (observers) or selected for video review (EM), and data from those samples are used to determine the species composition and amount of discarded catch. These samples of catch within each haul are the third level of the sampling hierarchy. While observers are trained to collect multiple large samples of catch, the number and size of samples taken from each haul will depend on the vessel configuration, fishing operations, and diversity of catch. The size of EM samples is largely determined by the number of video reviewers available relative to the amount of video to be reviewed.

At the fourth level of the sampling hierarchy, a predetermined number of individual fish of predetermined species is randomly selected from the species composition sample and measured. Lastly, at the fifth sampling level, a random selection of fish is used to collect otoliths, reproductive maturity assessments, stomach contents, genetic tissues, and other biological specimens. The number and species of fish selected for measurement and biological specimen collection is specified each year by the AFSC's stock assessment scientists. Sampling rates for genetic tissue collection by observers (e.g., 1 of 10 Chinook salmon caught as bycatch) are set each year by the AFSC's Auke Bay Laboratories. Sampling at the fourth and fifth levels of the sampling hierarchy does not occur with EM.

In summary, the overall sample design used by the Observer Program is a stratified design where, within each stratum, NMFS randomly selects primary units (vessels or trips) to be monitored. Within each selected trip, hauls are randomly selected to be further sampled, and marine mammal and seabird interaction data are collected. From each selected haul, a random sample of the catch is collected to obtain species composition and disposition data. From each species composition sample, individual fish are randomly selected and measured by observers only. Finally, from these measured fish, additional fish are randomly selected for the collection of biological specimens by observers only. More information on the sampling design used by

observers and the relationship between the sample design and catch estimation can be found in Cahalan et al. (2014) and the 2017 Observer Sampling Manual (AFSC 2016). The focus of this report is deployment related and the resulting evaluation is at the trip level of the sampling hierarchy.

Each year, the sampling design of the observer program is translated into an ADP. The ADP details how the sampling design will be implemented by the observer program. A summary of the 2018 ADP can be found in Section 1.3.

3.3. Performance Review Objectives

The following items from the 2018 ADP have been identified as objectives for evaluation in this report:

1. Deploy for the planned number of sea days. This objective will be considered to be met if the actual number of sea days expended falls within the range of values from simulated sampling provided in the 2018 ADP. The Observer Program's budget was expected to cover 4,470 days in 2018.
2. Deploy at the coverage rates specified in the 2018 ADP. Following the 2018 ADP, ODDS was programmed to randomly select logged trips at a rate of 20.18% in the *TRW - No Tender* stratum, 17.26% in the *HAL* stratum, 16.21% in the *POT - No Tender* stratum, 16.67% in the *TRW - Tender* stratum, 17.39% in the *POT - Tender* stratum, and 30% in the EM strata. Under a randomized deployment scheme, actual partial coverage rates are expected to fall 95% of the time within a 95% confidence interval computed from the realized coverage rates (under the assumption of a binomial distribution for observed trips).
3. Collect tissue samples from Chinook and chum salmon as specified in the 2018 Observer Sampling Manual to support the goal of collecting genetic samples from salmon caught as bycatch in groundfish fisheries to identify stock of origin. The sampling protocol established in the 2014 ADP (NMFS 2013) was used in 2018. Under this protocol, observers on vessels delivering to shoreside processors in the GOA trawl pollock fishery monitor the offload to enumerate salmon bycatch and obtain tissues for genetic analysis from the salmon bycatch. For trips that are delivered to tender vessels and trips outside of the pollock fishery, observers obtain salmon counts and tissue samples from all salmon found within at-sea samples of the total catch.
4. Minimize the number of conditional releases from observer coverage issued. The NMFS aimed not to grant conditional releases or temporary exemptions to vessels subject to observer coverage. It was expected that no conditional releases would be granted in 2018.
5. Randomize deployment of observers into the partial coverage category of fishing activities. This randomization is used to collect observer and EM samples that are representative of the entire fishing fleet (observed and monitored trips are equivalent to unobserved and unmonitored trips within a stratum). Evaluation of this objective is focused on the randomization of observer and EM deployments into primary sampling units, and how departures from a random sample affect data quality.

3.4. Observer Deployment Performance Metrics

Performance metrics have been developed to assess whether the trip-selection process (through the implementation of the 2018 ADP) provides a representative sample of fishing trips in the

North Pacific in 2018. These metrics reflect four mechanisms that can impact the quality of the data: sample frame discrepancies, non-response, differences in trip characteristics, and sample size.

The performance metrics used in this evaluation are as follows:

1. Deployment rates for each stratum: This is the basic level of evaluation for comparing targeted and achieved sampling rates, where sampling strata are partitions of the entire population about which we want to make inferences (e.g., generate estimates of catch). Implementation challenges can be identified in this step, such as sample frame inadequacy, selection biases, and issues with sample unit definitions. Specifically, this section assesses the following:
   A. Sample rates and number of samples relative to intended values.
   B. Quantification of under- and over-coverage rates (sample frame discrepancies). Over-coverage of a population occurs when the sample frame includes elements that are not part of the target population. When these elements are included in the random sample, effort (time, cost) is expended needlessly. Under-coverage results from having a sample frame that does not include a portion of the target population which can lead to biased data if that portion of the population differs from the population included in the sample frame.
   C. Non-response rates. Non-response occurs when randomly selected elements (trips or vessels) are not actually sampled. If these trips or vessels have different fishing behavior (e.g., catch, areas fished) than the rest of the population, the data collected will not represent the entire fleet (non-response bias).
2. Representativeness of the sample: Randomized sampling is a method used to ensure that the results of sampling reflect the underlying population. Departures from randomization can lead to non-representative data and hence potential bias in estimates of the parameters of interest. A randomized sample design is expected to achieve a rate of observed events that is similar across both space and time. Representativeness of the sample was divided into three separate components:
   A. Temporal representativeness
      i. Effort plots: plots of expected and actual observed effort over time. Areas where these two lines deviate from each other are indicative of periods with differential realized sample rates (and potential temporal bias).
   B. Spatial representativeness
      i. Maps: Maps provide a visual depiction of the spatial distribution of observer coverage relative to effort in each partial coverage stratum, as well as where low or high coverage rates occurred.
      ii. Probability of selecting a sample and observing a fewer or greater number of trips within an area than would be expected given the implemented sample rates. These data are used to identify departures from anticipated sampling rates.
   C. Representativeness of trip characteristics
      i. Consistency of trip characteristics for observed and unobserved portions of the stratum. These metrics are based, in part, on the availability of data for both observed

and unobserved fishing activities; for example, data that are reported for all trips on landing reports. Attributes tested in this report include the following:

- Trip duration (days).
- Vessel length (feet).
- The number of NMFS Areas fished during the trip.
- The amount of landed catch (metric tons).
- The number of species in the landed catch (also known as species richness).
- The proportion of the total landed catch that was due to the most prevalent species (pMax, an inverse measure of species diversity where an increase in pMax indicates a decline in diversity).

3. Adequacy of sample size: A well-designed sampling program will have a sample large enough to reasonably ensure that the characteristics of interest in the entire target population are represented in the data. Whether the sample size collected was adequate was determined through an examination of the probability of deploying observers at the implemented rate and having no observer coverage in one or more cells (e.g., defined by NMFS Reporting Area and strata).

Although these metrics can identify places where observed results differ from expectations, it is ultimately a subjective decision as to whether or not these differences are substantial enough to have management implications. This holds true even for tests that have associated p-values. Additionally, our focus on landed catch is due to the fact that total catch is comprised of retained and discarded portions, and since discarded catch is not available from unobserved trips, landed catch represents the only portion of the catch that is available from all trips.

3.5. Changes to This Report from Last Year

At their June 2017 meeting, the North Pacific Fishery Management Council supported allowing 165 vessels to be monitored with EM, with priority given to longline vessels whose data would be used for inseason management (NMFS 2017b, Appendix A). Ultimately, 141 vessels were allowed into EM (NMFS 2017b): 123 fishing predominantly with longline gear and 18 fishing predominantly with pot gear. Of the 123 longline vessels covered by EM, three were considered zero coverage because they were participants in experimental EM research as opposed to regulated EM methodology.

The strata used in 2018 were largely the same as those used in 2017, with two exceptions: the 2017 *HAL – Tender* and *HAL – No Tender* strata were combined into one *HAL* stratum in 2018 and the *EM HAL* stratum was also added to the regulated partial coverage monitoring program in 2018. The deployment performance of EM was therefore split by gear type, with the performance of *EM HAL* being analyzed to the same degree as observed strata. The performance of the *EM POT - No Tender* and *EM POT - Tender* strata are analyzed to a lesser degree due to their pre-implementation status.

As in 2017, trip-selection was the sole method used for selecting fishing activity for observation or monitoring in 2018. This is in contrast to prior years when vessel-selection was used in

conjunction with trip-selection. No minimum coverage hurdle was employed in 2017, whereas a 15% minimum coverage hurdle was used in 2018.

3.6. Evaluation of Deployments in 2018

The deployment of observers into the 2018 Federal fisheries in Alaska is evaluated at the level of the deployment stratum because each stratum is defined by a different sampling rate or by a different monitoring method (e.g., observers and EM). In this document, trips in the *EM HAL* stratum are considered successfully monitored if at least some video was reviewed from a trip. The rationale for defining monitored trips this way is that it is most similar to the way in which trips in other strata are considered observed (i.e., irrespective of whether or not haul information or usable species composition data were collected). Since *EM HAL* data was the only EM data used for catch accounting in 2018, *EM HAL* data is the only EM data analyzed to the same degree as observed strata. For *EM POT - No Tender* and *EM POT - Tender*, which were under pre-implementation, two values are reported: the number of trips for which data was received and the number of trips for which data was reviewed. The goal the NMFS set for *EM POT - No Tender* and *EM POT - Tender* in their pre-implementation status was only to *receive* data for trips at the programmed selection rate, not to *review* data for trips at the programmed selection rate.

3.6.1. Evaluating Effort Predictions

Each year the NMFS sets an annual budget in terms of observer days. Therefore, how close anticipated observed effort is to actual invoiced effort in each ADP is a function of how well the NMFS predicts effort and how well the NMFS achieves its sampling rate. The observer day budget for 2018 was set at 4,470 days in the 2018 ADP (NMFS 2017b). Based on simulations using 2017 fishing data conducted a year in advance of deployment for the 2018 ADP, the FMA predicted it would observe 4,394 fishing days at the end of 2018. In 2018, the FMA paid for 3,207 observer days, which was 27 % lower than predicted (Figure 3-1). This can partially be explained by the fact that the stratum-specific effort predicted in the 2018 ADP (NMFS 2017b) was higher than actual effort by 59.4% in the *TRW - No Tender* stratum and 51.6% in the *TRW - Tender* stratum, and lower than actual effort by 89.1% in the *POT - No Tender* stratum and 61.5% in the *POT - Tender* stratum (Table 3-1). The over-prediction of effort in the large *TRW – No Tender* stratum contributed greatly to the over-prediction of total effort.

3.6.2. Performance of the Observer Declare and Deploy System in Trip-Selection

The random selection of trips is made by the ODDS. The ODDS generates a random number according to the pre-determined rates and assigns each logged trip to either “selected to be observed” (selected) or “not selected to be observed” (not selected) categories. The NMFS observer provider has access to all selected trip information necessary to schedule observer logistics. Up to three trips may be logged in advance of fishing to provide industry users with flexibility to accommodate their fishing operations.

Logged trips have different dispositions. When initially logged, they are considered pending and can be either closed or cancelled. Whether these changes can be made by the user (person

logging the trip) or must be made by the observer provider (or the NMFS) depends on whether or not the trip is selected to be observed, the stratum the trip belongs to, and the timing of the activity. Trips can be closed (marked as complete) by the ODDS user after the planned trip departure date by either entering the dates of the trip and the port processor of the landing, or by selecting from a list of pre-populated landing reports. For partial coverage strata subject to observation, the observer provider is given 72 hours for an observer to board the vessel prior to the trip start. While a trip may be entered into ODDS that is scheduled to start earlier than 72 hours from the time of entry, if selected for observer coverage, the observer provider can opt to delay the start of the trip up to, but not exceeding 72 hours from the time of trip entry. This helps protect the observer provider from the high cost of deploying an observer with short notice. The vessel operator is protected as well by guaranteeing the assigned observer to the vessel up to 48 hours past the planned start of the fishing trip. This rule helps ensure that an observer is available to the boat in case of unforeseen events such as weather. If, however, the trip start date and time has passed by more than 48 hours, then the observer provider can cancel the trip and release the observer from the vessel and trip, and the vessel would need to log a new trip with a new 72-hour notice in place prior to fishing. These 'forced cancellations' are not present in trips that are not selected for observation since the logging, closing, or cancellation of the trip is entirely under vessel control. The vessel operator may change the dates of a logged trip regardless of selection status prior to, or in lieu of cancellation. However, trips that have not been closed at the end of the calendar year are automatically cancelled by the ODDS to prevent 2018 ODDS trips from affecting the deployment rates set for the 2019 ADP.

The number of trips logged in the ODDS in 2018 and their dispositions is summarized in Table 3-2. The forced cancellation rate by users and by the ODDS is summarized for selected trips in each stratum (Table 3-2). Of the 5,734 total trips logged, 1,125 were selected, and 179 were cancelled: 2 by ODDS (0.18%) and 177 by users (15.7%). The user cancellation rate for selected trips ranged from 3.8% for *EM HAL* to 37.5% for *TRW - Tender*.

The flexibility offered by the ODDS means that the outcome of random selection is known to the vessel operator for up to three logged trips in advance of fishing. In the case where ODDS users disproportionately cancel selected trips, one would expect observed coverage to be lower than the programmed selection rates. To reduce this potential bias, the ODDS is programmed to automatically select the vessel's next logged trip if a previously selected trip was cancelled by the user. Although these "inherited" trips preserve the *number* of selected trips in the year, they cannot prevent the *delay* of selected trips during the year. Therefore, the potential for temporal bias is still present. The percentages of selected trips from either inherits or waivers are found in Table 3-3. The relative percentage of selected trips that inherited their final selected-status due to a previous cancellation ranged from 5.1% for *EM HAL* to 44.4% for *TRW - Tender* (Table 3-3). The number of waived trips (i.e., trips given a "pass" on their required observer coverage by the NMFS) was low, with the highest level occurring in the *HAL* stratum at 2.2% (Table 3-3).

The extent to which trip-selections are changed from the time they are entered can be determined by comparing the rate of trip observation expected from 1) random selection of all logged trips (initial random selection) and 2) random selection of remaining trips after cancellations, waivers,

and inherited trips. In any case, the proportion of trips selected to be observed should fall within what would be expected given the binomial distribution (since each trip is either selected or not selected). The rates obtained (%, with associated p-value based on the binomial distribution) in the initial selection process were 16.32% (p-value = 0.256) for the *HAL* stratum, 30.15% (p-value = 0.938) for the *EM HAL* stratum, 16.38% (p-value = 0.918) for the *POT - No Tender* stratum, 22.45% (p-value = 0.346) for the *POT - Tender* stratum, 20.07% (p-value = 0.933) for the *TRW - No Tender* stratum, and 22.54% (p-value = 0.201) for the *TRW - Tender* stratum (Table 3-4). This means that there is no evidence that the ODDS was not selecting trips according to the programmed rate. The final selection rate after trips were closed, cancelled, or waived was 17.67% (p-value = 0.656) for the *HAL* stratum, 34.20% (p-value = 0.018) for the *EM HAL* stratum, 16.45% (p-value = 0.869) for the *POT - No Tender* stratum, 32.43% (p-value = 0.027) for the *POT - Tender* stratum, 20.88% (p-value = 0.462) for the *TRW - No Tender* stratum, and 36.73% (p-value = 0.001) for the *TRW - Tender* stratum (Table 3-4).

Evidence for differences between the initial and final selection rates were present in three of six partial coverage strata in 2018. In 2017, evidence for differences were present in five of six strata (AFSC and AKRO 2018). Once a separation between initial and final selection rates appears in a stratum, it tends to persist throughout the remainder of the year (Figure 3-2).

The fact that the final selection rates for most strata were greater than the initial selection rates results from the fact that cancelled trips that were originally selected for coverage are preserved through the inherit process, while cancelled trips that were not originally selected for coverage are not. These patterns are consistent with the hypothesis that trips selected for coverage are being delayed, and cancellation of selected trips results in a greater number of selected trips later in the year as the result of the inherit process. Various degrees of separation between the initial and final selection rates have been observed since the implementation of the restructured Observer Program (NMFS 2014, NMFS 2015a, NMFS 2016, NMFS 2017a, AFSC and AKRO 2018).

In addition to the inherit process, the lack of linkage between the ODDS and *e*Landings contributes to the differences between programmed selection rates in ODDS and trips that are ultimately observed. Currently, ODDS provides users with a list of Report IDs from *e*Landings from which to close their logged trips, and *e*Landings has been updated to prompt the entry of ODDS trip numbers. However, these data are not validated or error checked, making them unreliable in their current state. This linkage between the logged (ODDS) trip (with its selection probability) and its associated landing information is necessary to evaluate potential improvements in deployment efficiency within the partial coverage fleet.

3.6.3. Evaluation of Deployment Rates

This section compares the coverage rate achieved against the expected coverage rates. Data used in this evaluation are stored within the CAS (managed by the AKRO), the Observer Program database NORPAC (managed by the AFSC), and *e*Landings (under joint management by Alaska Department of Fish and Game – ADF&G; the International Pacific Halibut Commission – IPHC;

and the NMFS). Separate rate evaluations are conducted depending on whether the unit of observer deployment was at-sea fishing trips or dockside deliveries of pollock.

3.6.4. At-sea Deployments

The 2018 Observer Program had 11 different deployment strata to be evaluated. There was one full coverage stratum; it included trips taken both by vessels that were required to have full coverage (e.g., AFA vessels) and those fishing in the BSAI that opted into full coverage. There were six partial coverage strata: five observed strata defined by gear and tender designation and one regulated EM stratum for hook-and line vessels. There were two pre-implementation EM strata for pot vessels. There were also two zero coverage strata: one zero coverage EM research stratum and one zero coverage stratum for jig vessels and vessels under 40 ft. length overall.

Evaluations for the full coverage category and zero-selection pool are straightforward - either the coverage achieved was equal to 100% or 0%, respectively, or it was not. The program met expected rates of coverage in all full and zero coverage strata (Table 3-5). Partial coverage rates are expected to fall 95% percent of the time within a 95% confidence interval computed from the realized coverage rates (under the assumption of a binomial distribution for observed trips). If expected coverage levels were within the 95% confidence intervals, then we conclude that there was no evidence that coverage levels differed from the expected rates. Coverage rates were consistent with expected values in three of the six partial coverage strata, but were lower than expected within the *HAL* and *EM HAL* strata, and higher than expected in the *TRW - Tender* stratum (Table 3-5). The coverage rate for EM is based on information provided from the Pacific States Marine Fisheries Commission (PSMFC) that is available to analysts in the AFSC database. In 2018, there was considerable lag-time between the receipt and review of some *EM HAL* data, with the mean time between receipt and review being 60 days. This is compared to an average of 8 days during pre-implementation in 2016 (NMFS 2017c). By the end of 2018, PSMFC had not reviewed 62 selected *EM HAL* trips (Table 3-6). PSMFC had received data for 53 of those selected trips. The number of unreviewed *EM HAL* trips differed by month, with the highest numbers of unreviewed trips appearing in September and October Table 3-6. None of the 41 selected EM POT trips were reviewed Table 3-6, as the goal of EM POT in its pre-implementation phase was to establish a framework for receiving video, not to review video received. In total, 4,423 trips (41.6%) and 492 vessels (45.4%) were observed or monitored among all fishing in Federal fisheries of Alaska in 2018 (Table 3-5). In 2017, 4,220 trips (36.4%) and 407 vessels (36.4%) were observed (AFSC and AKRO 2018, Table 3-5).

3.6.5. Coverage Rates for Dockside Monitoring

Observers were assigned to monitor deliveries of Walleye pollock (*Gadus chalcogrammus*). The objective of this monitoring was to obtain a count of the number of salmon caught as bycatch and to obtain tissue samples for genetic analysis from these fish in each observed pollock delivery. There have been many iterations of the sampling design used to obtain genetic samples from salmon bycatch for the purposes of stock of origin (Faunce 2015). The sampling design used for this objective in 2018 remained unchanged from that used since 2011; all deliveries of Walleye pollock that are observed at sea were also observed dockside. While all Bering Sea

pollock trips and deliveries are observed, this is not the case in the GOA (NMFS 2015b). For this analysis, pollock deliveries are defined as any delivery where the predominant species is pollock in *e*Landings.

Given the design, the level of dockside observation of Walleye pollock deliveries should be 100% in the full coverage category. In 2018, 100% of full coverage Walleye pollock deliveries were observed in every port except Dutch Harbor, which had 99.7% of deliveries observed (Table 3-7). It is unclear why three pollock deliveries went unobserved in Dutch Harbor.

While expectations of the full coverage category are straightforward, evaluations of the partial coverage category are more complex. As a matter of policy, no tender deliveries are observed. While it may seem intuitive that the expected coverage rate for deliveries within the *TRW - No Tender* stratum should be equal to the programmed trip selection rate of 20.18%, this assumption is likely untrue because observers are not deployed into the pollock fishery but into the entire trawl fishery, and the relationship between the number of deliveries and trips is not expected to be constant, especially when measured across ports. Therefore, we present the dockside observation rates for the *TRW - No Tender* stratum (Table 3-7), but do not include any formal statistical tests.

Bycatch estimates of Chinook salmon in the GOA are estimated using methods described in Cahalan et al. (2015). In the event that a delivery cannot be monitored (e.g., the case in a tendered delivery or non-pollock delivery), then estimation of bycatch comes by applying salmon bycatch rates to landed catch. Estimates of stock of origin from salmon bycatch are produced by the AFSC's Auke Bay Laboratories (e.g., Guthrie et al. 2017).

3.7. Sample Quality

3.7.1. Temporal Patterns in Trip-Selection

The cumulative number of fishing trips in each stratum was multiplied by the stratum-specific selection rate to obtain the expected number of observed trips. Under the assumption that there is no temporal bias in observer coverage, 2.5% of values should be larger than the upper 95% confidence limit and 2.5% should be smaller than the lower limit. At the end of 2018, the number of observed trips was outside of this expected range in three of the six partial coverage strata: EM HAL (expected rate = 0.300, realized rate = 0.220, p-value = 0.000), HAL (expected rate = 0.173, realized rate = 0.155, p-value = 0.041), and TRW – Tender (expected rate = 0.167, realized rate = 0.350, p-value = 0.005; Figure 3-3). Coverage rates were outside of the expected range for 25.8%, 23.8%, and 33.2% of the year for the EM HAL, HAL, and TRW - Tender strata, respectively. Coverage rates were also outside of the expected range for 0.5% of the year for the POT – Tender stratum, although this stratum ended the year within its expected range of coverage (expected rate = 0.174, realized rate = 0.290, p-value = 0.097). Coverage rates were within their expected ranges for 100% of the year for the POT – No Tender (expected rate = 0.162, realized rate = 0.155, p-value = 0.665) and TRW – No Tender (expected rate = 0.202, realized rate = 0.203, p-value = 0.908) strata. Overall, there appeared to be less temporal bias in 2018 than in 2017, when three of six partial coverage strata had coverage rates outside of the

expected range for the majority of the year, including the *POT - No Tender* stratum, which had a higher than expected coverage rate for 100% of the year (AFSC and AKRO 2018).

3.7.2. Spatial Patterns in Trip-Selection

Under a strictly random selection of trips and with a large enough sample size, the spatial distribution of observed trips should reflect the spatial distribution of all trips. The hypergeometric distribution can be used to describe the results of sampling from a population of items (fishing trips) with different characteristics (NMFS Area fished). The expected number of trips based on this distribution is the sample rate multiplied by the number of trips that fished in an area (observed and unobserved). Using this method, we compared the expected number of trips and the observed number of trips in each NMFS Reporting Area and stratum combination (Figure 3-4). Note that in most cases, the sampling result is close to the expected result; larger differences tend to be associated with lower numbers of trips within a NMFS Area.

Using landings data, we calculated the probability of observing at least the number of trips we did observe within a stratum and NMFS Area. This calculation uses the sampling rate and the distribution of trips across NMFS Reporting Areas. This evaluation does not test whether the resulting coverage rate in a NMFS Area for a stratum is equal to the stratum selection rate, but instead tests whether the actual coverage rate (realized rate) in a NMFS Area for a stratum is unexpected compared to the stratum-wide realized observation rate. For the purposes of the following discussion, NMFS Areas with an unexpected number of trips (probability of our result is less than 0.05) are considered "low-p" areas.

The HAL stratum

Given that there were 19 NMFS Areas fished in *HAL*, we would expect there to be $0.05 \times 19 \approx 1$ low-p area for this stratum. There were three. The percent of trips observed among NMFS Areas in this stratum ranged from 0% to 25.5% (median = 8.5%). The probability of these coverage rates or rates that deviated further from expected values is depicted in Figure 3-5. These results mean that there was some clustering of observed trips among NMFS Areas that was different from expected. Some spatial bias appears to have occurred in the HAL stratum.

The EM HAL stratum

Given that there were 14 NMFS Areas fished in *EM HAL*, we would expect there to be $0.05 \times 14 \approx 1$ low-p area for this stratum. There was one. The percent of trips observed among NMFS Areas in this stratum ranged from 0% to 50% (median = 23.3%). The probability of these coverage rates or rates that deviated further from expected values is depicted in Figure 3-6. These results mean that there was no clustering of observed trips among NMFS Areas that was different from expected. No spatial bias appears to have occurred in the *EM HAL* stratum.

The POT - No Tender stratum

Given that there were 14 NMFS Areas fished in *POT - No Tender*, we would expect there to be $0.05 \times 14 \approx 1$ low-p area for this stratum. There was one. The percent of trips observed among NMFS Areas in this stratum ranged from 0% to 55.6% (median = 15.8%). The probability of these coverage rates or rates that deviated further from expected values is depicted in Figure 3-7.

These results mean that there was no clustering of observed trips among NMFS Areas that was different from expected. No spatial bias appears to have occurred in the POT - No Tender stratum.

The TRW - No Tender stratum

Given that there were 9 NMFS Areas fished in *TRW - No Tender*, we would expect there to be $0.05 \times 9 \approx 0$ low-p areas for this stratum. There were two. The percent of trips observed among NMFS Areas in this stratum ranged from 0% to 57.9% (median = 19.9%). The probability of these coverage rates or rates that deviated further from expected values is depicted in Figure 3-8. These results mean that there was some clustering of observed trips among NMFS Areas that was different from expected. Some spatial bias appears to have occurred in the *TRW - No Tender* stratum.

The POT - Tender stratum

Given that there were six NMFS Areas fished in *POT - Tender*, we would expect there to be $0.05 \times 6 \approx 0$ low-p areas for this stratum. There was one. The percent of trips observed among NMFS Areas in this stratum ranged from 0% to 66.7% (median = 34.3%). The probability of these coverage rates or rates that deviated further from expected values is depicted in Figure 3-9. These results mean that there was some clustering of observed trips among NMFS Areas that was different from expected. Some spatial bias appears to have occurred in the *POT - Tender* stratum.

The TRW - Tender stratum

Given that there were 4 NMFS Areas fished in *TRW - Tender*, we would expect there to be $0.05 \times 4 \approx 0$ low-p areas for this stratum. There were two. The percent of trips observed among NMFS Areas in this stratum ranged from 0% to 100% (median = 18.4%). The probability of these coverage rates or rates that deviated further from expected values is depicted in Figure 3-10. These results mean that there was some clustering of observed trips among NMFS Areas that was different from expected. Some spatial bias appears to have occurred in the *TRW - Tender* stratum.

3.7.3. Trip Metrics

This section is focused on answering one question related to the deployment of observers: are observed trips similar to unobserved trips? A permutation test (a.k.a., randomization test) was used to answer this question. This test evaluates the question "How likely is the difference we found if these two groups have the same distribution (in the metric we are comparing)?" Permutation tests compare the actual difference found between two groups to the distribution of many differences derived by randomizing the labels defining the two groups (e.g., observed and unobserved). Difference values in the permutation test were calculated by subtracting the mean metric value for the "No" condition from the mean metric value for the "Yes" condition. For example, the difference between vessel lengths in a permutation test for an observer effect would be the mean value for unobserved trips subtracted from the mean value for all observed trips. By randomizing group assignments, the combined distribution of randomized differences represents the sampling distribution under the null hypothesis that the two groups are equal. In this report

1,000 randomized trials are run for the permutation test. The p-value from the test is calculated as the number of randomized trials with greater absolute differences than the actual difference divided by the number of randomized trials. Similar to the other statistical tests used in this report, low p-values (< 0.05) indicate unlikely events under the hypothesis of equality and are therefore considered evidence against that hypothesis. In an attempt to improve clarity, although five values are calculated in the test; 1) the difference between groups, 2) the mean difference between groups from randomized trials, 3) #1 expressed as a percentage of the mean value of the metric being tested, 4) #2 expressed as a percentage of the mean value of the metric being tested, and 5) the p-value of the test, only values one, three and five are presented.

Six trip metrics were examined in the permutation test. These metrics were as follows: the number of NMFS Areas visited in a trip, trip duration (days), the weight of the landed catch (t), the vessel length (ft), the number of species in the landed catch, and the proportion (0 to the most predominant species (pMax). The metric vessel length is used to help interpret the results from landed weight of catch since fishing power is positively correlated to vessel length. Specifically, differences in weight *and* length are interpreted as a failure to achieve a random sample of vessels of different sizes, whereas differences in weight only lend more evidence that there is an observer effect. The number of species within the landed portion of the catch is a measure of species richness. Our pMax metric follows the concepts behind Hill's diversity number N1 that depicts the number of abundant species (Hill 1973) and is a measure of how "pure" catch is since a value of one would indicate that only the predominant (and presumed desirable) species was landed.

Are Observed Trips Similar to Unobserved Trips?

This comparison is the basis for examining if there is an observer effect (i.e., differential behavior when observed compared to when not observed) within partial coverage trips. Sample sizes for this test are presented in Table 3-8, and the results discussed below are presented in Table 3-9.

Of the six metrics compared in the *EM HAL* stratum, one had low p-values. Observed trips in this stratum landed 9.7% (0.439) more species than unobserved trips. Of the six metrics compared in the *HAL* stratum, two had low p-values. Observed trips in this stratum were 14.3% (0.8 days) shorter in duration and landed catch that weighed 15.6% (1.005 metric tons) less than unobserved trips. Of the six metrics compared in the *POT - No Tender* stratum, one had a low p-value. Observed trips in this stratum landed 14.3% (0.29) more species than unobserved trips. Of the six metrics compared in the *POT - Tender* stratum, there were no metrics with low p-values. Of the six metrics compared in the *TRW - No Tender* stratum, two had low p-values. Observed trips in this stratum occurred in 3% (0.03) fewer areas and were 9.4% (0.26 days) shorter in duration than unobserved trips. Of the six metrics compared in the *TRW - Tender* stratum, there were no metrics with low p-values. A visual depiction of individual results of this permutation test for the HAL, POT - No Tender, and TRW - No Tender strata is given in Figure 3-11 for illustration purposes.

Based on these results, there is some evidence for differences between observed and unobserved trips for *EM HAL*, *HAL*, *POT – No Tender* and *TRW – No Tender* strata, implying that observed trips are not entirely representative of all trips taken for those strata. With 36 statistical tests in total, we would expect 0.05×36 = 1.8 tests to have p-values below 0.05 by chance (assuming independent tests) when there are no differences between observed and unobserved trips – we observed 6 such results. Note that while some of the observed differences in the two POT strata seem quite large, sample sizes were very small (Table 3-8), making it difficult to detect differences statistically.

Gear, Tender, and Observed Status Combinations

Since 2013, permutation tests have been used to analyze the differences between observed trips and unobserved trips within strata. One of the analyses done by the permutation test is to compare trip lengths (in days) between observed and unobserved trips and determine whether there were significant differences. However, these permutation tests do not visually map the data for observed and tendered states together. To accomplish this, a plot of the trip durations for these states is included as Figure 3-12. These plots visually display data that complements the results of the permutation test, showing that trip duration differs with observed status most notably in the *HAL* and *TRW – No Tender* strata, and observed trips tend to be shorter.

3.8. Adequacy of the Sample Size

In a well-designed sampling program, the observer coverage rate should be large enough to reasonably ensure that the range of fishing activities and characteristics are represented in the sample data. The Catch Accounting System post-stratifies data into groups of fishing activities with similar trip characteristics such as gear, trip targets, and NMFS Area (Cahalan et al. 2014). At low numbers of trips and low sampling rates, the probability of no observer data within a particular post-stratum is increased and may result in expansions of bycatch rates from one type of fishing activity against landings for a different type of fishing activity. This will result in biased estimates of bycatch. For this reason, it is important to have a large enough sample (observed trips and vessels) to have reasonable expectation of observing all types of fishing.

Over the course of an entire year, some NMFS Areas have low fishing effort and as a result have a relatively high probability of being missed by the simple random sampling represented by observer deployments. The fishing effort data for each stratum and the number of observed trips over the course of 2018 was used to illustrate their combined effect on the probability of a NMFS Area containing observer data using the hypergeometric distribution (Figure 3-13). From this figure it can be seen how 1) the likelihood of at least one observation is increased with fishing effort and 2) is also increased with an increase in the selection rate. Given our sampling rates in the 6 partial coverage trip-selection strata, the probability of having no observed trips in a NMFS Reporting Areas increases quickly above 0.05 when there are fewer than 11 trips in the *EM HAL* stratum, 18 trips in the *HAL* stratum, 17 trips in the *POT - No Tender* stratum, 7 trips in the *POT - Tender* stratum, 13 trips in the *TRW - No Tender* stratum, and 6 trips in the *TRW - Tender* stratum in a given area. Including additional factors such as week, gear, and target will

decrease the number of trips with the same characteristics and hence increase the probabilities of obtaining no observer data of that character (post-strata of the CAS).

3.9. Responses to Council and SSC Comments

The SSC has requested that a specific section with responses to SSC comments be provided in the written report, as is done for SAFE documents. This section addresses comments (in italics) made by the Council and the SSC in response to the presentation of the 2017 Annual Report at the June 2018 Council meeting.

The Council offered the following comments:

Include an evaluation of observer effects at finer resolution than gear-level strata, so that observer effects in pelagic and non-pelagic trawl can be investigated.

This analysis has been conducted using multiple years of data and constitutes Appendix A. We have included results from multiple years to test the stability of results between years.

Continue to provide details on EM in Chapter 4 and also include information in the report about the number of EM trips selected, the number monitored, and the number reviewed, for clarification.

While the Council specifically mentions Chapter 4, most of the requested data are summarized in Chapter 3. These include: the number of EM trips taken, the number of EM trips selected, the number of EM trips that had an associated hard-drive received, and the number of EM trips selected and reviewed. These data are provided for both the regulated EM HAL stratum and the EM POT strata, which were under pre-implementation in 2018.

Add an appendix that describes details of cost calculations for EM and observer days over time.

This was not addressed in Chapter 3 but cost information is provided in Chapter 2.

The Council also recommends that NMFS communicate with the OAC on the results from the proposed ODDS agency subgroup.

Our response to this is addressed in SSC comments below.

The SSC offered the following recommendations to the Observer Program:

(June) The behavior of the ODDS system with respect to inheritance of trip selection after a trip is cancelled leads to temporally biased sampling of some strata, with many, or most, observed trips coming very late in the season. The SSC concurs with the NMFS recommendation that a sub-group be created to evaluate system behavior and identify ways to obtain broader, more representative observer coverage throughout the season.

(Oct.) The SSC notes that when a trip is designated to be observed via ODDS, but is then canceled, the subsequent trip for that vessel inherits the "observed" status. This systematically shifts sampling effort later in the season, generating temporal bias. Recognizing this, a Trip

Inheritance Group has been formed by NMFS. The SSC looks forward to the Trip Inheritance Group's recommendations to resolve this issue.

Staff working on ODDS have first been tasked with documenting the architecture and decision logic of the existing system. Progress on this item can be tracked in the document 'Analytical Tasks Related to the Observer Program' with a task entitled 'Agency ODDS Subgroup'. Once this task is complete, staff will focus on amending (if necessary) trip logging and cancellation rules.

(June) We reiterate that, while the SSC recognizes that development of variances for use in planning of deployments and stock assessment is ongoing, ***we urge the analysts to initiate a comparison of the likely magnitude of bias that has been detected between observed and unobserved trips with the overall magnitude and precision of discard or PSC that is being monitored for compliance by management.*** *The analysts note in the report that further clarification and conversation with the SSC is needed and we look forward to this exchange.*

The differences between observed and unobserved measures of retained catch, NMFS Areas, etc. in Chapter 3 likely do not directly translate to bias in PSC estimates. While it remains unclear to the OSC how such an analysis would be conducted, we note that this task should be included in the 'Analytical Tasks Related to the Observer Program' as a task entitled 'Observer Program Performance Metrics'. Staff have yet to be assigned to this issue.

(June) While the SSC supports the NMFS recommendation to use the same observer trip selection strata in 2019 as in 2018, in cases where there are multiple gear types in a stratum (e.g., pelagic and non-pelagic trawls) the SSC recommends analysis of the results by gear type separately in addition to analysis aggregated to the stratum level. Such disaggregation will avoid masking of gear-specific differences in catch composition and other factors that could provide justification for possible further subdivision of strata.

This analysis has been conducted using multiple years of data and constitutes Appendix A.

Following Council direction, we have limited our comparisons to pelagic and non-pelagic trawl. We have included results from multiple years to test the stability of results between years.

(June) The SSC remains concerned that performance metrics from EM pre-implementation have not been fully evaluated prior to full implementation of EM in the observer program. We look forward to seeing a full evaluation of this program as soon as is practical, as well as an evaluation of the tradeoffs between use of EM and the existing partially observed coverage category. As the Council considers continued growth of the EM program, it will be important to conduct appropriate cost comparisons, specifically including video review costs, as well as an evaluation of the ability of EM versus onboard observer data to meet program needs.

The Alaska Fisheries Science Center has embarked on a project to evaluate how loss of biological data resulting from EM expansion has and will affect its data products including stock assessments. This initial 'scoping' document is planned to be completed in time for the October Council meeting, conditional on the fact that FMA staff are not needed for the draft ADP compilation. Costs and design of the EM program are not planned to be addressed since we feel

they are best addressed in the existing ADP process in years when EM is funded from fee revenue.

(June) Compliance and enforcement issues remain a problem within the observer program that are contributing to bias, fluctuate substantially among years, and may be substantially underreported for a variety of social and safety reasons. The SSC encourages the training of crew fleet-wide on the necessity of the observing program to proper fishery management and how crew can contribute to the success of the program by interacting appropriately with observers. It is critical that these issues be addressed immediately.

(Oct.) Another item in the June 2018 SSC minutes that has not yet been addressed was fleet-wide training of crew on the necessity of the observer program. The SSC reiterates that compliance and enforcement issues remain a problem within the observer program that are contributing to bias, fluctuate substantially among years, and may be substantially underreported for a variety of social and safety reasons. This was highlighted as a critical need to be addressed immediately.

We agree with the SSC recommendations above and add that the 2018 Annual Report includes a new appendix in which the FMA has conducted an exploratory analysis of observer statements conditioned by the amount of observer and vessel combinations or the amount of time observers were on a vessel (Appendix D). This standardization of statement summaries into rates is the first of its kind for observer statement data.

3.10. OSC Recommendations to Improve Data Quality

3.10.1. Recommendations from the 2017 Annual Deployment Review

The Observer Science Committee made the following recommendations in its 2017 review of observer deployment to be considered in developing the 2019 ADP (NMFS 2018b). Following each italicized recommendation is the outcome of that recommendation.

The Observer Science Committee's Recommendations to improve the 2019 ADP were as follows:

1. *The OSC has three recommendations regarding the ODDS, its relationship to eLandings, and the effect of cancellations on achieved coverage:*
    a. *The OSC reiterates its 4-year recommendation that the NMFS improve the linkages between ODDS and eLandings (OSC recommendation for 2013, 2014, 2015, 2016 version of this Review).*

While the ability to review *e*Landings associated with a vessel in ODDS is already facilitated, and entry of an ODDS number associated with a landing is already facilitated in *e*Landings, decisions need to be made as to which of two models would be best to move forward with. Without direction on which option (model) to proceed with, no progress has been made on this issue. Outreach and education of the NMFS decision with industry would be necessary before implementation of either option.

b. *OSC reiterates its 3-year recommendation that the NMFS explore ways to reduce the impact of cancellations on the number of trips selected for observer coverage in the ODDS (OSC recommendation from the 2014, 2015, and 2016 version of this Review). This may be accomplished in a variety of ways that include, but are not limited to the following: reducing the number of trips that can be logged in advance, and/or reducing the incentive or ability to cancel trips selected for observer coverage or EM, since the ability to change dates is already facilitated.*

Most of these proposed solutions are already enabled in ODDS but are only applied in special circumstances. The ability to change dates has been facilitated in ODDS since its inception. For unselected trips, the operator needs only to change the dates in ODDS. Although special rules apply for trips logged within 72 hours of departure, the ability of an operator to change dates for selected trips is still facilitated but must be made through coordination with the observer provider. New restrictions on the number of trips a vessel operator can log into ODDS was implemented with the addition of EM vessels to ODDS in 2018, although they only apply to vessels that have special VMP or Appeal status changes. Should FMA desire to change the business rules to ODDS for the upcoming year, they could be enacted quickly by FMA technical staff. However, outreach and education of NMFS decision with industry would be necessary before implementation.

c. *This is the first year in which the OSC recommends that NMFS form an agency sub-group to document the way in which the ODDS currently operates and to describe alternatives for how it can be improved, particularly in regards to points a and b and whether technical improvements to ODDs could address these issues.*

In 2019 funds were received and a person hired to conduct this project. At the time of this writing three of six ODDS modules have been documented, and a list of recommended improvements is ongoing. This project is scheduled to be completed by the end of the calendar year.

2. *The OSC has two recommendations concerning stratification:*

a. *The OSC recommends that the strata be kept the same between the 2018 and 2019 ADPs. These strata are as they were in 2017, with the exception of combining the HAL - No Tender and HAL - Tender strata into one HAL stratum. The OSC makes this recommendation both to preserve stability in methods across years, and because further stratification would likely decrease sample size within some strata to undesirably small sizes, as was seen with the HAL - Tender stratum in 2017.*

This recommendation was implemented in the final 2019 ADP.

b. *The OSC provided evaluation of the Council's request to explore differences between NPT and PTR gear. Based on this evaluation, which considers factors pertinent to stratification, the OSC recommends against stratifying trawl trips by pelagic and non-pelagic gear types. The supporting analysis for this recommendation can be found in Appendix A [of the 2017 Annual Report; AFSC and AKRO 2018].*

Trawl gear was not split by NPT or PTR gear in the 2019 ADP.

3. *The OSC has two recommendations concerning future at-sea coverage rates for observers (and potentially monitoring):*

    a. *We reiterate our recommendation from last year that sampling rates in future ADPs be high enough in each stratum to maximize the probability of achieving three observed trips in each of the NMFS Areas.*

The 2019 ADP established a base-coverage rate of 15% above which available sea days are allocated according to a blended optimization routine focused on PSC fishes (Council intent). While the choice of this base coverage rate among all strata has been debated by the FMAC, numerous analyses performed by members of the OSC for the Council and NMFS have demonstrated that the likelihood of observing at least one or three trips within a stratum and area domain are increased dramatically up to 15% coverage above which the magnitude of additional gains are reduced.

    b. *The OSC recommends that future ADPs include, as one option, a sample design in which strata are selected at the same rate. Although this design could be considered a baseline used for making comparisons to other proposed designs, under some scenarios, this option may be recommended.*

This design was included in the draft 2019 ADP.

4. *The OSC recommends that the performance standards used to evaluate observer effects in the Annual Report be reassessed by the OSC. The performance standards were developed in 2013 with the restructuring of the Observer Program and have yet to be reviewed. The original purpose of this set of indicators was to evaluate the differences between the unobserved and observed population of trips using available information for the two groups; information that can be directly measured in both groups (e.g., total weight of landed catch). These metrics have been useful for evaluating whether the deployment of observers into the sampling strata has resulted in a representative sample of trips. However, an evaluation has not been conducted that relates these metrics to at-sea information. Additionally, the magnitude of the differences (the effect size) has not been evaluated relative to whether differences seen between the two groups are meaningful in the context of the overall data. We recommend evaluating the suite of metrics in context with how they relate to at-sea data collections and, to the extent feasible, provide additional information regarding interpretation of effect sizes and p-values (e.g., consideration of sample sizes).*

In recognition of the fact that the current methods have the drawback of multiple comparisons, we continue to focus on family-wide error rates when interpreting p-values. However, we acknowledge that in the public arena anyone 'significant' test result can be misinterpreted. OSC members met during March and April 2019 to discuss this issue but were unable to come to a conclusion about how best to proceed. No change to the performance metrics were made for the 2018 Annual Report. Model-based approaches are being considered as an alternative because of the ability to focus on a single factor (observer effects) while controlling for other effects (strata,

vessel size, gear). 'Plans to explore alternative approaches to evaluating observer effects' should be added to the list of analytical priorities related to the observer program maintained for the Council by the Alaska Regional Office.

3.10.2. Recommendations to Improve Data Quality and Guide the 2020 ADP

The OSC continues to be concerned about the consistently high cancellation rates for selected trips in tendering stratum, and notes that most issues reported to Office of Law Enforcement (OLE) by FMA related to ODDS now focus on tendering strata definitions.

We recommend that the ODDS trip logging and cancellation rules be re-evaluated and communicated to the Council and industry as soon as possible.

We recommend that draft 2020 ADP stratification designs include a re-examination of tendering strata. This may be accomplished in a variety of ways not limited to eliminating tendering stratum altogether or holding selection rates the same between tendered and non-tendered stratum within a gear type.

There has been continued interest by the Council in the evaluation of observer effects between PTR and NPT types of trawl gear. In response to the Council's June 2017 request, a detailed analysis of the issue was provided in Appendix A of the 2017 Annual Report (AFSC and AKRO 2018). Despite this analysis, the Council again asked for another analysis of this issue in their June 2018 review of the Annual Report. We have included the raw results of permutation tests in response to the Council's continued request. We continue to hold concerns with this analysis and defer to our conclusion contained within Appendix A of the 2017 Annual Report: **the OSC does not recommend stratification by type of trawl gear (i.e., NPT and PTR** strata**).** Briefly, this analysis is complicated by the fact that trips occur with both sub-gear types and results differ between years. This exposes the analyses to the Simpsons' paradox, wherein the results of numerous tests of different aggregations contradict each other. While the number of low probability tests exceeded the number of tests expected by a greater amount for non-pelagic than for pelagic trawl, we point out that both sub-gear types exhibited evidence that data from the observed trips are not likely to be representative of total trips for some metrics between years. We strongly recommend against the creation of a separate ADP strata for these sub-gear types for the following reasons. First, vessels may carry both gear types on a trip, and which of these will be fished is not necessarily known before a trip begins. This is important because definitions of which stratum a trip belongs to is necessary for the correct selection rate to be applied to the trip. Second, post-stratification methods in the Catch Accounting System already correctly account for differences in sampling effort between NPT and PTR trips. Third, we must look to our past and draw from our experience with creating tendering stratum for each gear type. This effort has been marginally successful. Although the selection rate for those trips is known, there are now so few trips in these strata that evaluating whether or not observer deployments were successful in gathering representative data has become difficult. It is at least worth exploring whether current sample sizes of the observer program can support such a split between sub gear types for the purposes of creating new ADP strata and whether the uncertainty in gear type known before the trip can be overcome.

We recommend continuation of the baseline + optimization approach for determining coverage levels among strata. Based on the results of analyses presented at the October 2018 Council meeting, we do not see strong evidence to reduce gear-specific baseline coverage levels below 15%.

The lack of coverage for the end of 2018 in the EM HAL stratum was apparently due to a lack of EM review. **We recommend that EM review rates be set to ensure that the entire year is sampled and review is timely enough so that data from EM can be used for catch accounting and fisheries monitoring as envisioned by the Council.** EM selection and EM review rates in the 2020 ADP may be calculated using existing ADP protocols as long as costs for EM are available.

Table 3-1. – Comparison between predicted and actual trip days for partial coverage strata in 2018. Predicted values come from the 2018 Annual Deployment Plan (ADP).

Strata	Predicted number of trip days in ADP	Actual number of trip days	% Difference from predicted
HAL	9,736	10,608	9.0
POT - No Tender	1,470	2,780	89.1
POT - Tender	169	273	61.5
TRW - No Tender	11,667	4,742	-59.4
TRW - Tender	552	267	-51.6
Total	23,594	18,670	-20.9

Table 3-2. -- Trip cancellation rates in the ODDS for 2018. A trip is cancelled by the system if the user did not identify whether fishing had occurred by the end of the year. "Paper" indicates that a trip was logged when the ODDS was not available.

Strata	Random number outcomes	Logged (*a*)	Cancelled by system (*b*)	Trips remaining (*c* = *a*-*b*)	Cancelled by user (*d*)	Paper	% User cancellation (*d*/*c* * 100)
HAL	Not Selected	1,820				0	
HAL	Selected	355	2	353	84	0	23.8
EM HAL	Not Selected	542				0	
EM HAL	Selected	234	0	234	9	0	3.8
POT - No Tender	Not Selected	577				0	
POT - No Tender	Selected	113	0	113	21	0	18.6
POT - Tender	Not Selected	38				0	
POT - Tender	Selected	11	0	11	3	0	27.3
TRW - No Tender	Not Selected	1,577				0	
TRW - No Tender	Selected	396	0	396	54	0	13.6
TRW - Tender	Not Selected	55				0	
TRW - Tender	Selected	16	0	16	6	0	37.5
Total	Not Selected	4,609				0	
Total	Selected	1,125	2	1,123	177	0	15.8

Table 3-3. -- Number of remaining trips after cancellation in each trip-selection strata (HAL, POT - No Tender, POT - Tender, TRW - No Tender, TRW - Tender, and EM HAL) that were selected using the initial random number generator (Random Number Selection) and those that remained after user manipulation (Total Final Selected). The relative impact of waivers in trip-selection is also shown (% Reduction of Selected Trips due to Waivers). **Not from random numbers.

Strata	Total trips	Random number selection (*r*)	Inherited selection** (*i*)	Randomly selected but waived (*w*)	Total final selected (*T*=*r*+*i*-*w*)	% Selected from inherits ((*i*/*T*)*100)	% Reduction of selected trips due to waivers (*w*/(*T*+*w*)*100)
HAL	1,726	269	43	7	305	14.1	2.2
EM HAL	692	225	12	2	236	5.1	0.8
POT - No Tender	608	92	10	2	100	10.0	2.0
POT - Tender	37	8	4	0	12	33.3	0.0
TRW - No Tender	1,796	342	33	0	375	8.8	0.0
TRW - Tender	49	10	8	0	18	44.4	0.0

Table 3-4. -- Number of logged trips in each partial coverage stratum (HAL, POT - No Tender, POT - Tender, TRW - No Tender, TRW - Tender, and EM HAL) that were selected using the initial random number generator (Random Selection Only) and those that remained after user manipulation (Final Expected). The relative impact of waivers in trip-selection is also shown (No Waivers).

Strata	Trip disposition	Selected trips	Total trips	Actual selection (%)	Programmed selection (%)	p-value (H0: Actual = Programmed)
HAL	Initial Random Selection, *a*	355	2,175	16.32	17.26	0.256
	After Cancellations, *b* (*a*-*b*)	269	1,726	15.59	17.26	0.069
	With Inherits, *c* (*a*-*b*+*c*)	312	1,726	18.08	17.26	0.372
	After Waivers, *d* (*a*-*b*+*c*-*d*)	305	1,726	17.67	17.26	0.656
EM HAL	Initial Random Selection, *a*	234	776	30.15	30.00	0.938
	After Cancellations, *b* (*a*-*b*)	225	692	32.51	30.00	0.158
	With Inherits, *c* (*a*-*b*+*c*)	238	692	34.39	30.00	0.013
	After Waivers, *d* (*a*-*b*+*c*-*d*)	236	692	34.10	30.00	0.020
POT - No Tender	Initial Random Selection, *a*	113	690	16.38	16.21	0.918
	After Cancellations, *b* (*a*-*b*)	92	608	15.13	16.21	0.509
	With Inherits, *c* (*a*-*b*+*c*)	102	608	16.78	16.21	0.700
	After Waivers, *d* (*a*-*b*+*c*-*d*)	100	608	16.45	16.21	0.869
POT - Tender	Initial Random Selection, *a*	11	49	22.45	17.39	0.346
	After Cancellations, *b* (*a*-*b*)	8	37	21.62	17.39	0.514
	With Inherits, *c* (*a*-*b*+*c*)	12	37	32.43	17.39	0.027
	After Waivers, *d* (*a*-*b*+*c*-*d*)	12	37	32.43	17.39	0.027
TRW - No Tender	Initial Random Selection, *a*	396	1,973	20.07	20.18	0.933
	After Cancellations, *b* (*a*-*b*)	342	1,796	19.04	20.18	0.240
	With Inherits, *c* (*a*-*b*+*c*)	375	1,796	20.88	20.18	0.462
	After Waivers, *d* (*a*-*b*+*c*-*d*)	375	1,796	20.88	20.18	0.462
TRW - Tender	Initial Random Selection, *a*	16	71	22.54	16.67	0.201
	After Cancellations, *b* (*a*-*b*)	10	49	20.41	16.67	0.446
	With Inherits, *c* (*a*-*b*+*c*)	18	49	36.73	16.67	0.001
	After Waivers, *d* (*a*-*b*+*c*-*d*)	18	49	36.73	16.67	0.001

Table 3-5. -- Number of total vessels (V), sampled vessels (v), total trips (N), sampled trips (n) for each stratum and observer deployment method (vessel and trip-selection) in 2018. The expected coverage and 95% confidence interval columns are expressed as percentages of the total number of trips taken within each stratum. Fleet totals are reported with and without EM data since EM were not used for catch estimation in 2018.

Coverage	Strata	*V*	*v*	*N*	*n*	Realized coverage	Expected coverage	95% Confidence Interval lower limit	95% Confidence Interval upper limit	Realized meets expected?
Full	FULL	159	159	3,400	3,400	100.0	100.0			Yes
Partial	HAL	364	176	1,990	309	15.5	17.3	14.0	17.2	No
Partial	EM HAL	120	81	767	174	22.7	30.0	19.8	25.8	No
Partial	POT - No Tender	73	53	626	97	15.5	16.2	12.7	18.6	Yes
Partial	POT - Tender	15	7	31	9	29.0	17.4	14.2	48.0	Yes
Partial	TRW - No Tender	76	67	1,864	378	20.3	20.2	18.5	22.2	Yes
Partial	TRW - Tender	18	11	40	14	35.0	16.7	20.6	51.7	No
Gear-based Total		602	364	5,318	981	18.4				
Partial	EM POT - No Tender	17	12*	163	41*	25.2*	30.0	18.7	32.5	Yes
Partial	EM POT - Tender	1	1*	1	1*	100.0*	30.0	2.5	100.0	Yes
Partial	Zero Coverage	361	0	1,725	0	0.0	0.0			Yes
Partial	Zero EM Research	3	0	23	0	0.0	0.0			Yes
Total Fleet (without EM POT)	Total	1084	484	10,630	4,381	41.2% Trips; 44.6% Vessels				

*Values for sampled trips and realized coverage for EM POT strata are based on EM hard drives received, not actual data reviewed. See Table 3-6 for review data.

Table 3-6. -- The number of EM hard drives received and reviewed by gear type and month. Totals may differ from Table 3-5 since trip start date was used to define trips here, rather than the landing date used to define trips in Table 3-5.

Gear	Data reviewed?	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Total
EM HAL	Yes	3	5	19	42	41	21	10	17	16	0	0	0	174
EM HAL	No	0	0	0	3	2	4	3	5	14	29	2	0	62
EM POT	No	19	2	0	0	1	2	1	1	8	2	2	3	41

Table 3-7. -- The number of TRW - No Tender Pollock deliveries by port and coverage category. IFP: Inshore Floating Processor, Hbr: Harbor.

FMP	Coverage category	Port	Total deliveries (*N*)	Observed deliveries (*n*)	% Observed
Bering Sea	Full	Akutan	817	817	100.0
Bering Sea	Full	Dutch Hbr.	1,121	1,118	99.7
Bering Sea	Full	IFP	2	2	100.0
Bering Sea	Full	King Cove	81	81	100.0
Bering Sea	Full	Sand Point	12	12	100.0
Total	Full		2,033	2,030	99.9
Gulf of Alaska	Partial	Akutan	78	18	23.1
Gulf of Alaska	Partial	King Cove	1	0	0.0
Gulf of Alaska	Partial	Kodiak	1,087	216	19.9
Gulf of Alaska	Partial	Sand Point	273	46	16.8
Total	Partial		1,439	280	19.5

Table 3-8. -- Number of trips by observation status in the 2018 trip-selection strata.

Strata	Observed	Unobserved
HAL	309	1,681
EM HAL	174	593
POT - No Tender	97	529
TRW - No Tender	378	1,486
POT - Tender	9	22
TRW - Tender	14	26

Table 3-9. -- Results of permutation tests between observed and unobserved trips in the 2018 trip-selection strata. OD: Observed difference (Observed - Unobserved).

Strata	Metric	NMFS areas	Days fished	Vessel length (ft)	Species landed	pMax species	Landed catch (t)
EM HAL	Observed difference	0.003	-0.113	0.361	0.387	-0.007	0.143
	OD (%)	0.267	-2.179	0.684	9.700	-0.824	2.108
	p-value	1.000	0.557	0.660	0.022	0.558	0.727
HAL	Observed difference	0.024	-0.760	-0.568	0.049	0.008	-1.048
	OD (%)	2.158	-14.345	-1.037	1.372	0.946	-15.593
	p-value	0.267	< 0.001	0.439	0.694	0.301	0.004
POT - No Tender	Observed difference	-0.019	-0.103	2.098	0.288	0.007	1.842
	OD (%)	-1.821	-2.337	2.732	14.296	0.743	5.632
	p-value	0.523	0.663	0.481	0.024	0.087	0.581
POT - Tender	Observed difference	0.131	-0.510	12.449	0.061	-0.004	49.863
	OD (%)	11.631	-5.792	14.580	2.646	-0.424	29.994
	p-value	0.688	0.891	0.214	1.000	0.294	0.647
TRW - No Tender	Observed difference	-0.032	-0.256	-1.480	-0.096	0.015	-4.352
	OD (%)	-3.040	-9.403	-1.750	-1.657	1.590	-4.549
	p-value	0.024	0.042	0.124	0.676	0.073	0.070
TRW - Tender	Observed difference	0.071	1.819	3.593	0.308	-0.004	122.714
	OD (%)	6.969	27.262	5.800	5.806	-0.407	51.755
	p-value	0.359	0.125	0.299	0.599	0.897	0.197

Figure 3-1. -- Actual paid sea days in 2018 (dotted line) in relation to the range of potential budgetary outcomes estimated in December 2017 for the Final 2018 Annual Deployment Plan (vertical bars).

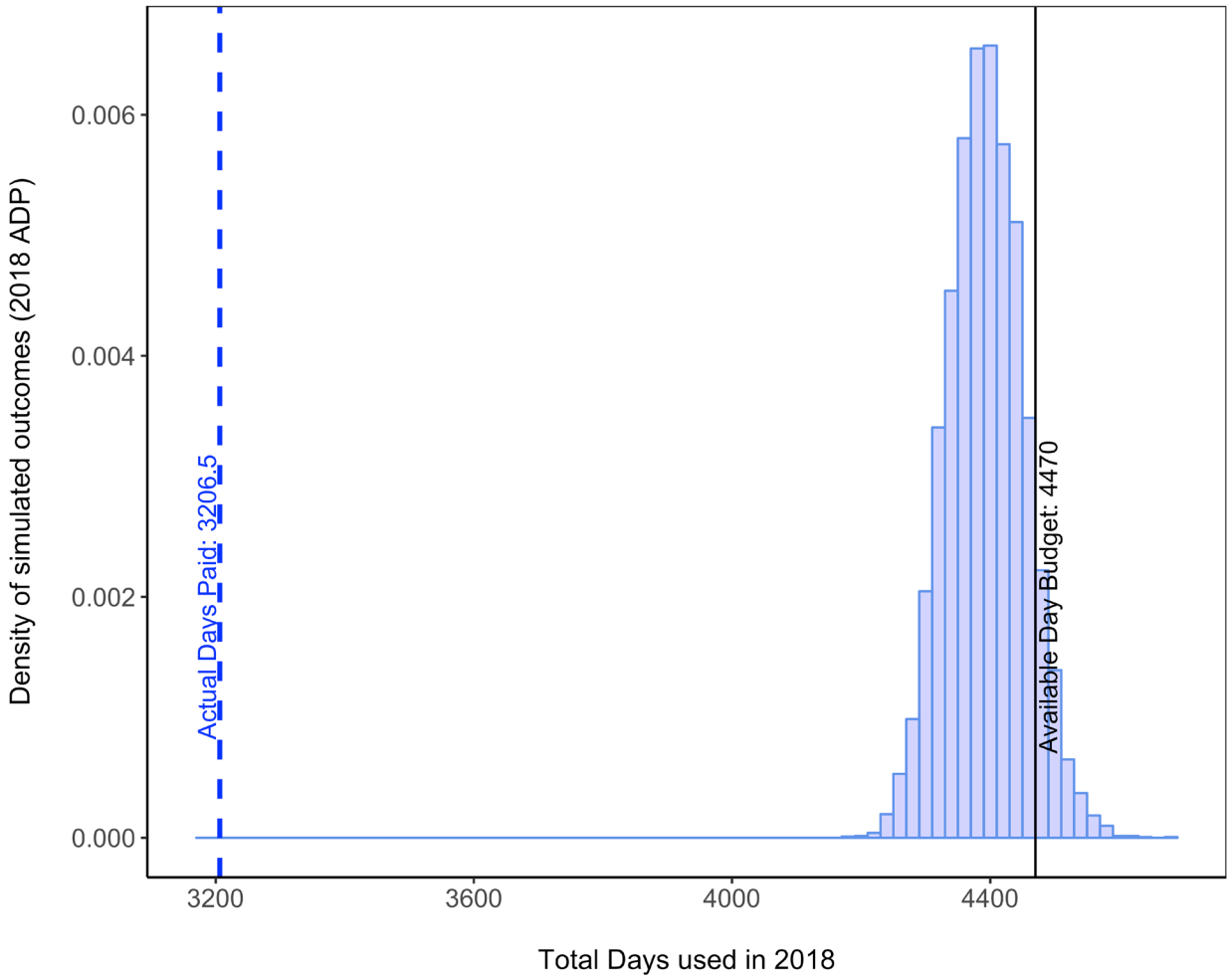


Figure 3-2. -- Rate of selected trips logged into ODDS organized by original date entered for all trips (grey line and grey text), and final date considering only non-cancelled trips (black line and black text). The programmed selection rate is depicted as the dotted line. Grey shaded areas denote the range of coverage rate corresponding to the 95% confidence intervals expected from the binomial distribution. The final coverage rates were higher than if trip dates had not been altered and/or cancelled.

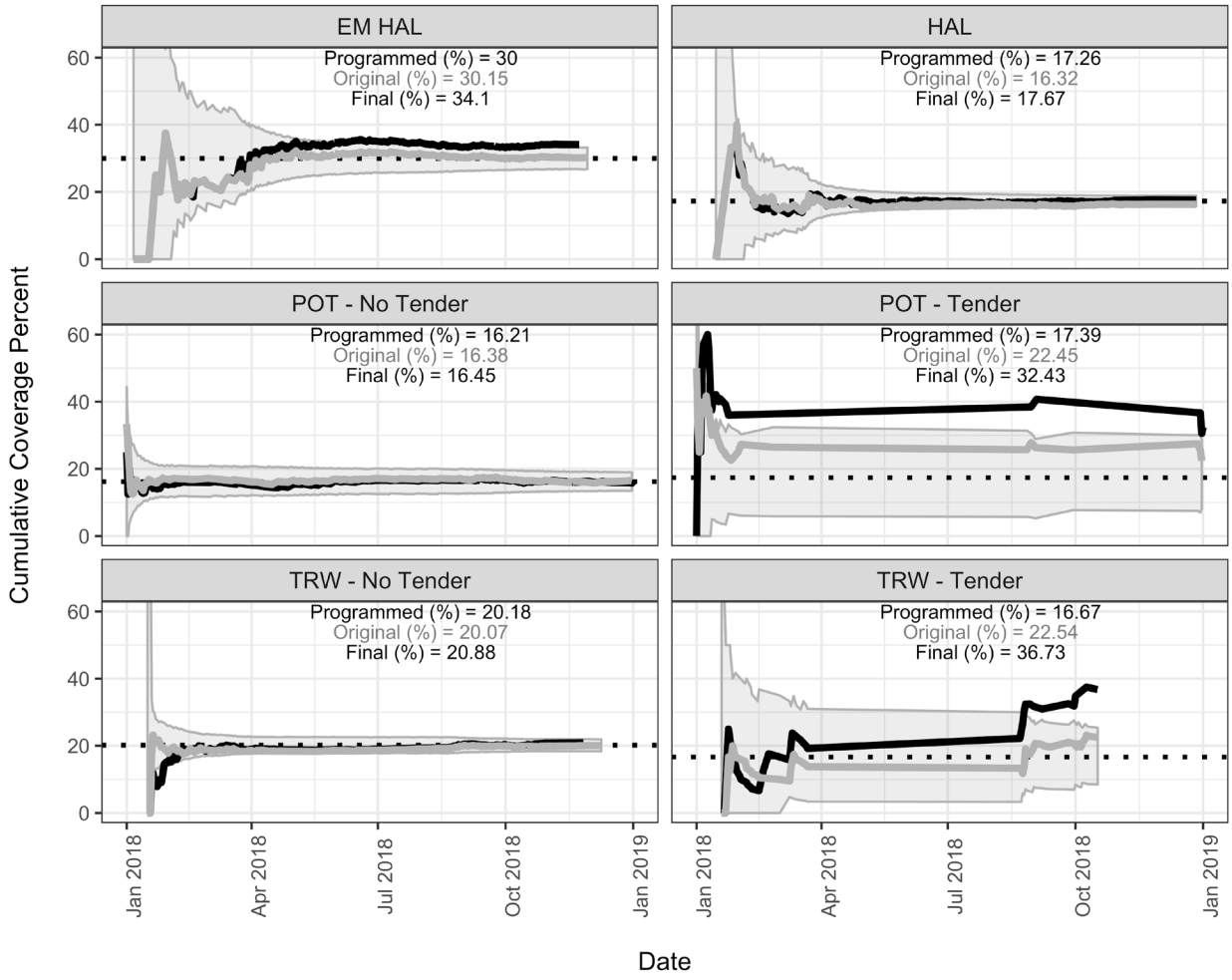


Figure 3-3. -- Cumulative number of trips observed during 2018 (black line) compared to the expected range of observed trips (shaded area) given fishing effort and sampling rates. Dates where the observed number of trips is outside of expected (less or more than the range; OOE) are depicted as tick marks on the horizontal x-axis. The results of tests that the observed rate derived from a binomial distribution sampled at the selection rate are denoted as p-values.

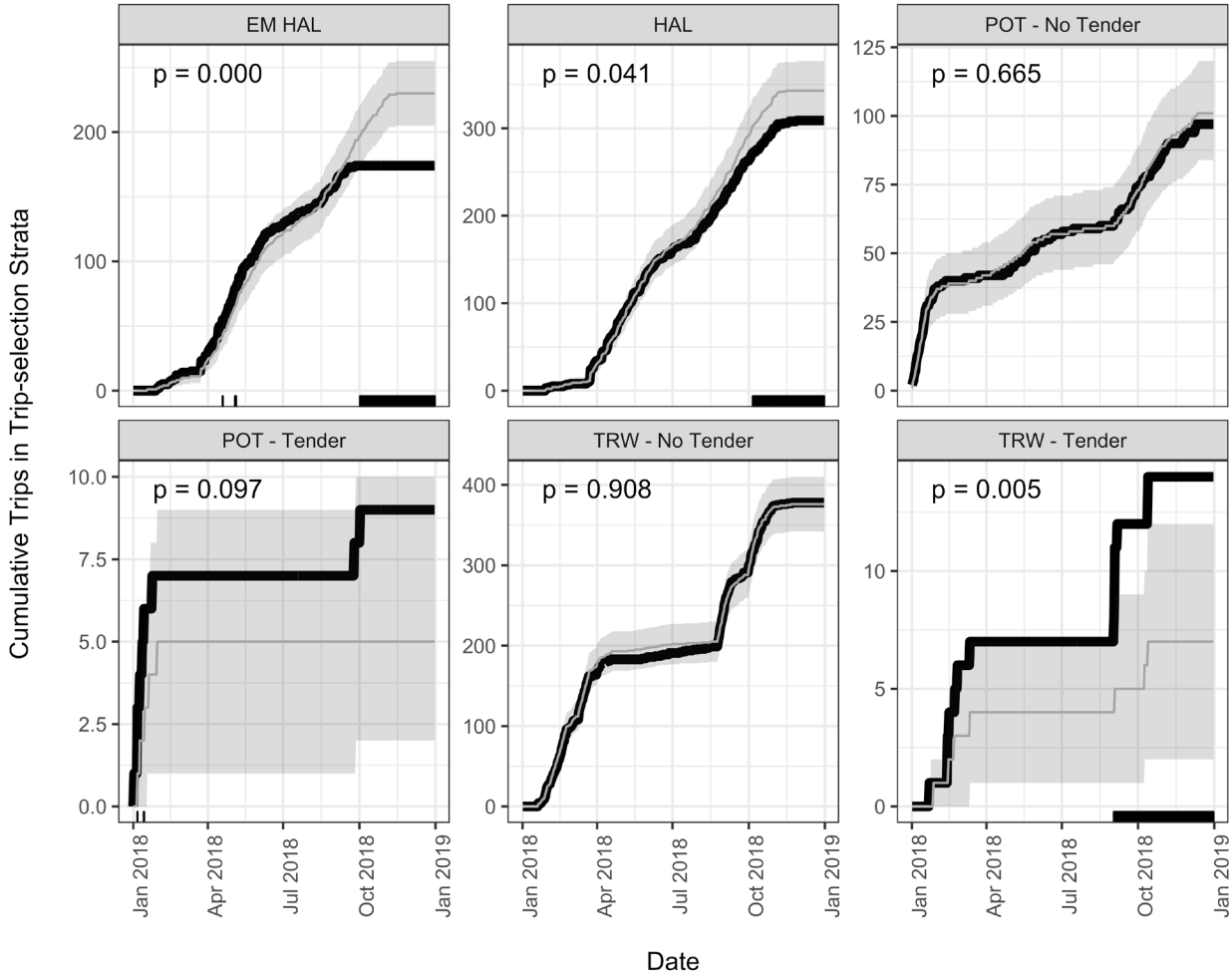


Figure 3-4. -- Comparison plots depicting the number of observed sample units compared to the number of expected observed sample units for each partial coverage stratum. Each point on a plot represents a NMFS Area. The darker the point, the more unusual the result.

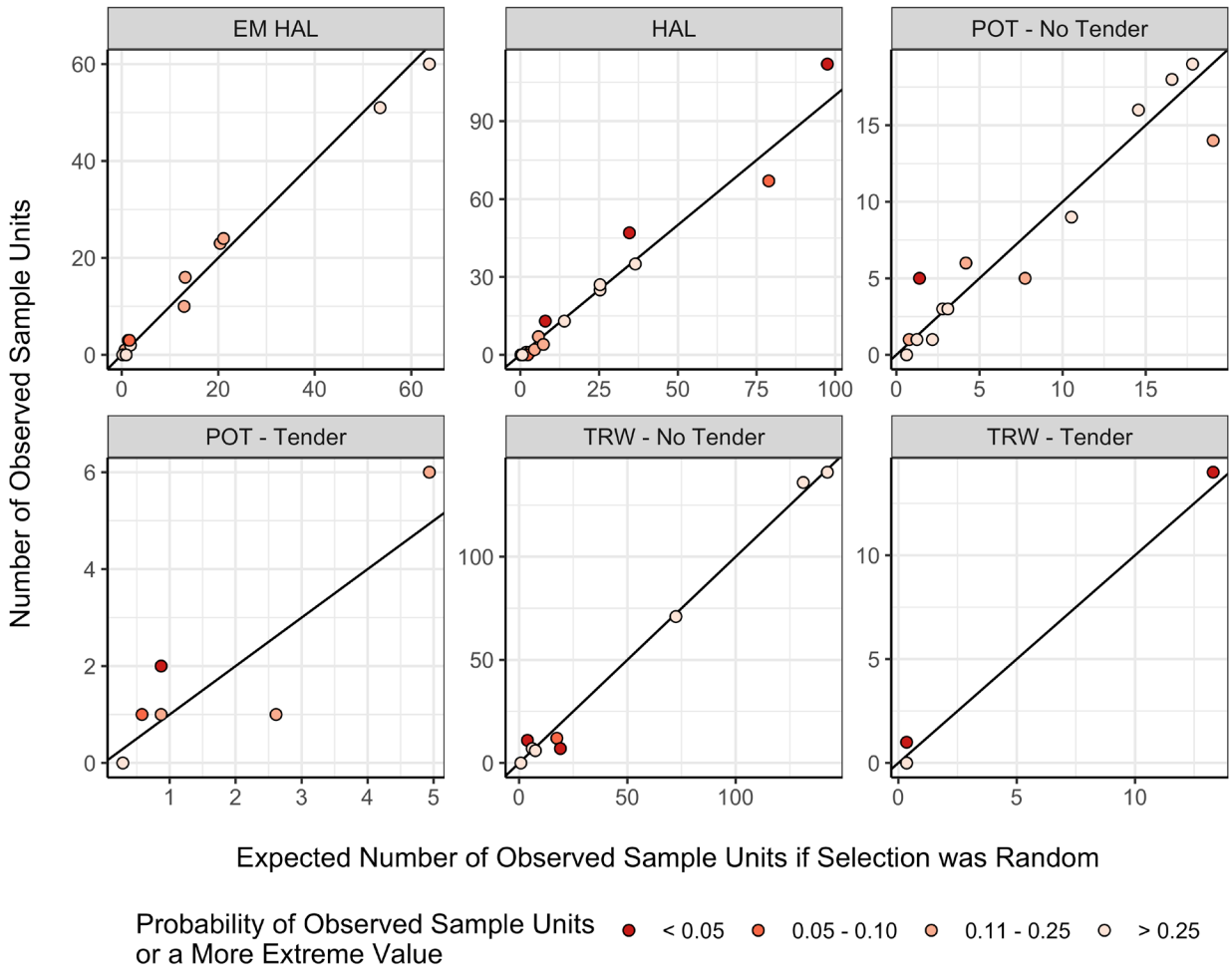


Figure 3-5. -- Probability of observing the realized or more extreme outcome (coverage rate) in a NMFS Reporting Area in the HAL stratum. Reporting Areas where unlikely outcomes occurred are shaded in darker colors.

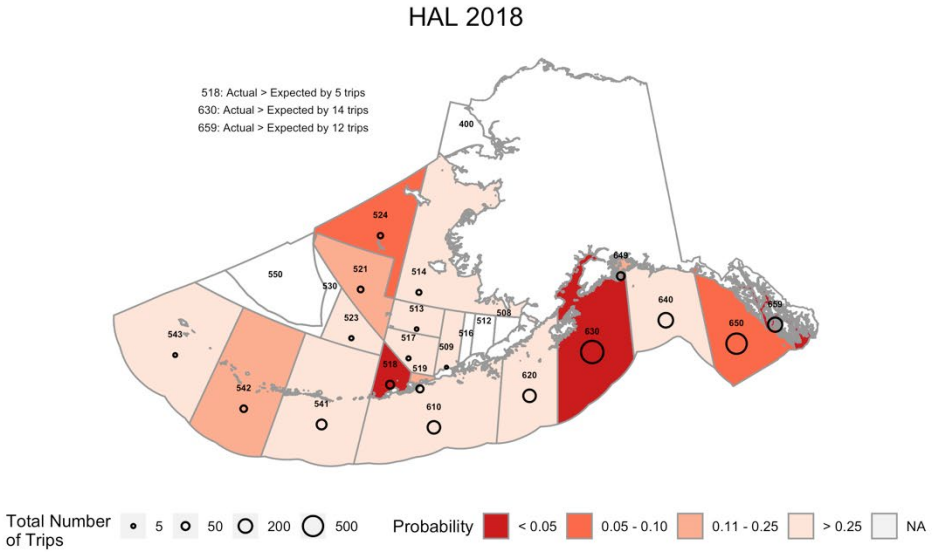


Figure 3-6. -- Probability of observing the realized or more extreme outcome (coverage rate) in a NMFS Reporting Area in the *EM HAL* stratum. Reporting Areas where unlikely outcomes occurred are shaded in darker colors.

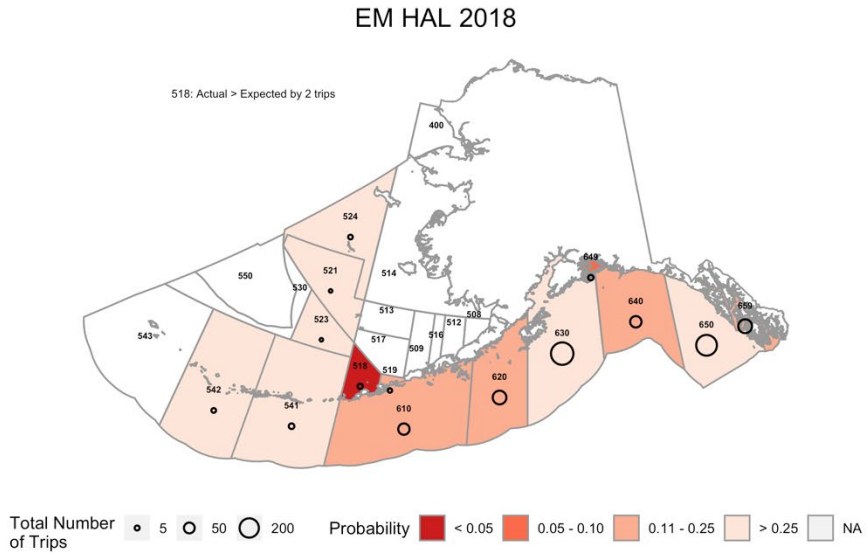


Figure 3-7. -- Probability of observing the realized or more extreme outcome (coverage rate) in a NMFS Reporting Area in the POT - No Tender stratum. Reporting Areas where unlikely outcomes occurred are shaded in darker colors.

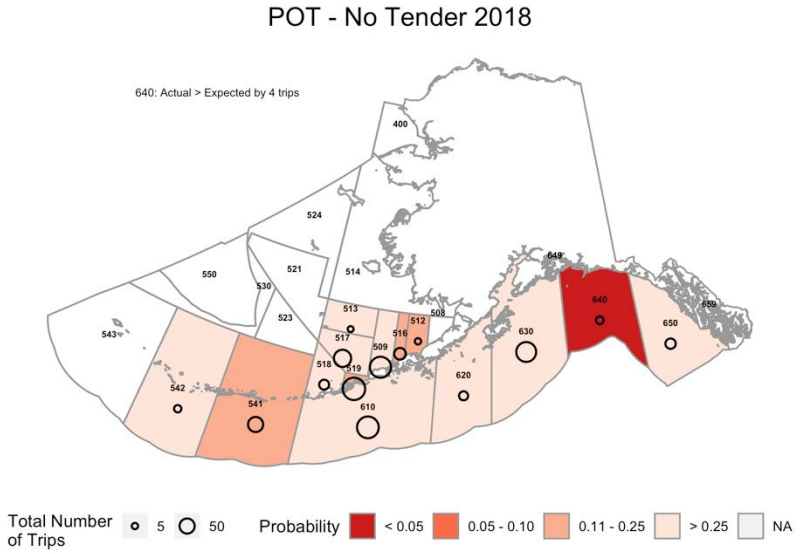


Figure 3-8. -- Probability of observing the realized or more extreme outcome (coverage rate) in a NMFS Reporting Area in the *TRW - No Tender* stratum. Reporting Areas where unlikely outcomes occurred are shaded in darker colors.

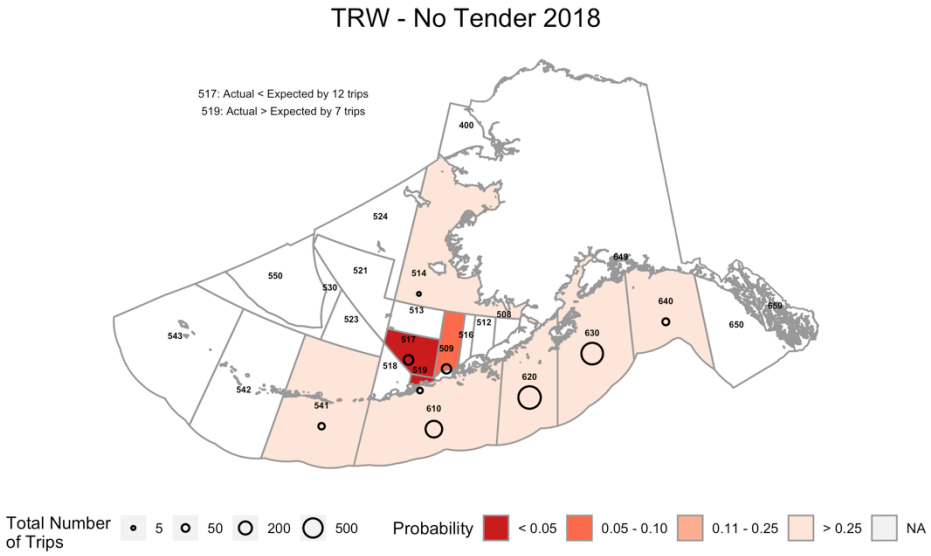


Figure 3-9. -- Probability of observing the realized or more extreme outcome (coverage rate) in a NMFS Reporting Area in the POT - Tender stratum. Reporting Areas where unlikely outcomes occurred are shaded in darker colors.

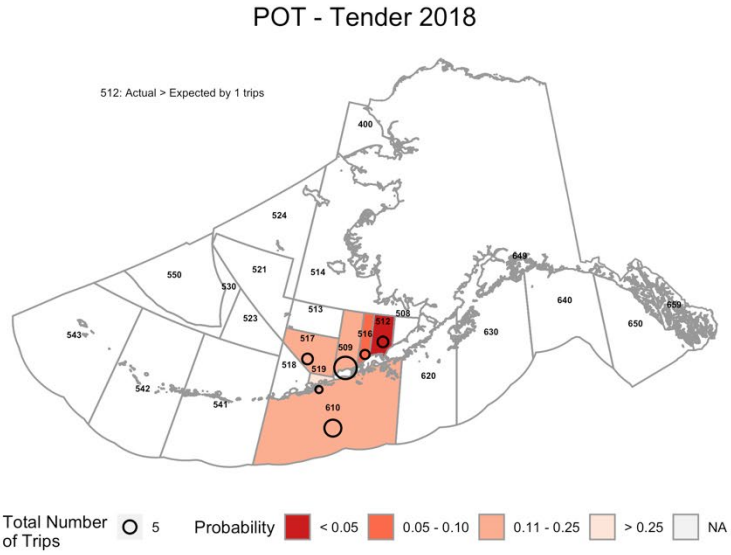


Figure 3-10. -- Probability of observing the realized or more extreme outcome (coverage rate) in a NMFS Reporting Area in the TRW - Tender stratum. Reporting Areas where unlikely outcomes occurred are shaded in darker colors.

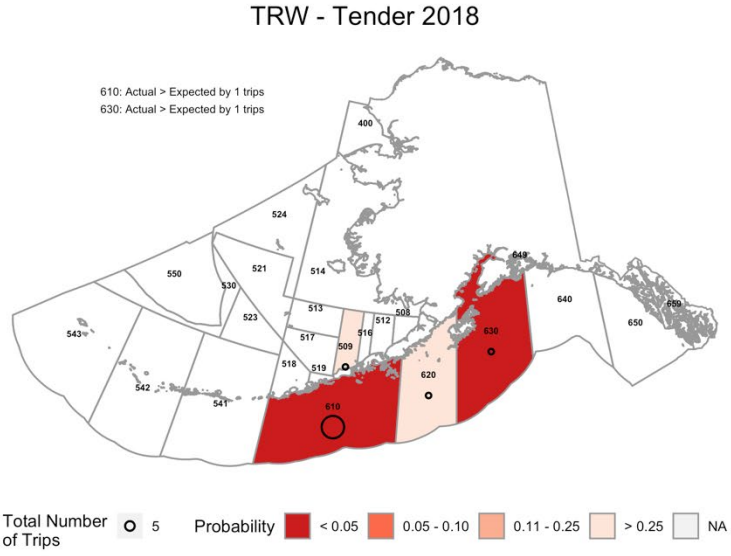


Figure 3-11. -- Example of results from permutation tests depicting percent differences between observed and unobserved trips for each strata in the partial coverage category. Grey bars depict the distribution of differences between observed and unobserved trips where the assignment of observed status has been randomized (this represents the sampling distribution under the null hypothesis that observed and unobserved trips are the same). The vertical line denotes the actual difference between observed and unobserved trips. Values on the x-axis have been scaled to reflect the relative (%) differences in each metric. The p-value for each test is denoted in the upper left corner. Low p-values are reason to reject the null hypothesis and conclude that there is an observer effect. Results from all permutation tests can be found in the Tables section of this report.

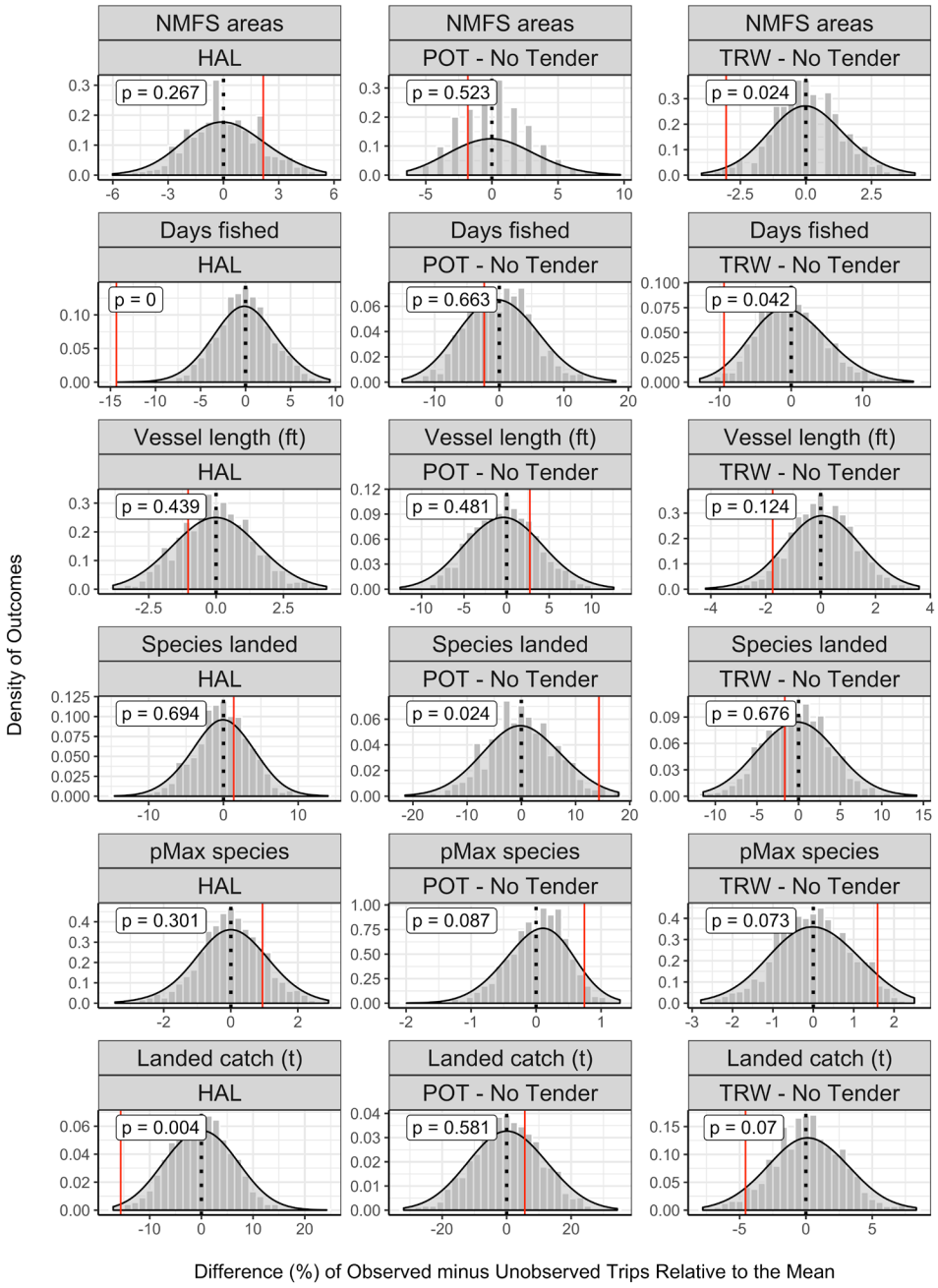


Figure 3-12. -- Distribution of trip durations for vessels in the partial coverage category by gear and observation status. Observed trips are depicted as transparent white bars overtop of solid black bars for unobserved trips. Trip durations where both observed and unobserved status exist are depicted in gray (This is not the same as a stacked bar chart, in which the height of the bar would reflect observed and unobserved on top of one another- this plot has each observation status in front of the other).

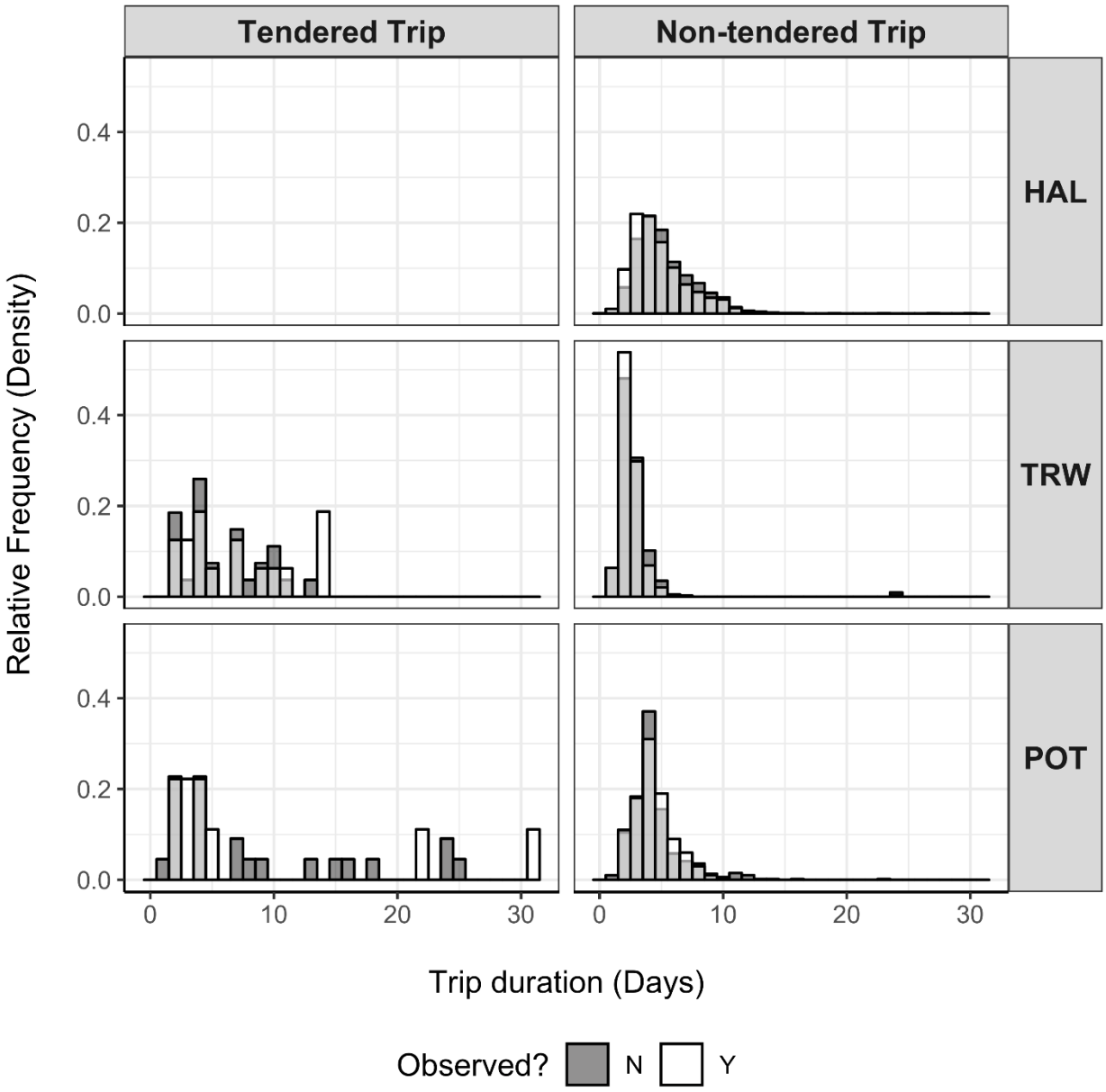
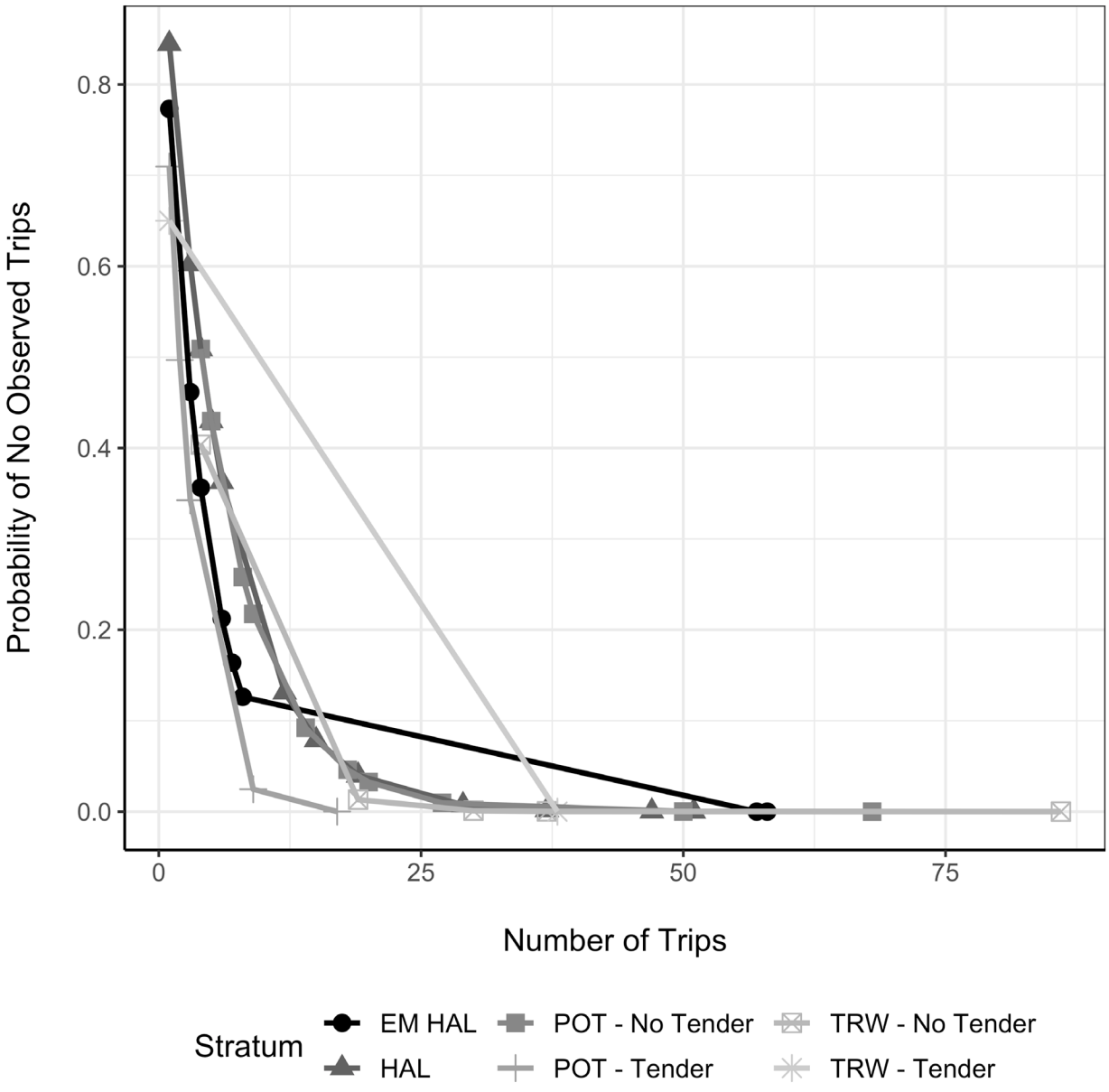


Figure 3-13. -- Probability of observing no trips in a NMFS Area and stratum given fishing effort and sampling rate. The x-axis has been truncated to increase resolution at low levels of fishing effort. The likelihood of having no observer data decreases with increasing total fishing effort and selection rate. The selection rate is 17.26% in the HAL stratum, 16.21% in the POT - No Tender stratum, 17.39% in the POT - Tender stratum, 20.18% in the TRW - No Tender stratum, 16.67% in the TRW - Tender stratum, and 30% in the EM HAL stratum.



4. Descriptive Information

4.1. Number of Trips and Vessels by FMP Area, Strata, Gear, and Vessel Length

In Chapter 3, Table 3-5 provides trip and vessel counts based on coverage type and strata. However, the Council has previously requested a summary of trip and vessel counts based on criteria which are not, or are no longer, considered when deploying observers on trips (e.g., FMP area and vessel length). Table 4-1 and Table 4-2 provide a summary of the number of vessels and trips by FMP area, strata, gear type, and vessel length category within the full and partial coverage categories. Trips are summarized as the number of monitored trips and the total number of trips. Monitored trips reflect either trips with an observer, EM hook-and-line trips if at least some video was reviewed, and EM pot trips for which data was received. The rationale for defining monitored trips this way for EM hook and line is that it is most similar to the way in which trips in other strata are considered observed (i.e., irrespective of whether or not haul information or usable species composition data were collected). Defining monitored trips this way for EM pot reflects the goal NMFS had for pre-implementation (i.e., to receive data for a trip at the programmed selection rate, not to review data for trips at the programmed selection rate). Table 3-6 presents detailed information about the number of hard drives received and reviewed by EM gear type.

Vessels and trips may be counted more than once in a vessel length category in Table 4-1 and Table 4-2 if a vessel is in more than one stratum, fishes in more than one FMP area, or utilizes more than one gear type on a trip or within the year. The table rows titled "BSAI Subtotal", "GOA Subtotal", and "Total Unique" include the number of unique vessels and unique trips in each vessel length category where each vessel or trip is counted only once, in each of the FMP areas or overall, respectively.

4.2. Total Catch and Discards and Amount of Catch Observed

The ADP does not assign observer or EM coverage by fisheries (because the fishery is not able to be identified before fishing occurs), instead observers or EM are deployed to trips and vessels across all fisheries. However, there has been interest in comparing observer and EM coverage across resulting fisheries, so this section includes summaries of monitored and total catch by area, gear type, and sector. The total catch of groundfish and Halibut (retained and discarded) was summarized from the NMFS CAS in Table 4-3 and Table 4-4 for 2018. These tables allow for comparisons of the metric of catch weight derived from CAS. Catch estimation methods are described in detail in Cahalan et al. 2014.

It is important to note that the proportion of catch weight monitored for a subset of fishing activity (i.e., a fishery) should not *a priori* be expected to equal the deployment rates (proportion of trips selected for observer or EM coverage) specified in the ADP. In particular, if there are differences in fishing characteristics between the subsets of fishing activity, specifically differences in catch weights (or discard rates) per trip, those differences will be reflected in the relative proportions of catch monitored. For example, within the partial coverage trawl stratum,

trips in the pollock fishery will have very different total catch weights and discard characteristics than trips in flatfish fisheries. In addition, there are several other factors that will contribute to the apparent inconsistencies between proportion of catch monitored, the proportion of trips monitored, and the deployment rate specified in the ADP. These include the actual number of trips selected (sample size), variability in deployment due to random chance, the ratio of number of trips in each of the fisheries, and lack of independence between the coverage rates within a sampling stratum[16].

In Table 4-3 and Table 4-4, the table columns titled "Monitored" indicate catch that occurred on trips where an observer was present or on EM hook-and-line trips for which some video was reviewed. Catch on vessels on EM pot trips are not included in the monitored column in these tables at this time. Once EM data from pot gear are integrated into the catch estimation process, catch on vessels in the EM pot strata will be included in the monitored catch. The columns titled "Total" represents estimates of all catch from all trips regardless of whether it was monitored. The rows title "Retained" indicate catch that was offloaded (minus dockside discard). The rows titled "Discard" are estimated at-sea discard.

All catch and discard information, including Halibut, summarized in these tables are in round weight metric tons. If species were landed in a condition other than round weight, then standard product recovery rates (PRRs) were used to obtain round weight. Halibut that were landed in ice and slime were additionally corrected for ice and slime using a standard 2% correction.

Additional retained and discard catch information, broken down by species for the Gulf of Alaska (GOA) and Bering Sea/Aleutian Islands (BSAI), are available online for 2018 as well as prior years.[17]

[16] More trips monitored in one subpopulation (fishery) equates to fewer monitored trips in the other subpopulations since all the trips across the different subpopulations must add to the total number of trips selected.

[17] Available online at: Monitored Catch Tables

Table 4-1. -- Number of vessels (V), total trips (N), monitored trips (n)[1], and percent of trips monitored (%) in 2018 in the BSAI by strata, gear type (hook-and-line (HAL), non-pelagic trawl (NPT), pelagic trawl (PTR), pot, and jig), and vessel length category (based on length overall, in feet) for the full and partial coverage categories.

		Vessel length category											
		<40'				40-57.4'				≥57.5'			
Strata	Gear	V	N	n	%	V	N	n	%	V	N	n	%
BSAI													
FULL	HAL									25	235	235	100
FULL	NPT									51	637	637	100
FULL	POT									5	43	43	100
FULL	PTR									90	2,224	2,224	100
EM HAL	HAL					5	10	3	30.0	8	14	2	14.3
EM POT – No Tender[2]	POT									8	50	12	24.0
EM POT – Tender[2]	POT									1	1	1	100
HAL	HAL					21	132	20	15.2	30	98	12	12.2
POT – No Tender	POT					5	37	3	8.1	49	351	52	14.8
POT – Tender	POT					1	2	1	50.0	10	20	7	35.0
TRW – No Tender	NPT									28	178	31	17.4
TRW – No Tender	PTR									1	1	1	100
TRW – Tender	NPT									1	1	0	0.0
Zero Coverage[3]	HAL	64	535	0	0.0								
Zero Coverage[3]	JIG					1	8	0	0.0				
BSAI Subtotal		64	535			28	189	27	14.3	243	3,852	3,256	84.5

[1] Monitored trips reflect either trips with an observer, EM hook-and-line trips for which some video was reviewed, or EM pot trips where data were received.

[2] For the purpose of this table, an EM POT trip is considered to have coverage if data was received for that trip since receiving data was the goal of the EM POT pre-implementation program. The number of EM POT trips reviewed is provided in Table 3-6.

[3] Zero Coverage in this table includes vessels fishing jig gear or vessels less than 40 feet LOA.

Table 4-2. -- Number of vessels (V), total trips (N), monitored trips (n)[1], and percent of trips monitored (%) in 2018 in the GOA and overall, by strata, gear type (hook-and-line (HAL), non-pelagic trawl (NPT), pelagic trawl (PTR), pot, and jig), and vessel length category (based on length overall, in feet) for the full and partial coverage categories.

		Vessel length category											
		<40'				40-57.4'				≥57.5'			
Strata	Gear	V	N	n	%	V	N	n	%	V	N	n	%
GOA													
FULL	HAL									6	14	14	100
FULL	NPT									35	207	207	100
FULL	PTR									22	72	72	100
EM HAL	HAL	1	1	0	0.0	83	522	118	22.6	36	227	53	23.3
EM POT – No Tender[2]	POT					4	25	6	24.0	6	88	23	26.1
HAL	HAL					231	1,089	176	16.2	122	697	108	15.5
HAL[3]	JIG					2	2	0	0.0				
HAL[3]	POT									3	8	3	37.5
POT – No Tender	POT					6	34	8	23.5	27	207	34	16.4
POT – Tender	POT					4	9	1	11.1				
TRW – No Tender	NPT									42	394	75	19.0
TRW – No Tender	PTR					1	37	8	21.6	61	1,298	277	21.3
TRW – Tender	NPT									11	13	5	38.5
TRW – Tender	PTR									12	29	11	37.9
Zero Coverage[4]	HAL	303	1,165	0	0.0								
Zero Coverage[4]	JIG	4	12	0	0.0	6	10	0	0.0				
Zero Coverage[4]	POT	1	7	0	0.0								
Zero EM Research	HAL					2	14	0	0.0	1	9	0	0.0
GOA Subtotal		306	1,185			327	1,740	317	18.2	245	3,184	839	26.4
TOTAL UNIQUE													
		356	1,708			334	1,917	341	17.8	394	7,005	4,082	58.3

[1] Monitored trips reflect either trips with an observer, EM hook-and-line trips for which some video was reviewed, or EM pot trips where data were received.

[2] For the purpose of this table, an EM POT trip is considered to have coverage if data was received for that trip, since receiving data was the goal of the EM POT pre-implementation program. The number of EM POT trips reviewed is provided in Table 3-6.

[3] On trips where more than one gear type is fished, the predominate gear type that will be used is selected in ODDS and determines the strata for the trip.

[4] Zero Coverage in this table includes vessels fishing jig gear or vessels less than 40 feet LOA.

Table 4-3. -- Monitored catch[1] (metric tons), total catch, and percent monitored (%) of groundfish and Halibut retained and discarded in the groundfish and Halibut fisheries in 2018 in the *Gulf of Alaska*. Empty cells indicate that no catch occurred.

	Catcher/Processor			Catcher vessel			Catcher vessel: Rockfish program			Gear total		
	Monitored	**Total**	**%**	**Monitored**	**Total**	**%**	**Monitored**	**Total**	**%**	**Monitored**	**Total**	**%**
HOOK AND LINE												
Retained	1,737	1,862	**93%**	2,622	17,924	**15%**				4,359	19,786	**22%**
Discard	516	558	**92%**	1,804	12,283	**15%**				2,321	12,841	**18%**
JIG												
Retained				0	12	**0%**				0	12	**0%**
Discard												
NON-PELAGIC TRAWL												
Retained	24,959	24,959	**100%**	3,771	26,109	**14%**	7,369	7,369	**100%**	36,099	58,437	**62%**
Discard	2,461	2,461	**100%**	636	5,063	**13%**	1,044	1,044	**100%**	4,141	8,567	**48%**
POT												
Retained				613	5,136	**12%**				613	5,136	**12%**
Discard				12	101	**12%**				12	101	**12%**
PELAGIC TRAWL												
Retained	871	871	**100%**	33,425	148,331	**23%**	5,807	5,807	**100%**	40,102	155,008	**26%**
Discard	91	91	**100%**	371	1,661	**22%**	13	13	**100%**	474	1,764	**27%**

[1] Monitored catch is from trips with an observer or EM hook-and-line trips for which some video was reviewed.

Table 4-4. -- Monitored catch[1] (metric tons), total catch, and percent monitored (%) of groundfish and Halibut retained and discarded in the groundfish and Halibut fisheries in 2018 in the *Bering Sea/Aleutian Islands*. Empty cells indicate that no catch occurred.

	Catcher/Processor			Mothership			Catcher vessel			Gear total		
	Monitored	**Total**	**%**	**Monitored**	**Total**	**%**	**Monitored**	**Total**	**%**	**Monitored**	**Total**	**%**
HOOK AND LINE												
Retained	115,633	115,641	**100%**				428	3,049	**14%**	116,061	118,690	**98%**
Discard	23,338	23,338	**100%**				201	1,716	**12%**	23,540	25,054	**94%**
JIG												
Retained							0	56	**0%**	0	56	**0%**
Discard												
NON-PELAGIC TRAWL												
Retained	339,190	339,190	**100%**	32,874	32,874	**100%**	16,674	27,930	**60%**	388,738	399,994	**97%**
Discard	28,584	28,584	**100%**	2,728	2,728	**100%**	776	1,747	**44%**	32,088	33,059	**97%**
POT												
Retained	4,566	4,566	**100%**				4,536	24,874	**18%**	9,102	29,440	**31%**
Discard	180	180	**100%**				98	486	**20%**	278	666	**42%**
PELAGIC TRAWL												
Retained	620,437	620,437	**100%**	119,933	119,933	**100%**	601,972	601,972	**100%**	1,342,342	1,342,342	**100%**
Discard	2,341	2,341	**100%**	383	383	**100%**	2,120	2,120	**100%**	4,845	4,845	**100%**

[1] Monitored catch is from trips with an observer or EM hook-and-line trips for which some video was reviewed.

4.3. Electronic Monitoring Video Review

This section provides metrics on the results of the EM video review. Since collection of EM data is new, the EM Works group requested that NMFS include this information as part of the Annual Report to be able to track reliability and image quality.

During 2018, video that was collected from vessels participating in the EM program was sent to Pacific States Marine Fisheries Commission (PSMFC) and Saltwater for review. The vessels fishing with hook-and-line gear data were transferred from PSMFC to NMFS and incorporated into the CAS for catch estimation to support inseason management of the fisheries. The method was not yet developed to use EM pot data in catch estimation, so those data were not used for inseason management and not reviewed by PSMFC.

4.3.1. EM Data from Hook-and-Line Vessels

EM data was collected on a total of 250 hook-and-line and 45 pot trips. Of these, PSMFC completed video review for 174 trips for vessels using hook-and-line gear and a total of 770 hauls. The PSMFC report is included in Appendix B.

Video and Sensor Completeness

During an EM trip there can be times when either the sensors or video data are not captured and there are gaps in the EM information. Video reviewers at PSMFC assessed the completeness of the video and sensor data during each trip and haul. The 2018 results are presented in Appendix Table B- 3 and key finding include the following:

- Sensor data was complete on 97% of the trips.
- Video was complete on 68% of the trips. However, the majority of the incomplete video did not impact the ability of reviewers to quantify the catch because the gap in the video occurred before (or after) fishing hooks were being brought onboard. Of the 770 hauls reviewed, 649 (84%) had complete video during the entire period when catch was bring brought onboard and sorted.
- About 15% of hauls reviewed had video gaps during fishing activity; most often these gaps resulted from video ending before catch handling ended, video starting after catch handling had begun, or from intermittent gaps in video coverage. All of these issues suggest technical problems relating to the set-up of the EM system. In general, video data was somewhat more likely to be incomplete on the first trip that a boat took with an EM system. PSMFC has been working with Archipelago Marine Resources (AMR) on changes to the software that will allow quantification of the lengths of these time gaps.

Image Quality

- Of the 770 hauls reviewed, 64.2% of the video was high quality; 31.3% was medium quality; the remaining 4% were low quality or unusable.

- The percentage of hauls with medium image quality was higher in 2018 than has been seen in previous years. The most common reason for medium-quality video was water spots (31.5%); other reasons included poor camera angles, night lighting, and glare.
- Low image quality was mostly a factor of intermittent gaps in the video.

Video Review Rates

- Video review rates for longline trips targeting Halibut and Sablefish ranged from 0.59 minutes of review per minute of video to 0.89 minutes of review per minute of video.
- Video review rate in the Pacific Cod snap longline fishery was slower and close to real time (e.g., 1 hour of catch handling could be reviewed in just over an hour). Pacific cod longline hauls tended to have a larger variety of species caught, as well as being the only fishery where stern hauling was conducted. Stern haulers were more difficult to review due to a side view of the line (as opposed to a top down view), as well as poor lighting on the line at night.

4.3.2. EM Data from Pot Vessels

A 2018 pre-implementation plan for using EM aboard vessels using pot gear was developed by the EM Workgroup with the pre-implementation goals of determining the efficacy of EM for catch accounting of retained and discarded catch and to identify key decisions that were needed in order to integrate pot EM into the Observer Program. Results of the pre-implementation work are being used to inform future NPFMC decisions.

Vessels were selected for participation in the pre-implementation program from a pool of volunteer vessels. Two EM service providers, Archipelago Marine Research (AMR) and Saltwater, Inc. (SWI) had received funding from the National Fish and Wildlife Service. The vessels worked with both AMR, and SWI for servicing and repairs. Vessels had to opt-in to the program for 2018 before November 1, 2017 in the ODDS application or by using the observer call in service. After EM systems were installed, vessels had to have a Vessel Monitoring Plan (VMP) approved by NMFS to ensure that all fishing activities were visible.

Results

20 pot vessels participated in the 2018 pre-implementation EM project. Some vessels participated in more than one fishery:

- 3 AMR Pot vessel VMPs approved in 2018.
- 17 SWI Pot vessel VMPs approved in 2018.
- 176 total 2018 Pot Trips.
- 127 non selected EM Pot trips.
- 44 EM selected trips.
- 1 self-selected for compliance monitoring
- 4 cancelled prior to trip.

Species and counts of catch were recorded for a subset of hauls for single pot gear and longline gear. String pot gear was reviewed in its entirety. For single pot gear, catch was reviewed for every third haul. Catch was defined as anything seen by an EM reviewer, excluding free-moving marine birds and mammals alongside the vessel. Video reviewers were trained by a PSMFC staffer working with the North Pacific Observer Program on Alaska species reporting conventions. The reviewers were instructed to record species to the lowest identifiable taxonomic level or grouping as required by the Alaska Region.

The review rate in the pot fishery was close to real time (e.g., 1 hour of catch handling could be reviewed in just under an hour) or longer for pots and the following observations were made:

- Review is time consuming when large amounts of bycatch exists.
- PSMFC was asked by NMFS to prioritize fisheries where data is used for management. This resulted in a lag of Pot data review.
- More negative data quality impacts are possible in higher bycatch pot fisheries (e.g., Pacific Cod) as it is harder to count high numbers of items quickly. This can result in lower ratings for data quality, image quality, and video completeness.
- Bias might exists towards pots with lower catch if reviewers move past pots which cannot be tallied/counted to the next pot that can. Once a pot is successfully tallied, the intended sample frame is resumed.

NMFS is working to support additional reviewers to decrease the review time lag, and to allow for longer review time needed by pot gear. This is necessary for 2019 as pot data will be used for management and will not have a different priority than longline data.

4.4. Observer Training and Debriefing

During the 2018 fishing year, approximately 425 individual observers were trained, briefed, and equipped for deployment to vessels and processing facilities operating in the Bering Sea and GOA groundfish and Halibut fisheries. These observers collected data on board 408 fixed gear and trawl vessels and at seven processing facilities for a total of 40,512 observer days (36,729 full coverage days on vessels and in plants; and 3,783 partial coverage days).[18]

New observer candidates are required to complete a three-week training class with 120 hours of scheduled class time and additional training by FMA staff as necessary. The FMA Division conducted training for 149 new observers to deploy in 2018 in addition to the 264 prior observers who attended a briefing of some type (Table 4-5). Portions of FMA's three-week observer training class were attended by observer providers, NOAA Fisheries Office of Law Enforcement, and NOAA General Counsel.

During their first two deployments, observers are required to complete a mid-cruise debriefing while still in the field. This mid-cruise debriefing provides the opportunity for both the observer

[18] Note that observer days are calculated differently from invoiced days. Observer days represent any amount of time an observer is on a vessel as part of their deployment which may be inclusive of non-fishing and standby days.

and FMA staff to assess the data collected up to that point, methods used, challenges encountered, and discuss future vessel assignments. After successfully completing two contracts, mid-cruise debriefings are only required on an individual basis if recommended by FMA staff. Mid-cruise debriefings can be completed in person, over the phone, electronically, or via fax. In 2018 there were seven mid-cruise debriefings in Anchorage, 187 in Dutch Harbor, 13 in Kodiak, and 17 in Seattle.

After each deployment, observers must meet with an FMA staff member for a debriefing interview. During the debriefing process, sampling and data recording methods are reviewed and, after a thorough data quality check, the data are finalized. 27 FMA staff members completed 115 debriefings in Anchorage, 1 in Dutch Harbor, and 572 debriefings in Seattle. Many observers deploy multiple times throughout the year and debrief after each contract, followed by a briefing for re-deployment. Since observers are required to attend more than one briefing annually, the total number of briefings and debriefings for 2018 does not represent a count of individual observers.

Depending on their performance and assessment during debriefing, observers must attend a one-day, two-day, an annual briefing, or a fish and crab identification briefing. In rare cases when an observer has demonstrated major deficiencies in meeting program expectations, they may be required to re-take the three-week training. Regardless of their required training as the result of debriefing, all returning observers must attend an annual briefing class prior to their first deployment each calendar year. These briefings provide observers with annual reminders on safe practices on fishing vessels and at processing plants, updates regarding their responsibilities for the current fishing season inclusive of programmatic and sampling updates, office of law enforcement training, seabird data collection, and USCG safety lectures and discussions. Additionally, observers are required to demonstrate their understanding and proficiency by passing the annual briefing exam, a seabird identification test, and successfully completing various in-class activities. In addition to all these updates, in 2018 specifically, all observers received their mandated cold water safety training and updated curriculum focused on the Halibut deck-sorting EFP updates for 2018.

As the final rule implementing the modification to the non-trawl lead level two endorsement was published on 29 June 2018, the Division was able to develop curriculum and began offering the Lead Level two Specialized Training starting in July 2018. Since then seven trainings were offered, with 19 individuals attending six of those trainings.

Prior to being deployed on NOAA surveys and fishing vessels, North Pacific observers, AFSC staff, and visiting scientists must fulfill a requirement for cold-water safety training. All staff responsible for providing safety training to observers are required to attend a USCG approved Marine Safety Instructor course, have experience at sea, and complete regular refresher and co-trainings. In 2018, FMA staff cross-trained with the Northwest Fisheries Science Center's At-sea Hake and Southeast Fisheries Science Center Observer Programs to share information and learn from the experience of another observer program and offered the safety training to numerous AFSC seagoing staff.

Garnering expert guidance from the AFSC's Marine Mammal Laboratory scientists, FMA training team members developed curriculum and trained AFSC sea-going personnel on marine mammal species identification in anticipation of their survey season.

Table 4-5. -- Number of observer training classes and number of observers trained/briefed from November 29, 2017 to November 15, 2018.[19]

Class type	Number of classes	Number of observers trained/briefed
3-Week Training	10	173
3-Day Annual	24	252
2-Day Briefing	5	5
1-Day Briefing	62	290
Lead Level 2	6	19
Fish and Crab ID Training	29	193
Total	136	932

[19] These dates were selected based on observers being trained in late November/December to deploy at the beginning of the fishing year in January, i.e. counting observers trained from December to December would not have represented the actual number trained for deployments in the 2018 fishing year.

5. Compliance and Enforcement

This chapter provides information about observer reported compliance data and the cooperative relationship between NOAA's Office for Law Enforcement, Alaska Division (AKD) and the North Pacific Observer Program (Observer Program).

Observer monitoring and compliance roles are identified in the Magnuson-Stevens Act and implementing regulations. Observers are required to accurately record sampling data, write complete reports, and report any observations of suspected violations relevant to the conservation of marine resources. The Observer Program documents and reports to AKD compliance information relevant to marine resources; safety; and observer deployment, accommodations, assistance, and work environment. Prior to deployment, observers are trained in compliance monitoring.

Observers can play an important compliance assistance role onboard vessels by communicating with operators about safety concerns and potential violations. While observers are not required to communicate potential violations to vessel operators, and they are not experts in all areas of regulation, they are encouraged to work with vessel operators if it will not impact their data quality, data collection, or work environment. **Strong rapport between crew and observers can contribute to a positive compliance assistance relationship.**

5.1. Enforcement and Partners in Alaska

5.1.1. NOAA Office for Law Enforcement

The NOAA OLE mission is to support resource management by enforcing the laws and regulations that protect living marine resources. Central to this mission is the OLE role in protecting observers and their ability to collect scientific data used to manage marine resources. Reports of rape, assault, sexual harassment, interference/sample bias, intimidation, coercion, hostile work environment and safety are among the highest OLE and AKD investigative priorities. OLE priorities are available on the web at https://www.fisheries.noaa.gov/resource/document/enforcement-priorities-fiscal-years-2018-2022 .

The AKD maintains a strong partnership with the Observer Program. Frequently in collaboration with the Observer Program, AKD Agents and Officers engage with industry to provide outreach, education, and compliance assistance. Agents and officers in the field respond to industry questions about Observer Program requirements and participate in outreach meetings to discuss fishery management programs.

AKD dedicates a full-time liaison contractor in Seattle to support Observer Program compliance reporting. Duties of the liaison include: receive, organize, and distribute compliance statements; provide resources and support to observers who have been victimized; develop and edit manuals,

reports, and training materials; provide training to Observer Program staff and observers; serve as liaison with Observer Program staff; distribute AKD outreach materials to industry; provide observer related administrative and investigative support to agents and officers.

AKD maintains a full-time liaison Special Agent. Duties include: provide resources and support to observers who have been victimized; conduct and assist with complex observer related investigations, liaison with Observer Program staff, provide agency analysis on observer-related topics, provide compliance monitoring portions of observer training and program staff updates, attend meetings and outreach events, and assist industry to comply with fishery management regulations.

5.1.2. U.S. Coast Guard

It is a high USCG priority to promote compliance with observer regulations to ensure that observers can effectively and accurately collect and report unbiased data. During at-sea boardings, the USCG seeks to detect and deter violations involving observers, including failure to carry an observer, observer harassment, gear tampering, presorting of catch, or biasing observer samples.

During USCG boardings where observers are present, boarding officers may discreetly invite observers to discuss concerns about their work environment or ability to perform duties. All reports of suspected offenses are passed to the AKD. Reports from observers describing harassment, intimidation, and safety issues are of particular concern.

The Observer Program reports observer statements of potential safety violations directly to the USCG for review on a case-by-case basis. NOAA Fisheries regulations establish national safety standards for commercial fishing vessels carrying observers. These regulations require that any commercial fishing vessel, not otherwise inspected, must pass a USCG dockside safety examination before carrying an observer. Observers also conduct an independent review of major safety items upon boarding a vessel.

The USCG may receive requests to assist the AKD or Observer Program to help evaluate safety concerns. In coordination with AKD and/or the Observer Program, the USCG may attempt to locate the vessel and conduct a commercial fishing vessel safety boarding at-sea or dockside. A USCG commercial fishing vessel safety examiner may require actions by the vessel operator to correct safety deficiencies prior to embarking with an observer.

5.1.3. Alaska Wildlife Troopers

The AKD and the Alaska Wildlife Troopers (AWT) collaborate under a Joint Enforcement Agreement which provides AWT authority to enforce observer and data protections under the Magnuson Act. AKD and AWT work together to investigate observer complaints and to conduct patrols and at-sea or dockside boardings. During joint and independent agency patrols, interaction with observers is encouraged to allow reporting opportunities and to develop a trust relationship.

In 2018, 17 observer related cases were forwarded to the AWT. These cases included 35 separate complaints. Seven of these cases remain under investigation; 10 have been returned to AKD with either compliance assistance having been provided by AWT, or with further action pending by AKD.

Two officers deployed to the Patrol Vessel *Stimson* for 21 days to conduct at-sea boardings and conduct plant inspections jointly with the AWT.

5.2. Reports of Potential Violations

The AKD works closely with the Observer Program and observer providers to address incidents that affect observer safety, sampling, and work environments. Every statement received from the Observer Program is evaluated and prioritized. Then, AKD Officers and Agents investigate the most egregious complaints to identify if violations have occurred and to determine the appropriate level or response. Many first offences and low-level infractions may be handled as compliance assistance or through issuance of warning.

AKD also utilizes observer compliance data to track compliance trends. Trend analysis helps the AKD focus and prioritize enforcement efforts. Table 5-1 and the following figures summarizes Observer Program statements received. *Note: where two observers are present, two statements may have been generated for the same event*.

Table 5-1. -- Observer Program complaints received by AKD by coverage sector and subject matter in 2017 compared to 2018. Dashed lines (--) indicate that the complaint type is not-applicable.

Complaint type	Full coverage		Partial coverage		Total	
	2017	2018	2017	2018	2017	2018
OLE Priority						
Harassment - Assault	3	3	0	0	3	3
Harassment - Sexual	6	8	1	3	7	11
Interference/Sample Bias	28	15	3	2	31	17
Intimidation/Coercion/Hostile Work Environment	24	27	3	2	27	29
Disruptive/Bothersome Behavior - Conflict Resolved	20	23	1	1	21	24
Safety – NMFS	40	53	8	14	48	67
Total OLE Priority	**121**	**129**	**16**	**22**	**137**	**151**
Limited Access Programs						
AFA	25	28	--	--	25	28
Amendment 80	80	67	--	--	80	67
Catcher Processor Longline	29	18	--	--	29	18
Rockfish Program	1	1	--	0	1	1
IFQ Retention	1	2	16	10	17	12
Total Limited Access Programs	**136**	**116**	**16**	**10**	**152**	**126**
Protected Resources and Prohibited Species						
Gulf of Alaska Salmon Bycatch	0	1	50	28	50	29
Bering Sea Pollock Salmon Bycatch	79	71	--	--	79	71
Marine Mammal	3	4	1	1	4	5
Seabird (majority is gear related)	1	1	14	7	15	8
Prohibited Species – Mishandling and Retention	73	49	21	10	94	59
Total Protected Resources and Prohibited Species	**156**	**126**	**86**	**46**	**242**	**172**
All Other Complaint Types						
Contractor Problems	7	12	--	--	7	12
Failure to Notify	59	36	16	11	75	47
Inadequate Accommodations	6	10	2	1	8	11
IR/IU	47	39	23	20	70	59
Miscellaneous Violations	6	6	5	0	11	6
Reasonable Assistance	36	38	9	20	45	58
Record Keeping and Reporting	122	157	198	92	320	249
Restrict Access	3	7	1	0	4	7
Observer Coverage	--	--	242	86	242	86
Total All Other Complaint Types	**286**	**305**	**496**	**230**	**782**	**535**
GRAND TOTAL	**702**	**676**	**614**	**308**	**1316**	**984**

Figure 5-1. -- Observer Program Priority statements received by AKD by subject matter in 2017 and 2018.

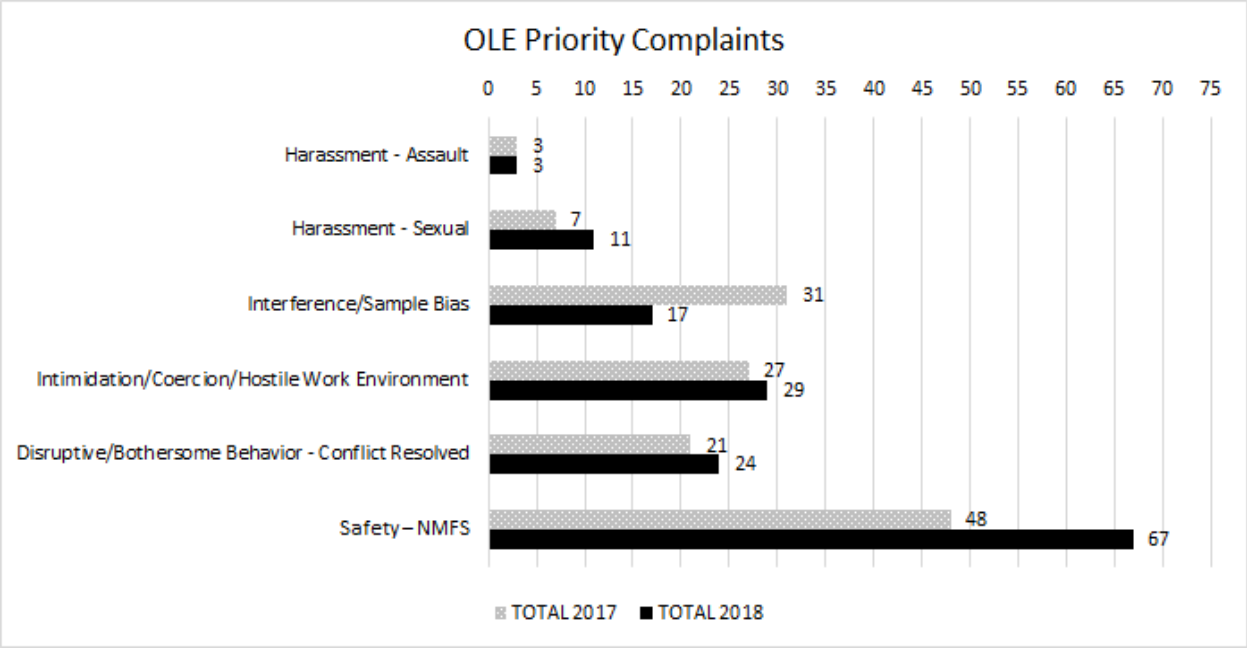


Figure 5-2. -- Observer Program Limited Access Program statements received by AKD by subject matter in 2017 and 2018.

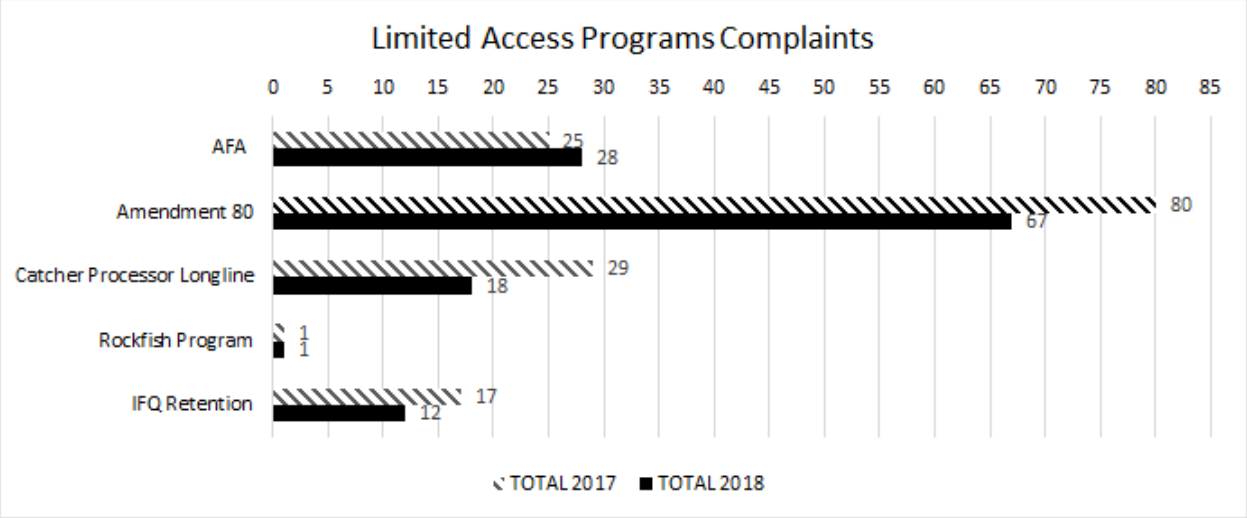


Figure 5-3. -- Observer Program Protected Resources and Prohibited Species statements received by AKD by subject matter in 2017 and 2018.

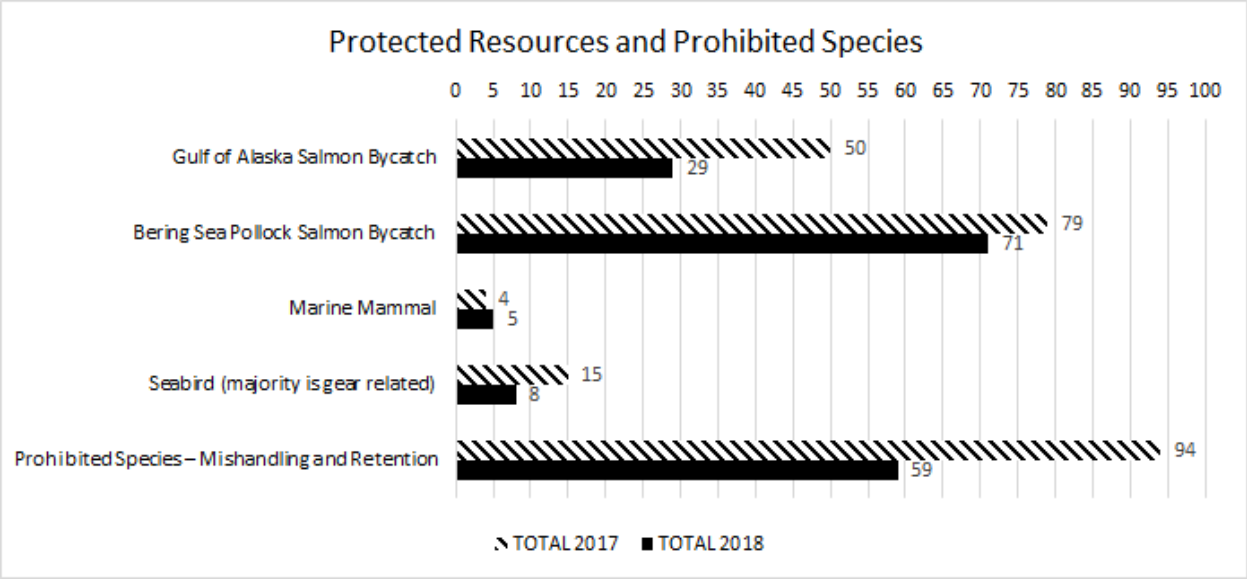
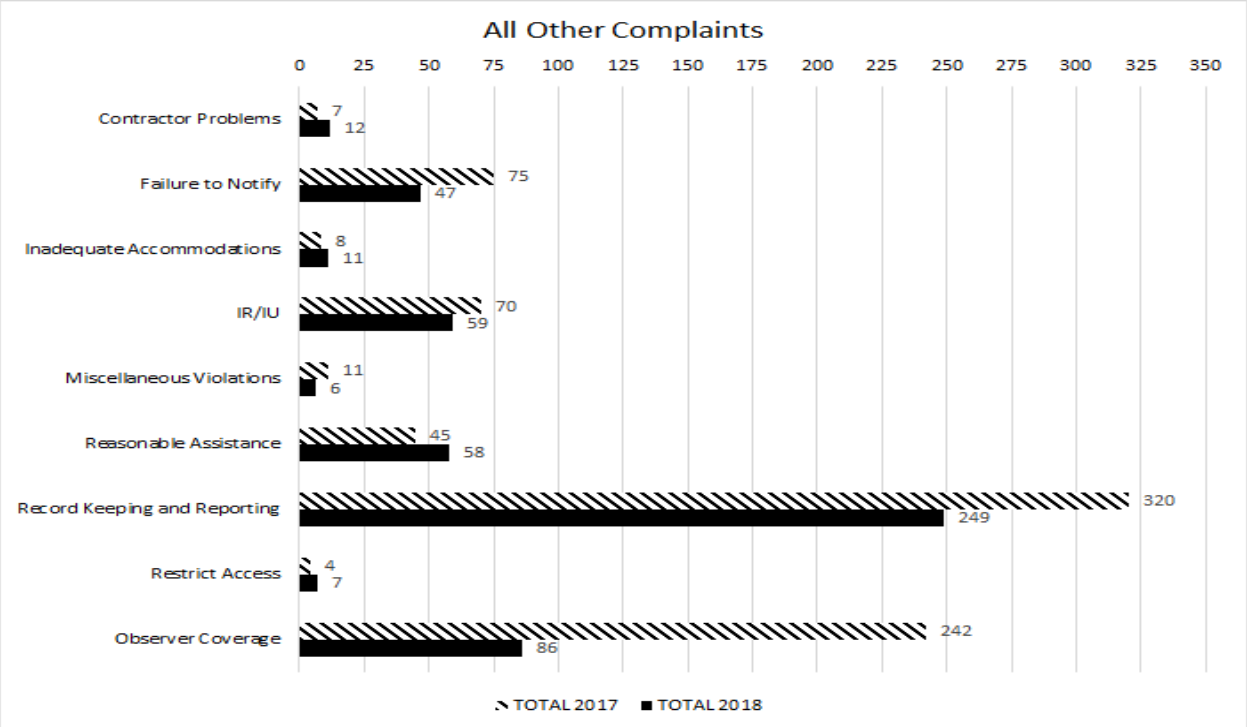


Figure 5-4. -- All other Observer Program statements received by AKD by subject matter in 2017 and 2018.



5.2.1. Highest Priority Violations

OLE has zero tolerance for rape, sexual assault or sexual harassment of any observer. Assault, intimidation, coercion and hostile work environments are unacceptable either. In 2017, there were seven statements of sexual harassment and three statements of assault reported through the Observer Program. In 2018, 11 statements were received reporting sexual harassment, and three reporting assault. Two of the assault statements described the same event; one was from a witnessing observer. This event occurred at port and the observer was encouraged to report the event to local law enforcement, but the observer chose to resolve it through her provider. The other incident was forwarded to City of Unalaska Police. Two of the sexual harassment statements received were witness statements. Three cases involving sexual harassment reported in 2018 have been forwarded for civil prosecution. Five cases remain under investigation; three of these occurred at shoreside processors while the observers were conducting their official duties. One occurred while in Dutch Harbor and is Alaska Police Department's jurisdiction.

The number of sexual harassment statements received have increased. This does not mean the rate of sexual harassment has increased; according to reporting observers, observers are feeling more comfortable and supported in coming forward to report. Reporting observers also have stated they want to ensure the next observer who follows them isn't also harassed. Some observers have also reporting feeling supported by the vessel operators and companies. The O'Hara Corporation was commended by an observer, and OLE appreciates their cooperation and dedication to ensuring observers can work in a safe environment free from harassment.

It is important to note that many sexual crimes go unreported. It is difficult for victims to report unwanted sexual contact, advances, or behavior of a sexual nature for many reasons - Sexual behavior tends to be difficult to discuss in the first place; observers may worry about impacts to their work environment, profession, or lost days on the job; and victims may fear being blamed, blame themselves, initially minimize what happened to them, or simply decide to deal with it later or not at all. Additionally, observers often know their harasser personally and may be reluctant to report because they don't want to impact the offender's job and dependents. See Figure 5-1.

5.2.2. Observer Safety and Professionalism

During routine boardings and when meeting with industry, AKD has been notified of concerns regarding observer professionalism. Vessel operators have reported observers returning to the vessels noticeably intoxicated. AKD is concerned about the observer's safety, as an intoxicated observer may not react effectively if an emergency were to occur, such as the vessel taking on water while transiting to the fishing grounds. Some companies have also voiced concerns about inappropriate relationships between observers and crew members. AKD has recommended to industry that they voice their concerns to the Observer Provider company they work with, but several vessel operators are concerned about retaliation from an observer.

5.2.3. Full Coverage Sector

Limited Access

There was an overall decrease in the number of statements involving limited access; there was a slight increase in the number of statements involving AFA. These statements typically document compliance concerns involving operational and equipment requirements specific to the limited access fishery, such as flowscales and video monitoring. In 2018, compliance assistance was used to resolve many of the complaints received. Compliance assistance at both the company level and directly to the vessel accounts for 16 complaints in AFA, 24 in Am80, and 6 in Catcher Processor Longline.

Salmon Bycatch in the Bering Sea

There was a slight decrease in the number of complaints received involving salmon bycatch in the Bering Sea pollock fishery. In 2017, 79 complaints were received; in 2018 71 complaints were received. Of these 71, 19 remain open. 27 were closed with compliance assistance provided, five were closed with a summary settlement issued, and four were resolved through written warnings being issued.

5.2.4. Partial Coverage Sector

Salmon Bycatch in the Gulf of Alaska

There was a noticeable decrease in the number of complaints received involving salmon bycatch in the Gulf of Alaska. In 2017, 50 complaints were received, dropping to 29 in 2018. It is important to note that these numbers are not rates. These numbers are simply the number of complaints received with no regard to the coverage rate or the number of sea days for the partial coverage fishery. Of the 29 complaints in 2018, ten were closed as no violation. 13 remain open, and enforcement action is expected.

5.2.5. Complaints Applicable to both Coverage Sectors

Complaints involving prohibited species mishandling and retention may have decreased from 2017 to 2018, but at 59 received in 2018, this still remains high. These complaints include Halibut being carried by the tail, Halibut being released incorrectly from longline vessels, Halibut and Tanner crab hitting the crucifer, and prohibited species sitting for hours before being discarded. 19 complaints remain open, two were resolved through the issuance of a summary settlement, and compliance assistance was provided for 22 complaints.

Complaints involving failure to notify the observer of fish being brought onboard has also decreased, from 75 complaints received in 2017 to 47 received in 2018. Despite the decrease, this continues to be a concern for AKD. Failure to notify may negatively impact an observer's ability to perform their duties. Some complaints involve egregious instances where there were nearly a dozen times an observer was not notified of fish being brought onboard. 24 complaints have been resolved through compliance assistance, one summary settlement has been issues, one written warning has been issued, and 12 remain open.

There has been a slight increase in the number of complaints involving failure to provide reasonable assistance. Similar to failure to notify complaints, AKD is concerned with this as failure to provide reasonable assistance may negatively impact an observer's ability to perform their duties. 58 complaints were received in 2018; 20 complaints were resolved through compliance assistance, two were resolved through the issuance of a summary settlement, two were resolved through the issuance of a written warning, and 18 remain open.

5.3. Outreach

5.3.1. Conferences and Symposia

Observer Liaison Contractor, Dennis Jaszka, attended the Freezer Longline Symposium on 15 May 2018 in Seattle. Here, Dennis was able to talk to a few vessel operators and first mates regarding compliance issues relevant to the freezer longline fleet.

Dennis also attended the End Violence Against Women International Conference, 3-5 April 2018 in Chicago where he attended lectures on gender bias, bullying, and effectively communicating with victims. He learned about law enforcement challenges regarding victim crimes and how to support victims and respond to reports of sexual harassment.

An AKD Special Agent presented a poster at the End Violence Against Women International conference in Chicago, IL. The poster outlined the risk reduction strategy model currently being used in AKD to reduce the opportunity for harassment to occur. This risk-reduction strategy is discussed with observers and industry alike in an effort to improve bystander intervention and increase reporting.

An AKD Special Agent presented a poster at the International Fisheries Observer and Monitoring Conference in Vigo, Spain. AKD conducted an anonymous survey to determine the number of safety and harassment related issues experienced by observers while deployed, as well as the impediments to disclosing such experiences. The poster which summarized the results, received third place at the conference.

5.4. Compliance Assistance

Compliance assistance provided to vessel operators and owners can greatly improve voluntary compliance without the need for monetary enforcement action to be taken. Compliance assistance is typically provided in person to a vessel operator, or during a meeting with vessel owner management. It can also be provided through compliance letters sent to owners and operators. Table 5-2 summarizes the number of time compliance assistance was provided for 2018 complaints.

5.4.1. Meetings with Industry

An AKD Agent met with multiple Seattle based vessel companies to discuss compliance concerns that were general to the particular management program the company's vessels were engaged in, as well as specific complaints reported on each company's individual vessels. The Agent met with a total of five companies. She also met with four plant managers to discuss compliance concerns applicable to each individual processor, as well as two co-op managers to discuss concerns relevant to the AFA co-ops. These meetings will continue annually as requested by each individual company.

5.5. Enforcement Actions

5.5.1. Written Warnings, Summary Settlements, Cases Forwarded for Prosecution

The 2019 A Season BSAI Observer Pulse Operation focusing on 2018 observer initiated investigations consisted of one dedicated IST in Juneau, an Observer Liaison in Seattle, and a team in Dutch Harbor including a supervisory enforcement officer, four enforcement officers, and one special agent. There were 191 individual complaints, involving 60 distinct catcher vessels, catcher processors, motherships and shoreside processors. A total of 87 complaints were resolved, 14 were furthered but remain open pending enforcement action or further investigation, and 90 remain open. Several investigations not part of the operation were also furthered, and new investigations were also discovered.

In 2018, AKD issued 13 written warnings and 18 summary settlements. Six cases have been forwarded for civil prosecution. Table 5-3 summarizes the status of these cases.

5.5.2. NOAA General Counsel - Enforcement Decisions, Orders and Enforcement Actions

No observer-related cases were charged or settled in 2018. However, six have been forwarded for prosecution, including four involving the sexual harassment/assault of an observer.

Table 5-2. -- Complaints received for selected category and number of time compliance assistance was provided for 2018 complaints.

Complaint type	Number of complaints received	Number of times compliance assistance was provided*
Limited Access - Operational and Equipment Requirements	113	46
Failure to notify	47	24
Reasonable assistance	58	20
Record keeping and reporting	249	44
Prohibited species	59	22
Safety	67	24
Salmon bycatch	100	27

*This chart does not list all instances were compliance assistance was provided.

Table 5-3. -- Status of Complaints - The table below records statements and resulting incidents. 'Enforcement Action taken' includes all civil and criminal prosecutions, summary settlements, and written warnings; 'Closed' includes information only and lack of resources incidents. Many info only incidents involved observer and operator communication resulting in voluntary compliance at sea.

Statements	Incidents	
898 Statements received and reviewed in 2018 (81 statements did not document an actual violation)	817 Statements were forwarded to agents and officers (417 new incidents created, 400 statements were added to open incidents)	260 Ongoing
		6 Forwarded for prosecution
		31 Enforcement Action taken
		247 Compliance assistance provided
		273 Closed - No OLE Action
Excludes 86 Observer Coverage potential violations reported by Agency Staff.	*Multiple statements are often combined into a single incident if the same vessel, operator, or company is involved. Ongoing includes cases submitted to General Counsel.*	

*As of 18 April 2019

6. Outreach

Outreach efforts continued throughout 2018 to provide information about the Observer Program and its ongoing effort for quality data collection and management of Alaska fisheries. This report focuses specifically on the outreach activities that were conducted in the fall of 2017 (in preparation for the 2018 fishing year) and throughout the 2018 calendar year. The majority of outreach efforts occurred in various locations in Seattle, Washington; Alaska; and via telephone (Table 6-1).

Numerous agency staff contributed to the various outreach events including NMFS (Observer Program, Sustainable Fisheries), OLE, and the USCG. Attendees at the meetings included: staff from the Alaska Departments of Fish Game, observer service providers, EM service providers, fisheries observers, processor companies, the Alaska Seafood Cooperative, vessel owners and operators, international scientists, other industry representatives, and the general public. The continued participation and feedback provided at these events is always appreciated.

The goals of the late fall 2017 and early 2018 outreach endeavors were to provide information about the Observer Program, vessel responsibilities, modifications to the 2018 Halibut Deck-sorting Exempted Fishing Permit (EFP), EM, the continued objective of collecting quality data, and management of these data.

Throughout this year, extensive coordination and collaboration continued between the FMA, AKRO, and the Alaska Seafood Cooperative regarding the management and implementation of the 2018 Exempted Fishing Permit to conduct a feasibility study to reduce Halibut mortality on designated non-pelagic trawl catcher processor vessels in the Bering Sea (Halibut EFP). In addition to weekly phone and in-person discussions, FMA field staff assisted with EM camera chute data pulls and troubleshooting chute system issues, and conducting deck safety plan assessments and approvals.

In June 2018, the International Fisheries Observer and Monitoring Conference was held in Vigo, Spain. Representatives from both AKRO and FMA were able to attend this conference and presented on a variety of topics: cultivating data quality, EM implementation, tools used in monitoring approaches, outreach and collaboration with industry, and quantifying individual observer sampling effort. This was a unique conference, affording an opportunity for agency staff to network, foster collaborations, and connect with industry constituents.

Recognizing the successful management of the Alaska fisheries and that walleye pollock is the most consumed wild fish in Germany, a German media outlet requested an observer interview. The goal of the interview was to highlight the role that observers play in successful fisheries management. FMA staff, the Alaskan Observers, Inc., Genuine Alaska Pollock Producers, and the German publication successfully coordinated this interview which was published to German media outlets in July 2018.

Operational challenges were faced at the 2018 due to lack of appropriated funding and the subsequent government shutdown. Thanks to the collaborative effort between the agency and

industry constituents, important observer data collections were salvaged. Of particular note, O'Hara Fisheries, FMA, and the Resource Ecology and Fisheries Management Division coordinated and enabled collection of stomach and Pacific cod maturity samples, to support studies on trophic level interactions. While scaling back on the total amount of sampling was necessary, the ability to collect any samples would not have been possible without the successful working relationship between the agency and industry constituents. Additionally, the Amendment 80 fleet assisted with the transport and distribution of the Halibut EFP deck-forms. Without these forms, vital information that is part of the Halibut EFP would not have been collected in a standardized and useable fashion.

The observer providers should be commended in continuing to safely deploy observers. They are integral in the contribution to the management of successful observer deployments in the Alaska fisheries. Of particular note, observer providers had minimal support during the government shutdown but managed to coordinate and deploy upwards of 220 observers for the 2019 A-season. Their daily interactions with members of the commercial fishing communities and their management of observer logistics continue to support the success of the Observer Program and fisheries management in Alaska.

Looking forward to 2019, NMFS plans to continue providing outreach meetings and activities to interested communities. The advances in technologies affords the ability to connect with remote communities and the use of web-based teleconferences and presentations. The combination of remote meetings (e.g., using Web-Ex and phone) and periodic in-person visits provides valuable interaction and communication between NMFS and the fishery members.

Table 6-1. -- Outreach activities related to the Observer Program in fall of 2017 and throughout 2018.

Date	Event	Location
10/16/2017	Seattle, WA	Pacific Marine Expo
12/28/2017	Phone	Aleutian East Boroughs
1/17/18	Kodiak, AK	Kodiak Trawl Fleet Meeting-Improving access to observer sampling, on site pre-cruises
2/2018	N/A	Fishermen News letter to the editor
3/21/18-3/24/28	Kodiak, AK	ComFish
5/15/18	Seattle, WA	Freezer Longline Coalition Symposium
5/12/18	Seattle, WA	Seattle Maritime Family Fun Day
6/8/18	Seattle, WA	NOAA Open House
6/11/18-6/15/18	Vigo, Spain	International Fisheries Observer and Monitoring Conference
6/18	Kodiak , AK	Assistance with Saltonstall-Kennedy Grant investigating the Improvement of Salmon by-catch estimates for the GOA trawl fleet
7/25/18	Dutch Harbor, AK	Observer interview with German media outlet
8/24/18	Kodiak, AK	Kodiak Trawl Fleet Meeting-Improving access to observer sampling
9/8/18	Dutch Harbor, AK	BioBlitz
All Year	Phone	Periodic EM Service Provider Outreach and Coordination Calls
All Year	Kodiak	Individualized pre-cruise meetings to review sampling on unique catcher vessels
All Year	Phone	Bi-weekly meetings with Amend 80 for Halibut Decksorting EFP
All Year	Dutch Harbor, AK	Industry support regarding non-regulated fisheries such Halibut EFP

7. NMFS Recommendations

7.1. Recommendations to Improve the 2020 ADP

Trip-selection Pool

- NMFS recommends that the observer trip selection strata based on gear (trawl, hook-and-line, and pot) which were implemented in 2016 remain the same for 2020. This follows the Observer Science Committee (OSC) and the Scientific and Statistical Committee (SSC) recommendation to try to stabilize the sampling design across years.
- NMFS agrees with the OSC recommendation that the draft 2020 ADP include a re-examination of tendering strata (tender pot and tender trawl). This could be accomplished in a variety of ways and should not be limited to eliminating tendering strata altogether nor holding selection rates the same between tendered and non-tendered strata within a gear type.
- NMFS continues to recommend maintaining a single trawl gear stratum (i.e., NPT and PTR in a single stratum). This provides maximum flexibility to vessels carrying both net configurations on a single trip while ensuring the stratum the trip belongs to won't change regardless of which net is fished. The realized rates between non-tender trawl gear types were different for non-pelagic trawl and pelagic trawl gear in 2018 (Appendix A); however, these differences are accounted for in estimation through the post-stratification process in the Catch Accounting System. The fishery management issues associated with these two gear types (primarily salmon PSC in the pollock pelagic trawl fishery and halibut PSC in the non-pelagic trawl fishery) differ and there are different sampling issues for these two PSC species. As a relatively rare species, salmon are accounted for shoreside when an observer is onboard and the vessel is not delivering to a tender. These counts are extrapolated to unobserved trips. In contrast, halibut discard estimates are only based on data collected by observers at sea, and extrapolated from observed to unobserved trips. NMFS supports the focus of the Council's Electronic Monitoring Committee to expand EM applications to monitor pelagic trawl vessels and tenders, complemented by shoreside observers.
- Within budget constraints, NMFS recommends continuing to allocate observer deployment using a 15% hurdle plus optimization based on discarded groundfish, Pacific halibut PSC, and Chinook salmon PSC. This allocation strategy provides a balance between minimizing the variability of discard estimates, prioritization of PSC-limited fisheries, and the need to reduce gaps in observer coverage in the partial coverage category.

ODDS

- Chapter 3 of this report (and previous Annual Reports) highlight several consequences of differential cancellation rates that were observed in ODDS including a temporal bias in the tender trawl stratum. NMFS recommends modifying ODDS to reduce the impact of

inherited trips while allowing flexibility to the fleet and accommodate changes to fishing plans.

- NMFS also recommends continuing to automatically release vessels 40-57.5 ft in length from observer coverage if the two previous trips were observed trips (i.e., if two trips in a row were observed and a third trip is selected, then the third trip will be released from coverage).

Performance metrics:

In the 2017 Annual Report, NMFS recommended evaluating the suite of trip metrics that are used in Chapter 3 to evaluate an observer effect. Recognizing that this analysis competes with other priorities for analytical staff time, NMFS recommends adding an item to 'Explore alternative approaches to evaluate observer effects' to the list of analytical priorities related to the Observer Program that is reviewed by the Council during staff tasking.

EM Selection Pool

- NMFS recommends continuing trip-selection in the EM pool where trips will be selected prior to departure, so the vessel will only be required to use the EM system on selected trips.
- The number of vessels allocated to the EM selection pool will be based on analysis of EM costs and the amount of available funding that is available. If there are insufficient funds to support all the vessels that opt into the EM selection pool, NMFS recommends that priority be given to 1) vessels that are already equipped with EM systems and 2) vessels 40-57.5 ft length overall (LOA) where carrying a human observer has been problematic due to bunk space or life raft limitations.
- We recommend that EM review rates are set to ensure that the entire year is sampled and review is timely enough so that data from EM can be used for catch accounting and fisheries monitoring as envisioned by the Council.

Dockside Monitoring and Tendering

- NMFS supports the EM Committee's priority to test and evaluate longer-term solutions for monitoring salmon bycatch in the trawl fisheries, including using EM on tender vessels to enable shoreside data collection from these deliveries.
- In 2020, NMFS recommends maintaining the status quo for dockside monitoring. NMFS will continue to collect genetic samples from salmon caught as bycatch in groundfish fisheries to support efforts to identify stock of origin. For vessels delivering to shoreside processors in the GOA pollock fishery, the sampling protocol would remain unchanged; trips that are randomly selected for observer coverage would be completely monitored for Chinook salmon bycatch by the vessel observer during offload of the catch at the shoreside processing facility. For trips that are delivered to tender vessels and trips outside of the pollock fishery, salmon counts and tissue samples would be obtained from salmon found within observer at-sea samples of the total catch. An Exempted Fishing

Permit affecting this sampling approach may require NMFS to re-assess this recommendation and increase shoreside monitoring to complement expanded EM tests in 2020.

No Selection Pool

Recognizing the challenging logistics of putting observers on small vessels, NMFS recommends maintaining status quo and placing vessels less than 40 ft in the no selection pool for observer coverage. However, since there is no monitoring data from this segment of the fleet, NMFS does continue to recommend that vessels less than 40 ft LOA could be considered for the EM selection pool in the future. The agency recognizes that the Council's priority for EM research is on trawl vessels, so the evaluation of data collected on fixed-gear less than 40 ft will not begin immediately.

7.2. Update to Previous Recommendations

NMFS has made recommendations in previous annual reports and annual deployment plans. Here we provide a status update on those recommendations.

Topic	NMFS recommendations	Status
No selection pool	2013-2018 Annual Reports: Recognizing the challenging logistics of putting observers on small vessels, NMFS recommended that vessels less than 40 ft length overall (LOA) be in the no selection pool for observer coverage.	Since the 2013 ADP, NMFS has been placing vessels less than 40 ft LOA in the No selection pool.
	2014-2016 Annual Reports: NMFS recommended that vessels less than 40 ft LOA be considered for testing of electronic monitoring since NMFS has no data from this segment of the fleet.	In December 2016, at the recommendation of the EM Workgroup, the Council requested a discussion paper about incorporating vessels <40 ft LOA in the EM selection pool. This project is on the list of analytical projects related to the Observer Program, but no staff have been assigned to work on this project yet. In February 2018, the Council reviewed a discussion paper of EM prioritization. The Council recommended that development of EM on trawl vessels as higher priority than implementation of EM on fixed gear vessels <40 ft LOA. In 2017 Annual Report NMFS recognized Council's priority for EM research has shifted to trawl vessels, so the evaluation fixed-gear <40 ft will not begin immediately. However, since there is no monitoring data from this segment of the fleet, NMFS does continue to recommend that vessels < 40 ft be considered for the EM selection pool in the future.
EM Selection Pool	2014 and 2015 Annual Reports: NMFS recommended continuing to allow hook-and-line and pot vessels < 57.5 ft LOA where taking an observer is problematic an opportunity to 'opt-in' to the EM selection pool to participate in the EM cooperative research under the EM pre-implementation plan developed by the EM workgroup.	This recommendation was implemented in 2016. The vessels were required to follow procedures outlined in the Final EM Pre-Implementation Plan. Vessels participating in the EM selection pool in 2016 were not required to carry an observer for the entire year and vessels were not required to log trips in ODDS. Starting in 2018, NMFS integrated EM into the Observer Program and starting to incorporate the EM selection pool into the 2018 ADP, rather than using an EM Pre-implementation Plan process.
	Final 2018 ADP - On August 8, 2017, NMFS published a final rule to integrate EM into the Observer Program. NMFS incorporated the EM selection pool into the 2019 ADP, rather than using an EM Pre-Implementation Plan process.	Under the regulated program, NMFS incorporated EM data from hook-and-line vessels into CAS in 2018 so the information was be used for inseason management. Pot pot vessels were still in "pre-implemtnation" in 2018 while the methods to incorporate the data into CAS were developed. Starting in

		2019 EM data from both pot and hook-and-line vessels is being used for inseason management.
	2016 Annual Report and 2018 ADP: NMFS supported the Council's request to expand the size of the EM pool. The final number of vessels was based on analysis of EM costs and available funding.	In 2018, there was sufficient funding to accommodate the 141 vessels that requested EM. In 2019, there was sufficient funding to accommodate all of the vessels that requested to participate in EM and NMFS approved the 168 vessels in the EM selection pool. If there were insufficient funds to support the expanded size of the EM pool, NMFS priority be given to 1) vessels already equipped with EM systems; 2) vessels wired for EM systems but not yet fully equipped; and 3) vessels 40-57.5 ft LOA where carrying an observer is problematic due to bunk space or life raft limitations.
	Draft 2018 ADP – NMFS communicated that the agency intended to implement post-selection process for EM trips in 2019 where 100% of trips would have video recording, and trips would be post-selected for review. This approach would provide a mechanism to avoid monitoring bias.	NMFS received feedback from the Council regarding logistical and cost considerations of a post-selection process. In the final 2018 ADP and the 2019 ADP, NMFS implemented trip-selection in the EM pool where trips were selected prior to departure, so the vessel were only be required to use the EM system on selected trips. However, NMFS recommended continuing to evaluate the monitoring effect in the EM selection pool and, in the future, may recommend post-selection of trips.
Observer trip Selection – strata definitions	2018 and 2019 ADP: NMFS recommended sampling strata based on gear and tender. The Council did not support a separate stratum for hook-and-line vessels delivering to tenders, because there are so few instances of this activity.	In the 2018 and 2019 ADPs, Hook-and-line vessels delivering to tenders were combined with the Hook-and-line vessels delivering shoreside for a single Hook-and-line stratum. This was due to the small number of tender deliveries for this gear type.
	2017 Annual Report: NMFS recommended maintaining a single trawl gear stratum (i.e., NPT and PTR in the stratum).	NMFS has continued to implement a trawl stratum. The flexibility of vessels to use both gear trawl types adds considerable ambiguity in the sampling plan design and its assessment that cannot be solved by trawl gear type stratification. The realized rates between non-tender trawl gear types were different for NPT and PTR gear in 2017 (Appendix A of 2017 Annual Report); however, these differences are accounted for in estimation through the post-stratification process. If there is continued concern about this issue, the Council's new focus on trawl within the EM workgroup (in particular, ongoing research on new ways to account for salmon) could provide longer-term solutions.

	2015 Annual Report: NMFS recommended evaluating two additional strata for the 2017 ADP: • Separate strata for vessels delivering to tenders. Based on analyses in this report and that from 2014, NMFS continues to see differences in the characteristics of tendering and non-tendering vessels. Establishing a separate stratum (or strata) for vessels delivering to tenders would enable NMFS to adjust sampling rates to provide the necessary data to manage fisheries. • Separate strata for partial coverage catcher-processors. Given the potential expansion in the number of catcher-processors in partial coverage in 2016, establishing a separate stratum (or strata) for partial coverage vessels would enable NMFS to adjust sampling rates.	In the 2017 ADP, the stratification scheme was based on gear and tender deliveries. Based on the analysis of alternative deployment strategies NMFS did not recommend implementing a separate stratum for partial coverage catcher-processors.
	2014 Annual Report: NMFS recommended that the 2016 ADP should explore defining strata to deploy observers by gear (e.g. fixed gear, and trawl gear) and FMP area (BSAI, GOA)	Strata definitions based on gear (hook-and-line, pot, and trawl) was implemented starting in 2016.
Observer trip Selection – allocation strategy	2016 Annual Report: NMFS recommended that sampling rates be high enough in each stratum to reasonably expect three observed trips in each NMFS Area and that the ADP include evaluation of 1) 15% coverage rates across all strata and 2) equal coverage rates that can be afforded 2017 Annual Report: Within budget constraints, NMFS recommended allocating observer deployment beyond the minimum "hurdle" using the using optimization based on discarded groundfish, Pacific halibut, and Chinook salmon. NMFS will also consider other PSC species (crab and herring).	In Appendix B of the 2019 Draft ADP, NMFS provided an evaluation of hurdle thresholds to evaluate whether the 15% threshold is warranted for all gear-specific strata. The analysis looked at the chances of observing 3 or more trips in each NMFS Reporting Area under varying levels of observer coverage in 3 years (2015-2017). While 15% coverage is sufficient to meet a 50% probability of observing three trips or more in most areas for the hook-and-line and trawl strata, it does not achieve this probability of observation in the other strata. Over the course of a year, some NMFS Areas will have low fishing effort and even at a 15% threshold, there is a relatively high probability that there will be no observed trips for those area. While it is possible to pool data across areas to produce bycatch estimates, these estimates suffer from lower resolution and variance estimates are not able to be produced. NMFS recommended of a 15% minimum level of sampling for the hurdle approach for all strata, which precautionary with respect to avoiding bias and increasing the chance of getting data across all gear types and areas. Starting in 2018 ADP NMFS implemented observer deployment allocation strategy of 15% plus optimization based on discarded groundfish and halibut and Chinook.

Dockside Monitoring and Tendering	2017 Annual Report: NMFS recommended maintaining status quo for dockside monitoring. However, for the past 3 years, NMFS had been unsuccessful in achieving its goal of obtaining an unbiased sample from the GOA pollock trawl fleet for enumerating salmon bycatch and determining stock of origin, which were primarily related to tendering activity. Therefore, NMFS recommended the Council and NMFS consider longer-term solutions for monitoring Chinook salmon PSC and trawl trips delivering to tenders in the GOA.	In the 2018 ADP, NMFS clarified the agency's objectives for collecting genetic samples from salmon PSC to identify stock of origin. The sampling protocol for vessels delivering to shoreside processors in the GOA pollock fishery is that when trips that are randomly selected for observer coverage those trips will be completely monitored for Chinook salmon bycatch by the vessel observer during offload of the catch at the shoreside processing facility. For trips that are delivered to tender vessels and trips outside of the pollock fishery, salmon counts, and tissue samples will be obtained from all salmon found within observer at sea samples of the total catch. Therefore, there is no expectation that offloads to tender vessels will be monitored. In addition, the Council has recognized evaluation of alternative sampling methods for salmon on CGOA Rockfish trawl CVs as one of its EM priorities. This may provide longer-term solutions to the dockside monitoring and tendering issues.
Vessel Selection	2014 Annual Report: Based on the 2013 and 2014 Annual Reports, NMFS recommended that participants in the vessel selection category be placed in the trip selection category.	This recommendation was implemented in 2015. Vessels that were in vessel selection were placed in the small-vessel trip selection strata in the 2015 and subsequent ADPs. Although, the EM Workgroup implemented vessel-selection for EM boats in 2016.
Observer Effect Performance Metrics	2017 Annual Report: NMFS recommended evaluating the suite of trip metrics used to evaluate observer effect. In particular, evaluating how they relate to at-sea data collections and, to the extent feasible, providing additional information regarding interpretation of effect sizes and p-values (e.g., consideration of sample sizes).	No change to the performance metrics were made for the 2018 Annual Report. Model-based approaches are being considered as an alternative and this item has been added to list of analytical priorities.
Trip Identifier	2014 Annual Report: NMFS staff will consider and identify the best approach to develop a trip identifier tied to landing data to provide linkage between ODDS and eLandings and improve data analysis. Identification of tender trips through electronic reporting on tenders (via tLandings) would also facilitate analysis.	NMFS implemented modifications to the eLandings system that enables the ODDS trip number to be voluntarily be entered on a groundfish landing reports in eLandings starting in 2016. Identification of tender trips has also been improved by requiring vessels delivering to tenders to identify whether they plan to do a tender delivery trip by checking a box in ODDS and by requiring tenders to use tLandings to report landing reports.
ODDS	2015 Annual Report: Allow vessels to log three trips in ODDS.	In the 2014 Annual report, NMFS recommended evaluating changes to ODDS to address temporal bias exhibited in 2013 and 2014. The 2015 annual report found differential cancellation rates in ODDS, and this led the OSC to recommend a change in cancellation policy be explored. However, a temporal bias in realized trips was not found in 2015 and NMFS did not change the ability for vessels to log 3 trips and cancel trips in ODDS.

	2016 Annual Report: In the longer term, NMFS recommended making changes to ODDS to allow changing the dates for observed trips, rather than cancelling and inheriting observed trips, while maintaining the order of the trips.	The recommended changes to ODDS have not yet been completed and there are logistical issues that make these changes challenging to implement. However, in 2017 we are seeing broader impacts of the trip inheriting process in ODDS (see chapter 3) and therefore have further recommendations for making changes to the application (see Section 7.1).
Conditional Releases	Draft 2016 ADP: NMFS recommended not granting conditional releases or temporary exemptions to vessels subject to observer coverage.	Starting in 2016, NMFS discontinued all conditional releases and temporary exemptions to vessels subject to observer coverage and mitigated the impact of observers on vessels through the EM pre-implementation plan. Qualifying vessels that volunteered for EM participation are not required to carry an observer.
	2015 ADP: Automatically release vessels 40-57.5 ft in length from observer coverage if the two previous trips were observed trips (i.e., if two trips in a row were observed and a third trip is selected, then the third trip will be released from coverage).	NMFS implemented this recommendation in the 2015 ADP in response to the Council's motion on the draft 2015 ADP. The "three in a row" release policy was continued under the 2016-2018 ADPs.
Voluntary Full Coverage	2013 ADP: Provide trawl vessels an option to carry an observer at all times when fishing in the BSAI.	During the 2013-2016 ADPs trawl catcher vessels were able voluntarily carry an observer at all times while fishing in the BSAI but they continued to pay fees in the partial coverage category. In 2016, NMFS published regulations to allow the owner of a trawl catcher vessel to annually request that NMFS place the vessel in the full coverage category for all directed fishing for groundfish using trawl gear in the BSAI in the following calendar year. Starting in 2017, the regulated process replaced the interim policy. In 2017, NMFS approved requests for 31 catcher vessels to be in the full coverage category. In the 2018, NMFS approved requests for 34 catcher vessels to be in full coverage.

Other recommendations:
At their June 2014 meeting, the Council's SSC recommended that: In addition to sample size needs for spatial and temporal coverage, develop accuracy and precision objectives for catch, PSC, and bycatch.

NMFS does not recommend that specific precision objectives for catch, PSC, and bycatch be used to determine deployment of observers. In the development of the starting in the 2016 ADPs, NMFS has compared alternative sampling designs by simulated observer deployments and estimating the relative precision of total retained and discarded groundfish. The alternative designs have been evaluated using a gap analysis and ranked based on the results from the simulations. NMFS agrees that as the program continues to develop, understanding the sources of variation provides additional information and aids in decisions about sample design. Recognizing that funds are limited, NMFS uses its ADP process to make annual adjustments to observer deployment that maximizes expenditures while considering risk of exceeding budgets. NMFS is continuing work to develop methods to assess variance of the catch estimates so that variance estimates can be considered in stock assessments, the ADP, and management actions.

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Appendix A –Evaluation of Pelagic and Non-pelagic Trawl Trips

Introduction

At its June 2017 meeting, the Council requested that NMFS evaluate whether there is evidence of an observer effect in either pelagic trawl (PTR) or non-pelagic trawl (NPT) gear fished by partial coverage vessels. These two gear types are typically used for different styles of fishing, with NPT gear associated with bottom contact and PTR gear typically fished in the water column. While this is often the case, both gear types can be fished on the bottom.

The recommendation followed a request from the Council's Fisheries Monitoring Committee for the evaluation, including a discussion about the "pros and cons" of separate observer deployment strata for those two gear types. One concern identified is vessels selected for observer coverage being directed to fish for pollock in order to avoid the at-sea sampling of salmon PSC that is done on non-pollock trips in the Gulf of Alaska. This type of activity can only occur when pollock is open for directed fishing but would result in a vessel avoiding an at-sea sample for salmon by taking a Pollock trip when observed. Such behavior would result in higher observer coverage in PTR gear since it is used to target pollock. Whereas salmon accounting for observed vessels fishing with NPT gear is based on highly variable at-sea samples, observed vessels fishing for pollock (usually using PTR gear) typically have salmon accounted for during the offload at the shoreside processing plant. In management situations where salmon PSC caps are a concern, industry may choose to fish such that their offload is primarily pollock on observed trips, thus obtaining a shoreside count of salmon PSC. Conversely, if Halibut PSC limits are a management concern, industry may direct more observed vessels to fish with NPT gear to obtain a larger sample of fishing activity with that gear type.

The 2018 Annual Deployment Plan separates trawl strata by tender status, not by whether the gear being used is pelagic or non-pelagic. The Catch Accounting System (CAS) post-stratifies observer and landings data based on whether the trip is recorded as NPT or PTR on the landing report ("fish tickets") or in the observer data. In both cases, the vessel operator is reporting the gear type being used to the observer (usually through the logbook) or through *e*Landings. Although the gear information is "self-reported," regulations at 50 CFR 679.2 (definitions) define pelagic and non-pelagic trawl gear to be of certain configurations (e.g., floats, mesh configurations, line configurations).

The two gear types are also associated with differing fishery management issues, with salmon PSC being the primary issue for the pollock pelagic trawl fishery and Halibut PSC being of concern for the non-pelagic trawl fishery. Being a relatively rare species, salmon are accounted for shoreside when an observer is onboard and the vessel is not delivering to a tender. These counts are extrapolated to unobserved trips. In contrast, Halibut discard estimates are only based on data collected by observers at sea and extrapolated from observed to unobserved trips.

The Observer Science Committee (OSC) responded to the Council's request with an Appendix in the 2017 Annual Report (AFSC and AKRO 2018, Appendix A). The OSC chose not to include a permutation test in that analysis after concluding that stratification by these sub-gear types is not feasible due to the fact that both PTR and NPT gear are used on some trips (AFSC and AKRO

2018). At its June 2018 meeting, the Council again requested that NMFS evaluate whether there is evidence of an observer effect in either pelagic trawl or non-pelagic trawl gear fished by partial coverage vessels. That analysis is provided here, with permutation test results included. All analyses consider only non-tendered trawl trips.

Results

Since 2016, 99.7% of the partial coverage category PTR landings targeted pollock (Appendix Table A-1). Of these 4,383 pollock trips, 97.3% had a catch composition of at least 95% pollock, which falls into the CAS "pelagic" pollock target (suggesting mid water tows). The remaining pollock landings were in the "bottom" pollock target category, which is based on the pollock being the predominant species retained, but less than 95% of the retained catch. The predominant targets for vessels fishing NPT gear were Pacific cod (54.3% of trips) and arrowtooth flounder (31.1% of trips), followed by pollock (8.8% of trips; Appendix Table A-1).

Observation rates for PTR gear were consistently higher than observation rates for NPT gear (Appendix Table A-2). This supports the theory that vessels may be opting to fish PTR gear when chosen for observer coverage. Also of note is that mixed-gear trips, where the vessel fishes both pelagic and non-pelagic gear during a trip, are not uncommon (Appendix Table A-2).

The results from the permutation test are mixed. Between 2016 and 2018, 11 of 18 metric/year combinations showed evidence of an observer effect in NPT gear (Appendix Table A-3). This is in comparison to 4 of 18 metric/year combinations showing evidence of an observer effect in PTR gear (Appendix Table A-3). Within each gear type, we would expect $18 \times 0.05 \approx 1$ metric/year combinations to show evidence of an observer effect by random chance. This means that while both gear types showed evidence of an observer effect, there was more evidence of an observer effect in NPT gear.

Discussion

The results of this analysis are similar to the conclusions made in Appendix A of the 2017 Annual Report (AFSC and AKRO 2018). This analysis simply provides more nuanced information requested by the Council that relates to the observation of trawl trips within the PTR and NPT gear types. The OSC continues to recommend against stratification by the NPT and PTR gear types (see OSC recommendations in Chapter 3 and additional explanation Appendix A of the 2017 Annual Report (AFSC and AKRO 2018)).

Appendix Table A-1. -- Number of trips (N) by target species for NPT and PTR gear types between 2016 and 2018. For the purpose of this table, mixed-gear trips are excluded.

Gear	Target	N
NPT	Pacific cod	1,020
	Arrowtooth flounder	584
	Pollock	166
	Flatfish (shallow water)	70
	Flathead sole	13
	Rex sole	7
	Sablefish	5
	Atka mackerel	4
	Rockfish	4
	Yellowfin sole	4
	Other	3
NPT Total		1,880
PTR	Pollock	4,383
	Arrowtooth flounder	6
	Flatfish (shallow water)	3
	Pacific cod	2
	Atka mackerel	1
	Rockfish	1
PTR Total		4,396

Appendix Table A-2. -- Number of total trips (N) and sampled trips (n) by trawl gear type. For the purpose of this table, each mixed-gear trip is counted three times: as a PTR trip, as an NPT trip, and as an NPT & PTR trip.

Gear	N	n	% Observed
2016			
PTR	1560	421	27.0
NPT	844	205	24.3
NPT & PTR	62	19	30.6
2017			
PTR	1544	350	22.7
NPT	508	82	16.1
NPT & PTR	38	1	2.6
2018			
PTR	1292	272	21.1
NPT	528	92	17.4
NPT & PTR	44	14	31.8

Appendix Table A-3. -- Results of permutation tests between observed and unobserved trips within the NPT and PTR gear types between 2016 and 2018. For the purpose of these tests, mixed-gear trips were excluded.

Gear	Metric	NMFS Areas	Days Fished	Vessel Length (ft)	Species Landed	pMax Species	Landed Catch (t)
2016							
NPT	Observed difference	-0.037	-0.493	-1.044	-1.764	0.049	-23.684
	OD (%)	-2.925	-14.584	-1.188	-26.854	6.022	-39.879
	p-value	0.335	< 0.001	0.373	< 0.001	0.008	< 0.001
PTR	Observed difference	-0.012	0.246	4.884	-0.185	-0.001	7.952
	OD (%)	-1.181	11.287	6.024	-3.833	-0.112	8.484
	p-value	0.195	0.010	< 0.001	0.128	0.395	< 0.001
2017							
NPT	Observed difference	0.063	-0.263	1.504	-1.521	0.056	-16.168
	OD (%)	5.051	-7.757	1.689	-21.083	6.765	-19.774
	p-value	0.278	0.055	0.354	0.008	0.016	0.007
PTR	Observed difference	-0.012	-0.115	-1.437	-0.224	-0.002	-3.072
	OD (%)	-1.178	-5.353	-1.698	-5.200	-0.169	-2.857
	p-value	0.193	0.285	0.186	0.109	0.002	0.150
2018							
NPT	Observed difference	-0.089	-0.290	-4.309	-0.360	0.032	-18.648
	OD (%)	-7.746	-8.889	-5.059	-4.035	4.142	-26.359
	p-value	0.046	0.011	0.019	0.572	0.168	< 0.001
PTR	Observed difference	-0.001	-0.203	-0.644	0.195	-0.002	-2.076
	OD (%)	-0.144	-8.149	-0.765	4.410	-0.158	-1.986
	p-value	1.000	0.193	0.611	0.178	0.441	0.387

Appendix B – Electronic Monitoring Video Review Results

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Introduction

Electronic monitoring (EM) programs use video monitoring to track fishery activities. EM can be a practical alternative to carrying an on-board observer, particularly when the space or cost of an observer is prohibitive. The North Pacific Fishery Management Council (NPFMC) established an intent to incorporate electronic monitoring (EM) as a tool of the North Pacific Observer Program for catch estimation in the fixed gear groundfish and halibut fisheries. In 2018, the NPFMC EM program fully incorporated EM as a monitoring option for fixed gear vessels in the partial coverage category of the North Pacific Observer Program.

Prior to 2018, pre-implementation plans for EM were developed by a working group of the NPFMC. The goals of pre- implementation were to determine the efficacy of EM for catch accounting of retained and discarded catch and to identify key decisions that would be made in order to integrate EM systems into the Observer Program. Results of the pre-implementation work were used to inform council decisions and develop the regulated program.

Pacific States Marine Fisheries Commission (PSMFC) developed a program beginning in 2012 to test the use of EM for the Trawl Rationalization Program on the West coast. This program led to a regulation recommendation for the whiting and fixed gear fleets by the Pacific Fishery Management Council; ongoing work is evaluating the possibility of using EM for other groundfish fisheries. PSMFC has participated in the NPFMC working group and has reviewed EM data for Alaska longline vessels since 2014.

The fixed gear vessels in the partial coverage category using EM included small boat longline and pot vessels targeting sablefish (*Anoplopoma fimbria*), Pacific cod (*Gadus macrocephalus*) and Pacific halibut (*Hippoglossus stenolepis*). EM systems were provided and installed by Archipelago Marine Research (AMR) and reviewed by PSMFC. This report details EM data collected during pre-implementation in 2018.

Methods

Vessel Participation

Vessels in participating fisheries could opt into the EM Selection pool and EM instead of an observer. If they were approved by NMFS to be in the EM Selection Pool, they would log each trip in the ODDS system and then trips were randomly selected for EM coverage and review. Vessels made landings in ports including Homer, Kodiak, Sand Point, and Sitka.

Electronic Monitoring Systems

AMR and Saltwater Inc. (SWI) were contracted to provide and install EM systems, collect data drives from the vessels, collect logbooks, and provide logistical support. The onboard systems included a sensor to capture hydraulic pressure activity, a GPS to capture locations from which the speed of the vessel was calculated, and two to four cameras. Additionally, on some vessels, an engine oil pressure sensor triggered the system to power down to a sleep mode during periods of inactivity (e.g., at night or in port) in order to reduce power drain.

Sensor data (GPS and hydraulics) were collected at 10-second intervals when the EM system was fully powered on. Video began recording when the hydraulic pressure exceeded a trigger threshold set by the EM technician and specific to each vessel. In order to capture all catch handling, video recording continued for 2 hours past the last point when pressure was above the trigger threshold.

Video feed and system information were displayed on the user interface (typically installed in the wheelhouse) providing vessel operators with a live update of system performance, and continuous video feeds (even when not recording).

Effort Logs

Effort logs were distributed to all of the participating vessels. Images of effort logs were transmitted to PSMFC.

Electronic Monitoring Video Review

PSMFC reviewers used EM Interpret™ Pro (EMI) software from AMR. The software integrates the hydraulic sensor and GPS data with the synced video output. GPS data, dates and times are automatically recorded and reviewers added annotations to identify trips, hauls, and catch data. A configuration of this software allows review of both the AMR and SWI EM data.

The start and end locations, dates, and times of all trips and hauls were annotated. Other metadata such as the vessel information, ports, and fishery were either recorded by the hardware or annotated by the reviewer.

Reviewers recorded whether a streamer line, used as a seabird deterrent, was present or absent for each longline gear trip. Reviewers would randomly check at least two setting events to determine if streamer lines were used or not, and would record use as ‘partial’ if streamer lines were used on one haul, but not the other.

Reviewers recorded whether sensor and video data were complete for each haul based on the quantitative data from the sensor readings. Reviewers also assessed data quality and image quality for each haul. “Data Quality” was defined as the overall ability of the reviewer to effectively quantify and accurately identify catch data. Data quality could be impacted by a diversity of factors such as the image quality, catch handling, and camera angles or operation. Reviewers also gave specific ratings of the image quality and reasons for decreases in image quality (e.g. water spots on the camera, night lighting, etc.)

Species and counts of catch were recorded for a subset of hauls. In 2018, one of every three hauls were reviewed. Catch was defined as anything seen by an EM reviewer, excluding free-moving marine birds and mammals alongside the vessel. Video reviewers were trained by a PSMFC staffer working with the North Pacific Observer Program on Alaska species reporting conventions. The reviewers were instructed to record species to the lowest identifiable taxonomic level or grouping as required by the Alaska region.

Catch that was kept on the vessel (excluding use as bait or food) was considered retained; otherwise, catch was recorded as discarded[20]. Discards included marine organisms that fell off or out of fishing gear before it came onboard the vessel, or that were free-floating on the surface. For cases where the video stopped recording before catch handling was completed, fish that were onboard at the time of the video ending were reported as retained.

Discards were categorized as intentional or unintentional depending on the method of discard. Any fish that dropped off the gear (i.e., without visible shaking or other interaction by a crew member, or without hitting the roller) was defined as unintentional. All other discards were categorized as intentional. If a halibut was discarded, reviewers assessed the release method and condition for each fish.

Video reviewers recorded the number of minutes it took to review each haul. On-deck sort time was calculated from the start and end times of catch handling in the video. Review rate was calculated as review minutes divided by sort minutes.

Results

Ninety-seven longline and 15 pot vessels participated in the 2018 EM project, completing 250 longline trips and 45 pot trips. EM data was reviewed for 83 longline vessels covering 174 trips. Trip level data is presented for these 174 reviewed trips (Appendix Table B-1).

EM data was reviewed for 94 halibut trips, 10 Pacific cod trips, and 70 sablefish trips containing a total of 1,875 hauls. The data spanned 532 halibut sea days, 38 Pacific cod sea days, and 435 sablefish sea days for a total of 1,005 sea days with trips averaging 5.8 days across all fisheries (Appendix Table B-1). Of the 1,875 hauls on reviewed trips, the catch level data was recorded for 770. All catch data presented is from this subset of hauls.

Effort Log

A complete logbook was submitted with the video data for 82 of the 174 trips (47%). The remaining 92 trips had no logbook submitted (Appendix Table B-2).

[20] If camera views were not sufficient to see the whole deck, fish were recorded as retained or discarded based on whether they were retained or discarded at the rail. It is possible that some fish were brought onboard and later discarded out of view of the rail cameras; these fish would be recorded as retained in the EM data since the discard was not visible to the EM reviewer. In instances where fish were initially retained and later discarded in view of the rail cameras, the fish were recorded as discarded.

Data Quality

Aspects of data quality including video and sensor completeness, overall data quality, and image quality were noted by reviewers for every reviewed haul.

About a third of longline trips and about 15% of reviewed longline hauls had video gaps during fishing activity; most often these gaps resulted from video ending before catch handling ended, video starting after catch handling had begun, or from intermittent gaps in video coverage. All of these issues suggest technical problems relating to the set-up of the EM system. In general, video data was somewhat more likely to be incomplete on the first trip that a boat took with an EM system (Appendix Figure B-1). PSMFC has been working with AMR on changes to the EMI software that will allow quantification of the lengths of these time gaps. Currently this data are sufficient for investigating gaps in an individual trip, but some complications remain in summarizing the data at a fleet level.

Data quality was rated as high or medium for 96% of the 770 reviewed hauls. The most common reason for low data quality was video completeness, followed by water spots and poor camera angles (Appendix Table B-3).

Review Rate

Review rate for halibut and sablefish target fisheries ranged from 0.59 minutes of review per minute of video to 0.89 minutes of review per minute of video. The review rate in the Pacific cod snap longline fishery was slower and close to real time (e.g.,1 hour of catch handling could be reviewed in just over an hour) (Appendix Table B-4).

Pacific cod longline hauls tended to have a larger variety of species caught, as well as being the only fishery where stern hauling was conducted. Stern haulers were more difficult to review due to a side view of the line (as opposed to a top down view), as well as poor lighting on the line at night.

Seabird Deterrents

Streamer lines are used as deterrents to seabirds on longline vessels. In 2018, 72% of trips were confirmed to have used a streamer line. No streamer line was used for 20% of trips and streamers were partially deployed for >1% of trips, while in the remaining 17% of trips the presence or absence of a streamer line could not be determined (Appendix Table B-5).

Catch Summary

Since total catch accounting is the goal for EM in the Southeast Alaska fixed gear sectors, all species of retained or discarded marine organisms were reported and summarized to the target fishery level (Appendix Table B-6). Video reviewers identified a high proportion of retained and discarded catch to species. Exceptions were primarily those species that reviewers have been instructed to identify to a group level because they are too similar to reliably differentiate (e.g., shortraker/rougheye rockfishes, and arrowtooth/Kamchatka flounders). There were also a small proportion of rockfish that were recorded as “Rockfish – unidentified” or “Rockfish – Small Red unidentified”.

For most discarded species, the majority of discards were discarded after interaction with the vessel or a crew member. Interactions included the crew member throwing the fish overboard after the fish came onboard; a crew member shaking the line or manipulating the hook to release the fish before the fish came onboard; or the fish hitting the vessel and falling back into the water while no crew was attending the line.

Pacific Halibut

Reviewers recorded the method of release and the condition of each individual halibut at the time of release. These release methods and condition ratings were identical to those used by the observer program with the addition of three new release methods after consulting with the observer program: "Hand release", "Other careful release" and "Other non-careful release". The majority (87%) of Pacific halibut were released carefully using the "Hook twisting and shaking" method. The next largest release method (4%) was the "Hand Release" method (Appendix Table B-8).

Most halibut were judged to have minor damage at the time of release, of those that could be assessed (85% of those assessed) (Appendix Table B-9). Without corresponding release condition data from onboard the vessel, it is not possible to test how well a video reviewer can assess halibut release condition from EM data. A halibut was given a release condition of "unknown" if the video reviewer could not observe both sides of the fish and the injuries could not be observed clearly at point of release. A release condition was not possible to capture for 75% of the discarded halibut across all fisheries.

Appendix Table B- 1. -- Summary of EM monitored fishing activity for 2018.

	Halibut Target		**Pacific Cod Target**		**Sablefish Target**			**All Fisheries**
	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	String Pot	
Vessels	29	31	1	6	32	7	-	**83**
Trips	41	53	1	9	61	9	-	**174**
Hauls	514	526	13	114	611	97	-	**1,875**
Reviewed Hauls	200	205	9	79	235	42	-	**770**
Sea Days	243	289	3	35	375	60	-	**1,005**
Average Trip Length (Days)	5.9	5.5	3.0	3.9	6.1	6.7	-	**5.8**

Appendix Table B- 2. -- Logbook submissions.

	Halibut Target		**Pacific Cod Target**		**Sablefish Target**			
Effort Log Completed	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	**Total**	**%**
Yes	12	31	1	7	24	7	**82**	**47%**
No	29	22	-	2	37	2	**92**	**53%**
Total	**41**	**53**	**1**	**9**	**61**	**9**	**174**	**100%**

Appendix Table B- 3. -- Data quality including video and sensor completeness, data quality, and image quality.

Trip Level Data Quality

	Halibut Target		Pacific Cod Target		Sablefish Target		
Video Complete	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	**Total**
Number of trips	29	38	1	5	39	6	**118**
Percent of trips	*71%*	*72%*	*100%*	*56%*	*64%*	*67%*	***68%***
Sensor Data Complete							
Number of trips	40	53	1	9	57	9	**169**
Percent of trips	*98%*	*100%*	*100%*	*100%*	*93%*	*100%*	***97%***

Haul Level Data Quality

Haul Video Completeness (number of hauls)	Halibut Target		Pacific Cod Target		Sablefish Target		Total
	Fixed Hook Longline	Snap Longline	Single Pot	Snap Longline	Fixed Hook Longline	Snap Longline	
Video complete - Entire haul recorded	171	177	9	72	184	36	**649**
Intermittent gaps in video	12	8	-	4	25	1	**50**
Video starts after haul start	10	8	-	2	12	-	**32**
Video ends before catch handling ends	2	-	-	-	1	2	**5**
Video ends before fish stowed (handling complete)	3	12	-	1	11	3	**30**
1+ cameras not working	2	-	-	-	2	-	**4**
Catch Video Completeness (number of hauls)							
Complete - All catch recorded	181	200	9	78	213	40	**721**
Incomplete	19	5	-	1	22	2	**49**
Data Quality from Video (Number of Hauls)							
High	159	159	9	57	178	38	**600**
Medium	26	45	-	21	45	4	**141**
Low	1	1	-	1	11	-	**14**
Unusable	14	-	-	-	1	-	**15**
No Video	-	-	-	-	-	-	**-**
Image Quality (Number of Hauls)							
High	134	142	9	37	141	32	**495**
Medium	51	59	-	40	81	10	**241**
Low	1	4	-	2	12	-	**19**
Unusable	14	-	-	-	1	-	**15**
No Video	-	-	-	-	-	-	**-**
Primary Reason for Medium Image Quality (Number of Hauls)							
Banding/Scrambling/Color	-	-		-	5	-	**5**
Dirty Cameras	12	-		3	6	1	**22**
Glare	9	6		7	9	3	**34**
Night Lighting	7	6		9	16	3	**41**
Obstruction	1	1		-	-	-	**2**
Poor Camera Angles	6	24		-	8	-	**38**
Video completeness	-	2		3	16	2	**23**
Water Spots	16	20		18	21	1	**76**
Primary Reason for Low Image Quality (Number of Hauls)							
Glare	-	-		-	1	-	**1**
Night Lighting	-	-		-	1	-	**1**
Poor Camera Angles	-	1		-	2	-	**3**
Video Completeness	1	-		1	6	-	**8**
Water Spots	-	3		1	2	-	**6**

Appendix Table B- 4. -- Review rate by target fishery. Review of both retained and discarded catch included.

	Halibut Target		Pacific Cod Target		Sablefish Target	
	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline
Haul Count	200	205	9	79	235	42
Average Sort Min/Haul	126	132	120	105	177	206
Average Review Min/Haul	108	83	76	106	132	114
Average Review Min/Sort Min	0.89	0.66	0.64	1.06	0.81	0.59

Appendix Table B- 5. -- Presence of streamer lines on EM monitored trips.

	Halibut Target		Pacific Cod Target		Sablefish Target		
Streamer Line Status	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	Fixed Hook Longline	Snap Longline	**Total**
Streamer Line Present	21	39	1	6	52	7	**126**
No Streamer Line	9	10	-	-	2	1	**22**
Partial	-	1	-	-	-	-	**1**
Unknown	11	3	-	3	7	1	**25**
Percent Trips with Streamer Line	***51%***	***74%***	***100%***	***67%***	***85%***	***78%***	***72%***

Appendix Table B- 6. -- Counts of retained and discarded catch in the sablefish, Pacific cod, and halibut fisheries.

Sablefish target											
		Fixed hook longline					Snap longline				
			Discarded					Discarded			
Species		Retained	Interacted w/ Vessel or Crew	Drop-off	Utilized onboard	Unknown	Retained	Interacted w/ Vessel or Crew	Drop-off	Utilized onboard	Unknown
Rockfish and Thornyheads	Rockfish - unident	52	304	14	0	0	0	0	0	0	0
	Rockfish, Black	21	21	0	0	0	0	0	0	0	0
	Rockfish, Canary	35	7	0	0	0	0	0	0	0	0
	Rockfish, Dusky	4	9	0	0	0	1	0	0	0	0
	Rockfish, Greenstriped	1	0	0	0	0	0	0	0	0	0
	Rockfish, Quillback	0	0	0	0	0	1	0	0	0	0
	Rockfish, Red Banded	298	80	8	0	0	12	9	0	0	0
	Rockfish, Silvergray	11	0	0	0	0	0	0	0	0	0
	Rockfish, Small Red unident	9	1	3	0	0	0	0	0	0	0
	Rockfish, Yelloweye	206	23	1	0	0	7	0	0	0	0
	Rockfish, Yellowtail	4	0	0	0	0	0	0	0	0	0
	Shortraker/Rougheye	1969	2595	69	0	0	71	62	2	0	0
	Shortspine Thornyhead	3438	1311	21	0	0	337	25	7	0	0
	Thornyhead unident	7160	3794	96	0	0	823	128	17	0	0
Sablefish		51541	4817	370	0	0	10161	235	92	0	0
Pacific Halibut		3657	6240	68	0	1	233	402	6	0	0
Pacific cod		346	275	4	9	0	15	3	1	2	0
Lingcod		23	7	0	0	0	0	0	0	0	0
Flatfish	Flatfish - unident	2	27	1	0	0	0	0	0	0	0
	Flounder, Kamchatka/Arrowtooth	85	2149	23	0	0	20	27	1	44	0
	Sole, Curlfin	0	1	0	0	0	0	0	0	0	0
	Sole, Deepsea	0	0	0	0	0	0	0	0	1	0
	Sole, Dover	3	88	0	1	0	0	0	0	0	0
	Sole, Flathead	3	9	0	0	0	0	0	0	0	0
	Sole, Rock Sole unident	0	2	0	0	0	0	0	0	0	0
	Turbot, Greenland	0	2	0	0	0	0	0	0	0	0
Other Fish	Pollock (Walleye Pollock)	5	3	0	0	0	0	0	0	0	0
	Gadid - Unident	3	0	0	0	0	0	0	0	0	0
	Grenadier (Rattail), Giant	0	61	3	0	0	0	40	5	0	0
	Grenadier, (Rattail) - unident	83	24827	385	413	0	83	1934	73	1009	0
	Flatnose, Pacific (Codling)	2	0	0	0	0	0	2	0	1	0
	Pomfret - unident	3	20	0	0	0	0	0	0	0	0
	Ratfish, Spotted	1	27	1	0	0	0	0	0	0	0
	Roundfish - Unident	7	124	33	0	0	0	3	10	0	0
	Skilfish	1	0	0	0	0	0	0	0	0	0
	Sculpin - Myoxocephalus unident	0	2	0	0	0	0	0	0	0	0

	Sculpin - Unident	26	351	4	0	0	-9	0	0	57	0
	Sculpin, Bigmouth	0	1	0	0	0	0	0	0	0	0
	Sculpin, Irish Lord - unident	0	0	0	0	0	1	0	0	0	0
	Wrymouth Unident	0	0	0	0	0	1	0	0	0	0
	Fish head /lips or parts	1	11	0	0	0	0	2	0	0	0
	Decomposed fish	0	2	0	0	0	0	0	0	0	0
	Fish - unident	0	16	5	0	0	0	0	1	0	0
Shark	Shark, Blue	1	16	0	0	0	0	1	0	0	0
	Shark, Pacific Sleeper	0	4	5	0	0	0	0	0	0	0
	Shark, Spiny Dogfish	6	4278	52	0	0	0	84	0	0	0
	Shark, Salmon	0	1	0	0	0	0	0	0	0	0
	Shark - unident	0	9	0	0	0	0	0	0	0	0
Skate	Ray, (Skate) - unident	0	17	0	0	0	0	0	0	0	0
	Skate - Soft Snout unident	40	1021	11	0	0	0	98	0	0	0
	Skate - Stiff Snout unident	0	1	1	0	0	0	0	0	0	0
	Skate, Big	84	55	0	0	0	0	7	0	0	0
	Skate, Longnose	17	470	10	0	0	0	3	0	0	0
	Skate - eggcase	0	20	0	0	0	0	0	0	0	0
Crab	Crab - unident	0	16	2	0	0	0	0	0	0	0
	Crab, King - unident	0	15	1	0	0	0	0	0	0	0
	Crab, Lithodid unident	0	2	0	0	0	0	0	0	0	0
	Crab, Tanner - Unident	2	56	0	0	0	0	2	0	0	0
Coral	Bryozoans/Coral Unid	16	1416	2	0	0	0	22	0	0	0
	Coral, Red Tree	0	2	0	0	0	0	0	0	0	0
Invertebrate	Crinoids	0	93	0	0	0	0	0	0	0	0
	Invertebrate - Unident	10	293	2	0	0	0	1	0	0	0
	Jellyfish	0	2	0	0	0	0	1	0	0	0
	Octopus	7	13	2	0	0	0	1	0	0	0
	Octopus, Pelagic	0	1	0	0	0	0	0	0	0	0
	Sand Dollars, Sea Urchins	0	24	0	0	0	0	0	0	0	0
	Sea Anemone	0	4	0	0	0	0	0	0	0	0
	Sea Whip, Sea Pen	0	20	0	0	0	0	0	0	0	0
	Snail - Unident	0	1	0	0	0	0	0	0	0	0
	Sponge - Unident	0	3	0	0	0	0	1	0	0	0
	Starfish - Unident	4	172	1	0	0	0	16	0	0	0
	Starfish, Basket	2	48	0	0	0	0	1	0	0	0
	Starfish, Brittle	0	136	0	0	0	0	60	0	0	0
	Starfish, Sunstar	1	87	8	0	0	0	6	0	0	0
Bird	Albatross, Black-footed	0	3	0	0	0	0	0	0	0	0
	Albatross - Unident	0	4	0	0	0	0	0	0	0	0
	Fulmar, Northern	0	1	0	0	0	0	2	0	0	0
	Gull - Unident	0	2	0	0	0	0	0	0	0	0
Misc. - rocks, mud, garbage, etc.		13	165	1	0	0	2	19	0	0	0
Unknown		0	57	1	0	0	0	0	0	0	0

Pacific Cod Target

Species		Fixed Hook Longline					Snap Longline				
			Discarded					Discarded			
		Retained	Interacted w/ Vessel or Crew	Drop-off	Utilized Onboard	Unknown	Retained	Interacted w/ Vessel or Crew	Drop-off	Utilized Onboard	Unknown
Rockfish and Thornyheads	Rockfish - Unident	0	0	0	0	0	3	2	0	0	0
	Rockfish, Dark Unident	0	0	0	0	0	1	0	0	0	0
	Rockfish, Northern	0	0	0	0	0	2	0	0	0	0
	Rockfish, Quillback	0	0	0	0	0	1	0	0	0	0
	Rockfish, Red Banded	0	0	0	0	0	2	0	0	0	0
	Rockfish, Rosethorn	0	0	0	0	0	2	0	0	0	0
	Rockfish, Small Red Unident	0	0	0	0	0	0	2	1	0	0
	Rockfish, Tiger	0	0	0	0	0	1	0	0	0	0
	Rockfish, Yelloweye	2	0	0	0	0	73	2	0	0	0
	Shortraker/Rougheye	0	0	0	0	0	8	0	0	0	0
	Thornyhead Unident	0	0	0	0	0	1	1	0	0	0
Sablefish		0	2	0	0	0	0	39	0	0	0
Pacific halibut		0	165	0	0	0	143	1272	14	0	0
Pacific cod		1808	30	8	0	0	9959	121	52	36	0
Lingcod		0	0	0	0	0	14	2	1	0	0
Flatfish	Flatfish - Unident	0	4	0	0	0	0	83	6	0	0
	Flounder, Kamchatka/Arrowtooth	0	56	1	0	0	2	375	2	2	0
	Sole, Dover	0	0	0	0	0	0	1	0	0	0
	Sole, Flathead	1	7	0	0	0	0	133	0	0	0
	Sole, Rock Sole Unident	0	0	0	0	0	0	6	0	0	0
Other Fish	Pollock (Walleye Pollock)	33	3	0	0	0	355	134	1	0	0
	Gadid - Unident	1	1	0	0	0	181	37	3	0	0
	Grenadier, (Rattail) - Unident	0	0	0	0	0	-1	1	0	1	0
	Roundfish - Unident	1	1	1	0	0	93	72	18	4	0
	Sculpin - Myoxocephalus Unident	0	0	0	0	0	0	95	0	0	0
	Sculpin - Unident	0	0	0	0	0	35	447	0	20	0
	Sculpin, Irish Lord - Unident	0	5	0	0	0	13	75	0	26	0
	Wrymouth Unident	0	0	0	0	0	0	67	2	0	0
	Fish head /lips or parts	0	0	0	0	0	0	2	0	0	0
	Fish - Unident	0	0	0	0	0	0	5	2	0	0
Shark	Shark, Pacific Sleeper (Mud)	0	0	0	0	0	0	2	0	0	0
	Shark, Spiny Dogfish	0	0	0	0	0	0	254	1	0	0
Skate	Ray, (Skate) - Unident	0	1	0	0	0	1	5	1	0	0
	Skate - Soft Snout Unident	0	26	1	0	0	2	131	0	0	0
	Skate - Stiff Snout Unident	0	0	0	0	0	9	7	1	0	0
	Skate, Big	42	129	0	0	0	215	278	1	0	0
	Skate, Longnose	4	5	0	0	0	48	39	0	0	0
Coral	Bryozoans/Coral Unid	0	0	0	0	0	1	0	0	0	0

Invertebrate	Invertebrate - Unident	0	2	0	0	0	0	40	2	0	0
	Octopus - Unident	0	0	0	0	0	2	4	3	1	0
	Sand Dollars, Sea Urchins	0	0	0	0	0	0	1	0	0	0
	Sea Anemone - Unident	0	1	0	0	0	1	45	0	0	0
	Sea Whip, Sea Pen - Unident	0	103	1	0	0	0	184	0	0	0
	Snail - Unident	0	0	0	0	0	0	1	0	0	0
	Snail, Empty Shell	0	0	0	0	0	0	2	0	0	0
	Starfish - Unident	0	0	0	0	0	1	33	2	0	0
	Starfish, Basket	0	0	0	0	0	0	8	0	0	0
Bird	Fulmar, Northern	0	0	0	0	0	0	1	0	0	0
	Gull - Unident	0	0	0	0	0	0	13	0	0	0
	Seabird - Unident	0	1	0	0	0	0	9	1	0	0
Misc. - rocks, mud, garbage, etc.		0	0	0	0	0	2	63	0	0	0
Unknown		0	0	0	0	0	0	2	1	0	0

Pacific Halibut Target

Species		Fixed Hook Longline					Snap Longline				
			Discarded					Discarded			
		Retained	Interacted w/ Vessel or Crew	Drop-off	Utilized Onboard	Unknown	Retained	Interacted w/ Vessel or Crew	Drop-off	Utilized Onboard	Unknown
Rockfish and Thornyheads	Rockfish - unidentified	27	82	4	0	0	6	12	3	0	0
	Rockfish, Black	42	167	0	0	0	2	0	0	0	0
	Rockfish, Canary	37	4	0	0	0	0	0	0	0	0
	Rockfish, China	0	3	0	0	0	0	0	0	0	0
	Rockfish, Dark (was Dark Dusky)	0	4	0	0	0	1	2	0	0	0
	Rockfish, Dusky (was Light Dusky)	19	50	1	0	0	17	3	0	0	0
	Rockfish, Greenstriped	0	1	0	0	0	0	0	0	0	0
	Rockfish, Northern	1	0	0	0	0	0	0	0	0	0
	Rockfish, Quillback	126	82	1	0	0	45	4	0	0	0
	Rockfish, Red Banded	299	197	1	0	0	20	10	1	0	0
	Rockfish, Rosethorn	0	0	0	0	0	8	0	0	0	0
	Rockfish, Silvergray	105	189	1	0	0	3	1	0	0	0
	Rockfish, Small Red unidentified	5	6	0	0	0	4	0	0	0	0
	Rockfish, Tiger	5	14	0	0	0	0	0	0	0	0
	Rockfish, Yelloweye	583	233	2	0	0	419	12	0	0	0
	Rockfish, Yellowtail	7	0	0	0	0	0	0	0	0	0
	Shortraker/Rougheye	404	882	19	0	0	349	526	12	0	0
	Rockfish, Shortspine Thornyhead	103	29	2	0	0	219	9	1	0	0
	Rockfish, Thornyhead unidentified	222	182	3	0	0	166	62	3	0	0
Sablefish		2517	959	29	0	0	1633	1218	15	0	0
Pacific halibut		8729	8987	136	0	1	6846	5362	64	0	0
Pacific cod		923	1984	36	718	3	742	821	10	484	0
Lingcod		222	237	12	0	0	57	61	2	0	0
Flatfish	Flatfish - unidentified	1	16	2	0	0	0	5	1	0	0

	Flounder, Kamchatka/Arrowtooth	22	774	6	20	0	297	343	5	190	0
	Flounder, Starry	0	1	1	0	0	0	0	0	0	0
	Sole, Dover	0	27	1	0	0	0	7	0	0	0
	Sole, Flathead	0	24	0	0	0	0	8	0	0	0
	Sole, Petrale	0	1	0	0	0	0	0	0	0	0
	Sole, Rock Sole unidentified	3	56	1	0	0	0	1	0	0	0
Other Fish	Pollock (Walleye Pollock)	0	50	0	5	0	7	2	0	3	0
	Gadid - unidentified	1	11	1	3	0	2	69	0	0	0
	Grenadier, (Rattail) - unidentified	0	1522	11	1	0	61	226	15	242	0
	Eelpout - unidentified	0	0	0	0	0	1	0	0	0	0
	Greenling - unidentified	0	4	0	0	0	0	0	0	0	0
	Pomfret - unidentified	3	1	0	0	0	0	0	0	0	0
	Ratfish, Spotted	4	293	0	0	0	0	80	1	0	0
	Ronquil/Searcher - unidentified	1	1	0	0	0	0	0	0	0	0
	Roundfish - unidentified	1	25	1	0	0	0	73	0	0	0
	Salmon - unidentified	0	4	0	2	0	1	1	0	0	0
	Sculpin - Myoxocephalus unidentified	20	312	4	0	0	3	81	0	2	0
	Sculpin - unidentified	40	2896	7	16	1	52	1055	6	135	0
	Sculpin, Bigmouth	0	36	0	0	0	0	8	0	0	0
	Sculpin, Irish Lord - unidentified	71	761	0	0	0	7	31	0	1	0
	Wolf-eel	0	2	0	0	0	0	1	0	0	0
	Wrymouth Unidentified	0	13	0	0	0	0	5	0	1	0
	Fish head /lips or parts	0	5	0	0	0	-1	10	0	0	0
	Decomposed fish	0	0	0	0	0	0	5	0	0	0
	Fish - unidentified	1	20	3	0	0	0	5	1	0	0
Shark	Shark, Blue	0	1	0	0	0	0	1	0	0	0
	Shark, Pacific Sleeper (Mud)	0	9	1	0	0	0	9	0	0	0
	Shark, Spiny Dogfish	60	3296	27	0	0	-2	1114	10	13	0
Skate	Ray, (Skate) - unidentified	1	50	0	0	0	0	29	0	0	0
	Skate - Soft Snout unidentified	22	745	3	0	1	3	500	2	0	0
	Skate - Stiff Snout unidentified	0	1	0	0	0	0	2	0	0	0
	Skate, Big	4	513	7	0	0	3	280	1	0	0
	Skate, Longnose	49	888	6	0	0	8	606	5	0	0
	Skate - eggcase	0	1	0	0	0	0	0	0	0	0
Crab	Crab - unidentified (Family Unknown)	0	10	0	0	0	0	6	0	0	0
	Crab, King - unidentified	0	0	0	0	0	0	21	0	0	0
	Crab, Box	0	1	1	0	0	0	0	0	0	0
	Crab, Tanner - Unidentified	0	1	0	0	0	0	2	0	0	0
Coral	Bryozoans/Coral Unid	3	33	0	0	0	2	30	0	0	0
	Coral, Red Tree	0	2	0	0	0	0	0	0	0	0
Invertebrate	Invertebrate - unidentified	9	86	5	0	0	0	133	1	0	0
	Jellyfish - unidentified	0	1	1	0	0	0	3	0	0	0
	Octopus - unidentified	15	40	11	0	0	14	11	0	3	0
	Sand Dollars, Sea Urchins	0	15	1	0	0	0	63	1	0	0

	Sea Anemone - unidentified	2	21	0	0	0	0	11	0	0	0
	Sea Whip, Sea Pen - unidentified	0	11	1	0	0	0	49	0	0	0
	Snail - unidentified	13	166	16	0	0	0	174	2	0	0
	Sponge - unidentified	0	3	0	0	0	0	2	0	0	0
	Squid - unidentified	0	1	1	0	0	0	0	0	0	0
	Starfish - unidentified	12	245	6	0	0	0	138	2	0	0
	Starfish, Basket	0	51	0	0	0	0	9	0	0	0
	Starfish, Brittle	0	5	0	0	0	0	96	0	0	0
Bird	Albatross, Black-footed	0	0	0	0	0	0	1	0	0	0
	Shearwater, Short-tailed	0	0	0	0	0	0	1	0	0	0
Mammal	Northern Elephant Seal	0	1	0	0	0	0	0	0	0	0
Misc. - rocks, mud, garbage, etc.		3	227	2	0	0	0	119	1	0	0
Unknown		3	7	1	0	0	0	18	2	0	0

Appendix Table B- 7. -- Pacific halibut counts for each type of discard, release method, and release condition for the three target fisheries.

			Halibut target		Pacific Cod target		Sablefish target	
Discard type	**Release method**	**Release condition**	Fixed hook longline	Snap longline	Fixed hook longline	Snap longline	Fixed hook longline	Snap longline
Discarded General	Crucifying	Dead/Sand Fleas/Bleeding	2	-	-	-	-	-
		Minor	-	-	-	-	15	-
		Moderate	-	-	-	-	5	-
		Severe	3	-	-	-	-	-
		Unknown	33	-	-	-	124	-
	Cut the gangion	Minor	1	-	-	-	1	-
		Moderate	-	1	-	-	-	-
		Severe	-	-	-	-	1	-
		Unknown	8	2	-	-	6	-
	Gaff	Dead/Sand Fleas/Bleeding	1	1	-	-	-	-
		Minor	-	1	-	-	-	-
		Moderate	11	12	-	-	5	-
		Severe	-	-	-	-	3	-
		Unknown	70	3	-	-	34	-
	Hand release	Minor	2	151	1	5	1	-
		Moderate	-	4	-	-	-	-
		Unknown	8	739	-	11	4	-
	Hit the roller	Dead/Sand Fleas/Bleeding	3	-	-	-	-	-
		Minor	14	-	-	3	9	-
		Moderate	3	-	-	-	4	-
		Unknown	209	23	-	5	135	1
	Hook straightening	Unknown	-	-	-	-	1	-
	Hook twisting and shaking	Dead/Sand Fleas/Bleeding	13	3	-	-	3	-
		Minor	1,630	1,392	7	343	782	324

		Moderate	13	28	-	1	3	1
		Severe	4	-	-	-	3	-
		Unknown	6,312	2,661	156	862	4,267	63
	Other careful release	Minor	1	-	-	-	1	-
		Unknown	8	3	-	-	4	-
	Other non-careful release	Dead/Sand Fleas/Bleeding	1	-	-	-	-	-
		Minor	10	8	-	4	3	1
		Moderate	2	-	-	-	1	-
		Severe	-	1	-	-	-	-
		Unknown	65	40	-	6	207	2
	Unknown	Dead/Sand Fleas/Bleeding	2	-	-	-	-	-
		Minor	2	13	-	-	18	-
		Moderate	1	-	-	-	-	-
		Severe	-	-	-	-	6	-
		Unknown	216	58	-	3	247	-
Damaged	Crucifying	Dead/Sand Fleas/Bleeding	3	-	-	-	4	-
		Minor	-	-	-	-	2	-
		Moderate	1	-	-	-	27	-
		Severe	4	-	-	-	8	-
		Unknown	10	-	-	-	36	-
	Cut the gangion	Unknown	1	-	-	-	2	-
	Gaff	Dead/Sand Fleas/Bleeding	1	-	-	-	2	-
		Minor	1	-	-	-	-	-
		Moderate	1	-	-	-	1	-
		Severe	5	-	-	-	10	-
		Unknown	-	-	-	-	13	-
	Hand release	Minor	-	1	-	-	-	-
		Moderate	-	22	-	-	-	-
		Unknown	-	14	-	-	-	-
	Hit the roller	Minor	4	1	-	-	-	-
		Moderate	9	-	-	-	6	-
		Severe	1	-	-	-	3	-
		Unknown	23	-	-	-	18	-
	Hook twisting and shaking	Dead/Sand Fleas/Bleeding	5	7	-	1	3	1
		Minor	10	-	-	-	1	-
		Moderate	9	16	-	-	1	-
		Severe	1	1	-	-	1	1
		Unknown	47	2	-	-	18	-
	Other careful release	Unknown	2	1	-	-	-	-
	Other non-careful release	Dead/Sand Fleas/Bleeding	1	-	-	-	-	-
		Minor	-	2	-	-	-	2
		Moderate	2	5	-	-	-	-
		Severe	-	1	-	-	1	-
		Unknown	8	1	-	-	8	-
	Unknown	Dead/Sand Fleas/Bleeding	4	-	-	-	1	-
		Minor	-	-	-	-	1	-

		Moderate	-	-	-	-	1	-
		Severe	-	-	-	-	3	-
		Unknown	3	-	-	-	5	-
Predated	Crucifying	Dead/Sand Fleas/Bleeding	16	-	-	-	7	-
		Unknown	-	-	-	-	2	-
	Gaff	Dead/Sand Fleas/Bleeding	7	1	-	-	28	-
		Unknown	-	-	-	-	1	-
	Hand release	Dead/Sand Fleas/Bleeding	1	16	-	4	-	-
		Severe	-	1	-	-	-	-
		Unknown	-	1	-	-	-	-
	Hit the roller	Dead/Sand Fleas/Bleeding	20	-	-	-	9	-
		Unknown	-	-	-	-	1	-
	Hook twisting and shaking	Dead/Sand Fleas/Bleeding	116	117	-	22	89	6
		Minor	1	-	-	-	-	-
		Moderate	-	1	1	-	-	-
		Severe	2	1	-	-	1	-
		Unknown	15	-	-	1	16	-
	Other non-careful release	Dead/Sand Fleas/Bleeding	3	5	-	1	12	-
		Unknown	-	-	-	-	2	-
	Unknown	Dead/Sand Fleas/Bleeding	2	-	-	-	3	-
		Unknown	-	1	-	-	-	-
Drop Off Above Water	No Selection	Dead/Sand Fleas/Bleeding	1	-	-	-	-	-
		Unknown	124	49	-	13	62	6
Drop Off Below Water	No Selection	Unknown	11	15	-	1	6	-
TOTAL			**9,123**	**5,426**	**165**	**1,286**	**6,308**	**408**

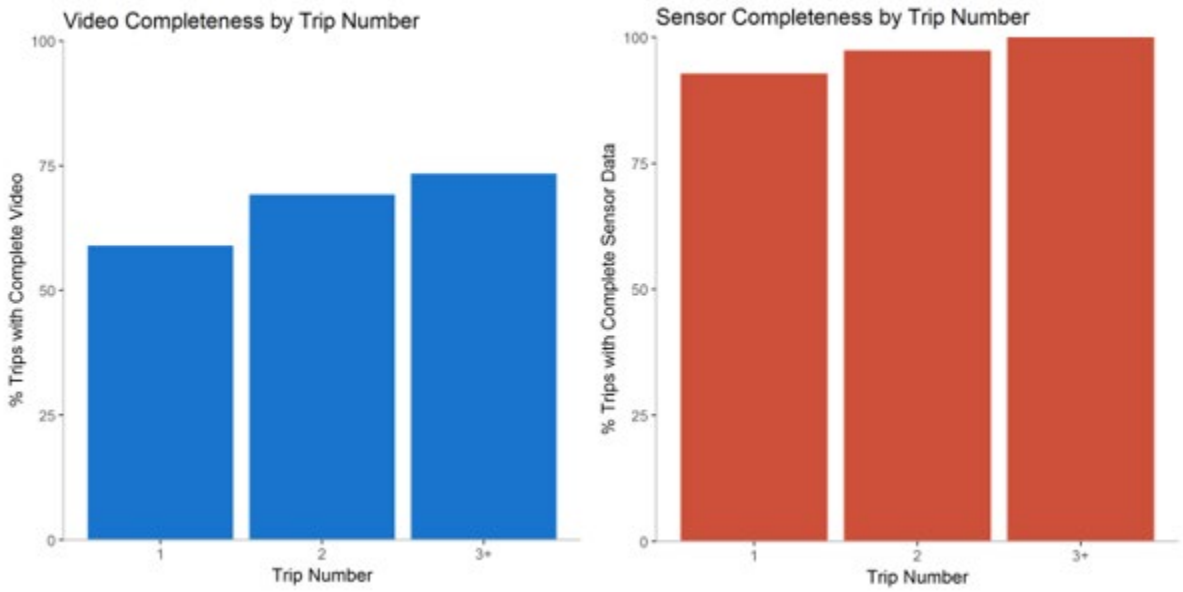
Appendix Table B- 8. -- Summary of Pacific halibut counts for each release method by target fishery.

	Pacific Halibut Target				Pacific Cod Target				Sablefish Target		All Fisheries	
	Fixed Hook Longline		Snap Longline		Single Pot		Snap Longline		Fixed Hook Longline			
Release Method	Count	%	Count	%	Count	%	Count	%	Count	%	**Total**	**% of total**
Crucifying	17	1%	-	> 1%	-	> 1%	-	> 1%	34	2%	**51**	**> 1%**
Cut the gangion	3	> 1%	1	> 1%	-	> 1%	4	> 1%	-	> 1%	**8**	**> 1%**
Gaff	73	3%	1	> 1%	-	> 1%	-	> 1%	15	1%	**89**	**1%**
Hand release	43	2%	207	15%	-	> 1%	22	> 1%	3	> 1%	**275**	**2%**
Hit the roller	67	2%	22	2%	-	> 1%	40	1%	40	3%	**169**	**1%**
Hook twisting and shaking	2,442	90%	1,042	75%	-	> 1%	5,696	95%	1,303	92%	**10,483**	**90%**
No Selection	37	1%	20	1%	119	100%	59	1%	7	> 1%	**242**	**2%**
Other non-careful release	8	> 1%	45	3%	-	> 1%	19	> 1%	4	> 1%	**76**	**1%**
Unknown	9	> 1%	58	4%	-	> 1%	139	2%	6	> 1%	**212**	**2%**
Grand Total	**2,699**		**1,396**		**119**		**5,979**		**1,412**		**11,605**	

Appendix Table B- 9. -- Summary of Pacific halibut counts for each release condition by target fishery.

	Pacific Halibut Target				Pacific Cod Target				Sablefish Target		All Fisheries	
	Fixed Hook Longline		Snap Longline		Single Pot		Snap Longline		Fixed Hook Longline			
Release Condition	Count	%	Count	%	Count	%	Count	%	Count	%	**Total**	**% of total**
Dead/Sand Fleas/Bleeding	122	5%	74	5%	8	7%	99	2%	85	6%	388	3%
Minor	1,280	47%	953	68%	37	31%	2,200	37%	664	47%	5,134	44%
Moderate	19	1%	6	> 1%	-	> 1%	7	> 1%	1	> 1%	33	> 1%
Severe	2	> 1%	-	> 1%	-	> 1%	1	> 1%	-	> 1%	3	> 1%
Unknown	1,238	46%	343	25%	74	62%	3,613	60%	655	46%	5,923	51%
No Selection	38	1%	20	1%	-	> 1%	59	1%	7	> 1%	124	1%
Grand Total	**2,699**		**1,396**		**119**		**5,979**		**1,412**		**11,605**	

Appendix Figure B-1. -- Video and sensor completeness in relation to the number of trips the electronic monitoring system had been on a specific vessel.



Appendix C – Electronic Monitoring Innovation Project (eMIP) Summary for 2018

The primary focus of this project spearheaded by the AFSC Observer Program is to develop a suite of cost-effective remote monitoring systems that integrate automated image processing to support the Council and Agency goals to integrate remote monitoring data into the catch data stream for catch accounting. The research was supported through a competitive RFP process, which is funded by Fisheries Information Systems (FIS) and the National Observer Program (NOP). In previous project research, we focused on improving hardware design and in-depth analyses of developing automation to fully support automated fish count, size measurement and species identification across trawl and longline fishery applications. This research relied on training imagery in our collaboration with and collections from numerous surveys (IPHC, and NMFS Sablefish and BSAI/GOA Trawl) and volunteer vessels. Detail on our efforts developing automation is detailed in the publications listed below. In 2018, we continued our focus on improving hardware design and advancement of real time processing of image and sensor data across three fishery objectives 1) camera chute for on deck sorting of Halibut in the trawl fishery, 2) stereo rail for multispecies longline fishery and 3) truth-of-concept development automated monitoring salmon compliance in plants.

Our research is working toward the goal of being able to derive length/weight measurements, and species and count data elements needed to estimate total discarded catch and length compositions necessary for stock assessments. These camera systems also integrate automated image analyses that could greatly improve timeliness for extracting data from Electronic Monitoring (EM) and solve storage capacity issues of storing voluminous video data onboard vessels. Storage costs related to video could also be greatly reduced, since most imagery would not be retained. These advances have the potential to benefit other EM programs as the technology could be transferable and the machine learning algorithms could be re-trained for any new image data stream. Outcomes of 2018 research in four topic areas are summarized below.

Improved automation and hardware design for camera chute to support estimation of Halibut discard on trawl vessels

The goal of this is to enable rapid discard and census accounting for deck-sorted Halibut to support on-board observer data collection and Halibut bycatch estimation. Deployments occurred on 6 volunteer vessels participating under an Exempted Fishery Permit. Imagery were used to improve length measurement accuracy and identify images that should not be used for length estimation due to lighting, obscured camera lens and flopping fish. We also collaborated and deployed to the Pacific coast trawl survey to build on our image library adding training datasets to improve species identification including. Sensor type and configuration was finalized to ensure we are highly confident of accurate triggering for each fish. Our work helped us streamline implementation by providing real-time data collection and automated bycatch statistics on a haul by haul basis for Halibut discard. Improved system design now provides system function, accurate PSC numbers and weight discarded on a haul by haul basis.

Improve stereo rail systems to support implementation and real time catch event processing on longline vessels

We focused on 3 areas for development to improve the stereo rail system: 1) operationalize advanced stereo cameras, sensors and monitoring of system health, 2) test and complete automation of catch event detection and storage for later analysis, 3) test the efficacy for using image sensors alone to "perceive" haul back without use of other sensors to lower cost, improve ease of system integration and installation into the vessels operations. Deployments continued on 3 volunteer industry longline vessels during 2018. We also continued our collaborations and deployments with IPHC and NMFS Sablefish survey to collect training datasets and test accuracy for length measurements, catch event detection, tracking and species ID. The new training datasets provided significant improvements to our machine learning species identification algorithm and we now have a 94% + accuracy rate for the 4 most dominant species including Halibut, Sablefish, Dogfish Shark and Grenadier. This is significant since approximately 80% of the catch from the directed Halibut and Sablefish fisheries are these four species.

Complete documentation of the vision application (OrthusVision) for machine vision cameras for public dissemination

Software documentation is near completion and include; explanation on how it operates, instructions on use, requirements (attributes, capabilities, characteristics), architecture/design (relations to an environment and construction principles used in design), technical (algorithms, interfaces, and APIs). It will also include manuals for the end-user, system administrators and support staff. The operating system can be used on numerous Gige machine vision cameras that can be extended to many applications in other regions for significant leveraging of FIS dollars. This represents a significant step forward as EM systems are no longer limited to deploying internet protocol (IP) cameras.

Develop proof of concept monitoring system for salmon bycatch compliance in offload plants

We deployed IP cameras or used video data from cameras already available at several offload plants in Kodiak to monitor salmon sorting. Video data were annotated for presence of salmon and used to develop machine learning algorithms to automate detection and count. Initial results were encouraging and this study will continuing in through 2019 and 2020 that will include a validation study to ensure accuracy of results.

Machine Learning Publications funded through FIS/NOP

Wang, G., J. N. Hwang, K. Williams, F. Wallace, and C. S. Rose. 2016. Shrinking encoding with two-level codebook learning for fine-grained fish recognition. Pages 31-36 *in* Proceedings of the 2016 ICPR 2nd Workshop on computer Vision for Analysis of Underwater Imagery CVAUI; December 4, 2016, Cancun, Mexico.

Wang, G., J. N. Hwang, K. Williams, and G. Cutter. 2016. Closed-Loop Tracking-by-Detection for ROV-Based Multiple Fish Tracking. Pages 7-12 36 *in* Proceedings of the 2016 ICPR 2nd Workshop on computer Vision for Analysis of Underwater Imagery CVAUI; December 4, 2016, Cancun, Mexico.

Wang, G., J. N. Hwang, C. Rose, and F. Wallace. 2017. Uncertainty sampling based active learning with diversity constraint by sparse selection. Pages 1-6 in Proceedings of the 2017 IEEE 19th International Workshop on Multimedia Signal Processing; October 16-18, 2017, Luton, United Kingdom.

Wang, G., J. N. Hwang, Y. Xu, F. Wallace, and C. S. Rose. 2018. Coarse-To-Fine Segmentation Refinement and Missing Shape Recovery for Halibut Fish. Pages 370-374 *in* Proceedings of the 2018 IEEE Global Conference on Signal and Information Processing (GlobalSIP); November 26-29, 2018, Anaheim, California.

Wang, G., J. N. Hwang, C. Rose, and F. Wallace. 2019. Uncertainty-Based Active Learning via Sparse Modeling for Image Classification. IEEE Transactions on Image Processing, 28(1), 316-329.

Huang, T. W., J. N. Hwang, S. Romain and F. Wallace. 2018. Fish Tracking and Segmentation from Stereo Videos on the Wild Sea Surface for Electronic Monitoring of Rail Fishing. IEEE Transaction on Circuits and Systems for Video Technology, doi: 10.1109/TCSVT.2018.2872575.

Huang, T. W., J. N. Hwang, S. Romain and F. Wallace. 2017. Tracking and Measurement of Catch Events in Stereo Video for Longline Fisheries. Presentation at American Fisheries Society 141th Annual Meeting, Aug. 2017.

Huang, T. W., J. N. Hwang, S. Romain and F. Wallace. 2016. Live Tracking of Rail-Based Fish Catching on Wild Sea Surface. Presentation at ICPR 2nd Workshop on Computer Vision for Analysis of Underwater Imagery (CVAUI), 4 Dec. 2016.

Huang, T. W., J. N. Hwang and C. S. Rose. 2016. Chute based automated fish length measurement and water drop detection. Presentation at IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP), 20-25 March 2016.

Appendix D – Observer Statement and ODDS Trip-Logging Rates

This section provides a new analysis of compliance and safety issues recorded as observer statements in 2018. Specifically, we offer a new way of interpreting statements recorded by observers using *rates of incidents* recorded rather than raw *numbers of statements* recorded as described in Chapter 5. We summarize rates by various factors normally associated with observer deployments, and also provide additional information regarding trip-logging compliance issues recorded by the FMA Division in 2018.

Background and Purpose

As described in Chapter 5, observers record "statements' regarding potential violations, harassment issues, and workplace safety. These are typically recorded during the debriefing process after a cruise[21] is completed. These statements get forwarded to OLE and/or the US Coast Guard, and some of those become cases that are pursued further by OLE. For descriptions of the statement types recorded by observers, see Chapter 5.

The Observer Program has identified a need to understand the factors that contribute to compliance and safety incidents to better assist enforcement outreach efforts and guide FMA observer trainings in which observers are prepared to handle 'life on a boat' as a fishery observer. The central question this analysis seeks to answer is: *after controlling for how many observers or days an observer is deployed, how often do incidents occur in some of the different deployment situations observers find themselves placed into and how do patterns change when we group the data by factors associated with observing fisheries?* As this question implies, this analysis is primarily exploratory in nature.

The FMA Division has completed a preliminary analysis to determine the rate of incidents that occurred in 2018 summarized by several factors. Calculating a rate rather than simply describing the number of statements recorded allows these numbers to be standardized for things like coverage rate and deployment days. We believe that this method will prove to be more informative than the number of statements in each category across all factors for the year since all of the summaries are directly comparable to each other.

Methods

Number of Incidents Versus Number of Statements

Historically in Chapter 5, OLE has reported the number of statements recorded, aggregated across all management sectors, vessel types, gear types, and coverage types. Each statement is recorded in the observer database as a single record for each cruise, permit, and statement type. Within each statement record, observers also record the field 'number of incidents' that indicates how many times the particular issue occurred. It is important to note that this analysis uses the term 'incidents' differently than OLE uses the term in Chapter 5. In Chapter 5 an 'incident'

[21] A cruise number is associated with an observer, and is assigned upon training and lasts until debriefing. A cruise period can last up to 90 days, contain many individual deployments, and is limited to four vessels.

refers to an enforcement action against a violating vessel or plant. Here, the term 'incident' refers to a specific instance of a potential violation or safety issue reported by an observer during their deployment, regardless of whether the incident was pursued by OLE or not. For example, if haul logbook data were not provided to an observer in the timely manner required by regulations on 10 separate hauls, the observer will write one record-keeping and reporting statement during debriefing, with 10 incidents. OLE reports this as one observer statement for all 10 incidents. The actual number of incidents falls away in the standard reporting method described in Chapter 5, and until now has not been used for analysis. In order to accurately determine how often particular issues occur during observers' deployments, this analysis uses the actual number of incidents recorded rather than the number of statements.

First Incident Date Versus Statement Received Date

The complaints summarized by OLE in Chapter 5 are determined to be from 2018 based on the date they were received by OLE. The lag time between the date an incident actually occurs at sea and the date the statement is written and forwarded to OLE can be weeks. Observers do record the date the first incident occurred when they write statements. This analysis uses this date ('first incident date') to determine which incidents occurred in 2018. As a result, some values may differ slightly from those presented in Chapter 5. However, we feel that using this date is more appropriate for this analysis because it more closely aligns with the observer's deployment dates and is a better match for using number of incidents rather than number of statements.

Description of Factors

There are many factors that contribute to how many incidents are recorded in statements for an observer vessel/plant assignment. Some factors are associated with gear-type or sector (e.g., bird streamer line deterrents are only required for longline vessels), while others are more inter-personal (e.g., the number of crewmembers onboard a vessel). Factors chosen for this first-attempt analysis focus on things that are easily-identifiable within the observer database for each cruise/permit. Appendix D Table 1 lists the factors and description of each factor.

Rate Calculation Method

Two separate rates were calculated and are presented in this report: number of incidents per 1,000 deployed days; and number of incidents per vessel/plant assignment.

Number of Incidents per 1,000 Deployed Days

The number of incidents per 1,000 deployed days is simply a scaled version of the metric of 'incidents per deployed day'. This rate accounts for variability between deployment lengths across vessel/plant assignments. For readability we multiplied by 1,000 because the values of incidents per day were so small. Incidents per 1,000 deployed days are presented in this analysis for all statement types.

To calculate this rate, the denominator of total days deployed first had to be determined for each factor. This was gathered from haul and delivery information recorded by all deployed observers in 2018 wherever possible, and secondarily from eLogbooks and *e*Landings. All factors – with one exception are captured in the observer's haul, delivery, or logistics data: Vessel Type, Gear Type, Observer Role (Lead or Second), NMFS region, and Coverage Type (Full or Partial as per ADP definitions). The factor Management Program was first obtained from the Alaska Region's eLogbook and *e*Landings data and matched to 2018 observer data using cruise, permit, dates, and landing report ID when applicable.

Each day where a particular factor was recorded by the observer in their haul or delivery data constituted a deployment day for that particular factor value. For example, every day where a particular observer recorded vessel type of Catcher Processor (CP/MS) in their haul data was counted as a 'CP/MS deployment day'. Every deployed day was assigned at least one value within each factor, and in some cases more than one (e.g., it is not uncommon for a CP to fish both in both CDQ and AFA fisheries in the same day, so a day would have been counted for each in this analysis). Days where the factor value could not be matched from haul or delivery data within the cruise/permit[22] were matched from the 'nearest neighbor' date within the cruise/permit.

For the numerator of number of incidents, observer statements were matched to cruise/permits where they were recorded and summed for each factor value. The final rate was then calculated from all incidents divided by the sum of all deployed days for each factor value:

$$R_1 = \left(\frac{\sum Incidents}{\sum Deployed\ Days}\right) * 1{,}000 \quad .$$

This report separates the six OLE priority statement types into two broad groups. In the first, named OLE Priority: Safety and Duties, data summaries are as described above. The second group of OLE Priority is named OLE Priority: Inter-Personal. For this group, summary rates are calculated using the number of incidents per vessel in the numerator, and vessel/plant assignment in the denominator.

Number of Incidents per Vessel/Plant Assignment

The four statement types that fall under OLE Priority are:

- Intimidation, Coercion, and Hostile Work Environment
- Harassment – Sexual
- Harassment – Assault
- Disruptive/Bothersome Behavior: Conflict Resolved

[22] Synonymous with a vessel or processing plan. The term refers to each vessel or processing permit.

The rate of incidents per vessel/plant assignment is used for these statement types because of the sensitive and egregious nature of these incident categories and the fact that they affect a person (thereby defining the unit of measure). Here, a single incident may be enough to generate enforcement action.

To calculate this rate a cruise-vessel/plant assignment was considered to be associated with a given factor-value if the observer recorded any haul or delivery data with the factor-value. Every vessel/plant assignment was assigned at least one value within each factor, and in some cases more than one (see previous example re: CP's fishing both CDQ and AFA). Statements were then matched for cruise/permits where they were recorded. Finally, the rate per vessel/plant assignment was calculated as the sum of all incidents divided by the sum of all vessel/plant assignments for each factor value:

$$R_2 = \left(\frac{\sum Incidents}{\sum Assignments}\right) .$$

Although it may seem that we have committed the error of 'double-counting', this is not the case since all summaries by individual factors are independent of the summaries of other factors. In other words, all of the data for the year are summarized only for one factor at a time; no effort has been made to account for factors simultaneously.

Finally, some efforts were made to protect the identity of individual observers or vessels. In cases where there were fewer than six observers deployed for a factor in a year, that data was excluded from the analyses and data summary tables.

Results

Appendix Table D-1 shows the results of this rate calculation for statement types grouped into their categories as defined by OLE, with the additional splitting of the 'OLE priority' statements into sub-categories of 'Inter-Personal' and 'Safety and Duties,' as described above. Appendix Figure D-1 through Appendix Figure D-6 show relative rates as a heat map for each statement type within the categories defined by OLE. Trends in ODDS related issues reported to OLE is depicted as Appendix Figure D-7.

Discussion

This analysis represents the first attempt of its kind to standardize observer reporting to control for the number of observers and or time deployed. Our choice of incidents compared to violations does not completely erase the effects of deployment – there is a greater chance to accumulate incidents on longer deployments – however analysis of incidents does highlight areas of potential impact. Regardless of the method, there are many ways to investigate these data and a thorough understanding of potential violations is in its infancy. The FMA Division is currently working with OLE to revise the observer statement database to improve the utility of collected information. Planned improvements include: 1) improved collection of incident information to more closely match the units in the observer deployment plans; and 2) reducing the time needed

for observers to complete statements during debriefing. This work is ongoing and is expected to be completed for 2020.

The relative composition of ODDS trip logging issues reported to OLE has dramatically changed since the introduction of tendering stratum in 2017. It appears that vessel operators either do not know or change their designation of tendering status between logging the trip and realizing the trip. This is problematic since coverage rates expected are generated from ODDS records made when logging the trip and are evaluated using records generated after the trip has been realized.

Appendix Table D-1. -- Number of deployment days and distinct vessel/plant assignments related to each analyzed factor. These are the denominators for the rate per 1,000 days and the rate per assignment calculations. Summaries within each factor are independently calculated.

Factor	Category	Description	Deployed days	Vessel/Plant assignments
COVERAGE TYPE	FULL	Full Coverage	37037	969
	PARTIAL	Partial Coverage	3771	626
VESSEL TYPE	CP/MS	Catcher-Processor / Mothership	24893	521
	CV	Catcher Vessel	13571	1001
	PLANT	Processing Plant	2344	74
OBSERVER ROLE	LEAD	Lead observer	9966	206
	SECOND	Second observer	11043	262
	SOLE	Sole observer	19818	1155
NMFS REGION	AI	Aleutian Islands	3514	138
	BS	Bering Sea	30026	870
	GOA	Gulf of AK	4949	668
	PLANT	Processing Plant	2344	74
GEAR TYPE	HAL	Hook and Line	7759	408
	NPT	Non-Pelagic Trawl	14716	468
	PLANT	Processing Plant	2344	74
	POT	Pot or trap	1082	112
	PTR	Pelagic Trawl	14978	636
MANAGEMENT PROGRAM	A80	Amendment 80	1109	56
	AFA	American Fisheries Act	12900	385
	AFA PLANT[23]	AFA processing plant	2344	74
	CDQ	Community Development Quota	3823	221
	EXP[24]	Experimental Fishing Project	10686	255
	IFQ	Individual Fishing Quota	2044	282
	OA	Open Access	8480	570
	RPP	Rockfish Program	693	82

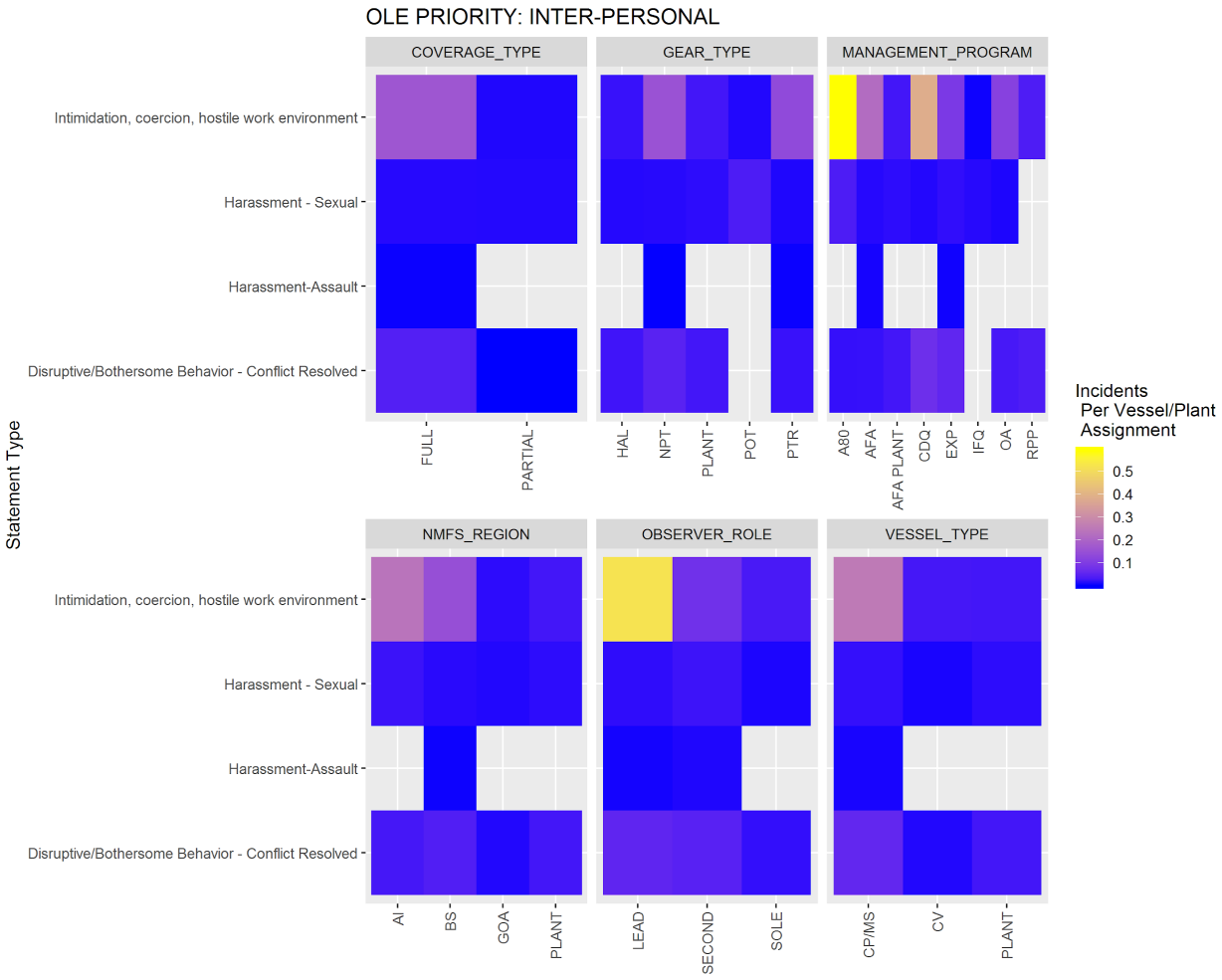
[23]AFA PLANT: all plant observer deployment days were treated as management program AFA PLANT, because even though there are other management program fisheries that deliver to plants where FMA observers are deployed, the majority of observer duties at processing plants are AFA-related.

[24]EXP (Exempted Fishing Permit): In 2018 all EXP deployment days were days where an observer was deployed to a vessel fishing under the Halibut deck-sorting EXP in the Amendment-80 fleet.

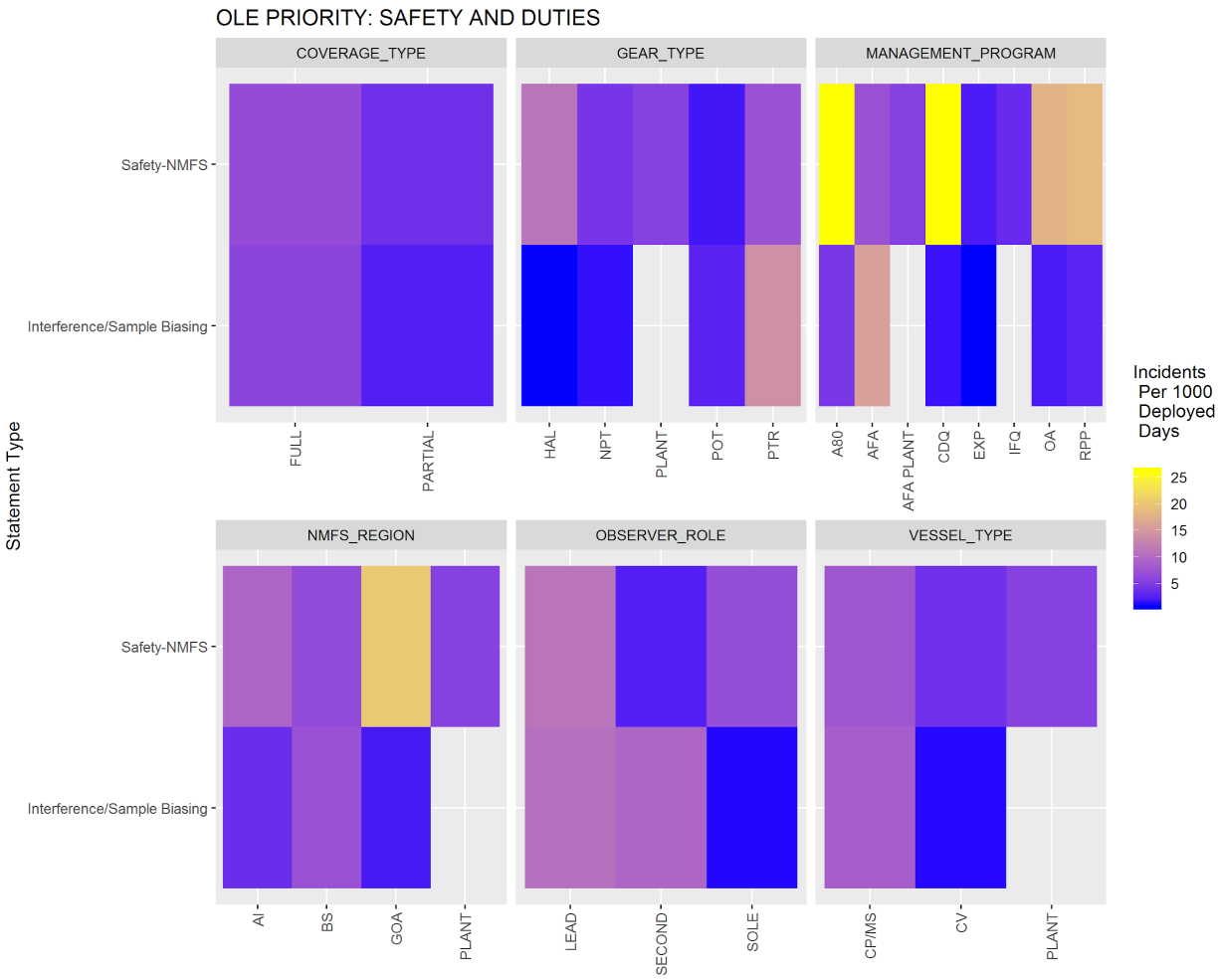
Appendix Table D-2. -- Incident rates as recorded by observers in 2018 for each analyzed factor. Statements types are grouped into the major categories defined by OLE in Chapter 5. For further breakout of the rate of incidents for each statement type by factor, see Appendix Figures D1-D6.

Factor	Category	OLE PRIORITY Inter-Personal		OLE PRIORITY Safety and Duties	Limited Access Programs	Protected Resource and Prohibited Species	U.S. Coast Guard	All Other Statement Types
		Incidents per assignment	Incidents per 1000 deployed days					
COVERAGE TYPE	FULL	0.22	5.7	12.7	38.9	11.3	21.7	67.9
	PARTIAL	0.02	3.2	6.4	6.6	29.2	16.4	91.8
VESSEL TYPE	CP/MS	0.34	7.0	16.6	56.8	9.9	27.0	77.5
	CV	0.04	3.2	5.2	3.2	14.9	13.9	63.4
	PLANT	0.07	2.1	5.5	3.8	33.3	3.0	30.7
OBSERVER ROLE	LEAD	0.59	12.2	21.7	113.9	20.3	30.3	146.2
	SECOND	0.15	3.6	12.0	11.3	13.5	19.6	31.1
	SOLE	0.06	3.2	8.0	10.8	12.2	18.2	57.0
NMFS REGION	AI	0.29	11.4	13.1	191.8	12.0	58.1	31.6
	BS	0.20	5.8	14.0	47.4	12.0	25.5	81.4
	GOA	0.03	4.2	22.2	13.7	24.4	24.4	83.0
	PLANT	0.07	2.1	5.5	3.8	33.3	3.0	30.7
GEAR TYPE	HAL	0.05	2.8	11.9	25.8	13.7	19.3	55.9
	NPT	0.21	6.8	5.8	68.2	9.3	23.3	62.7
	PLANT	0.07	2.1	5.5	3.8	33.3	3.0	30.7
	POT	0.04	4.6	4.6	8.3	0.9	58.2	51.8
	PTR	0.17	7.0	21.4	16.8	17.4	23.7	98.9
MANAGEMENT PROGRAM	A80	0.64	32.5	30.7	68.5	31.6	73.9	303.0
	AFA	0.25	7.5	23.2	18.9	17.5	26.0	105.3
	AFA PLANT	0.07	2.1	5.5	3.8	33.3	3.0	30.7
	CDQ	0.47	26.9	27.7	261.1	36.4	97.0	213.7
	EXP	0.17	4.0	2.9	92.9	4.9	23.9	70.1
	IFQ	0.01	2.0	3.4	11.7	33.3	19.1	86.6
	OA	0.15	10.1	20.0	21.8	19.0	37.5	66.0
	RPP	0.07	8.7	21.6	2.9	11.5	24.5	59.2

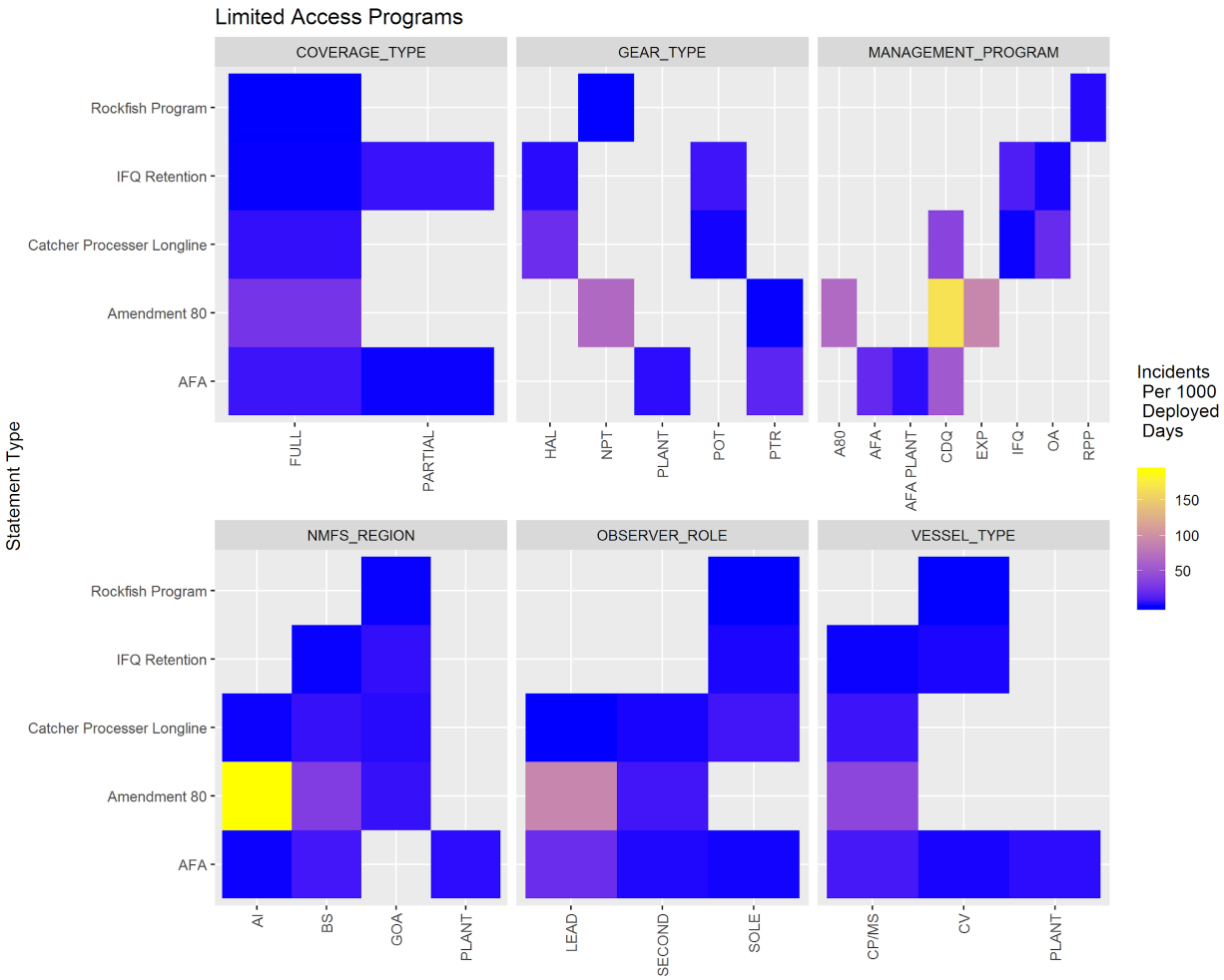
Appendix Figure D-1. – Heat map showing the relative number of incidents per vessel/plant assignment for the four listed OLE Priority statement types that relate to the inter-personal environment and observer well-being. Note that this chart uses rate of incidents per assignment rather than incidents per day.



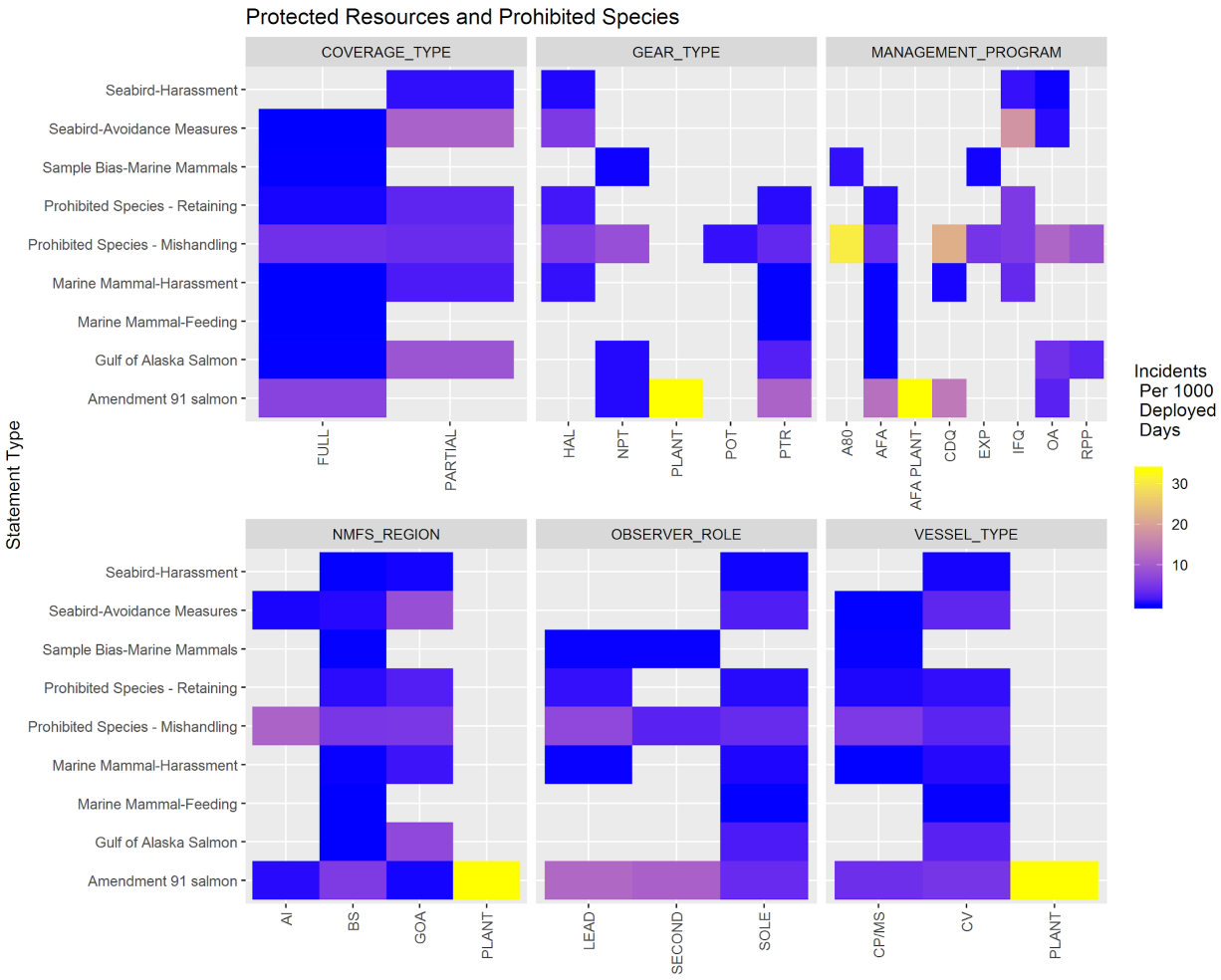
Appendix Figure D-2. -- Heat map showing the relative number of incidents per 1,000 deployed days for the two listed OLE Priority statement types that relate to observer safety and duties.



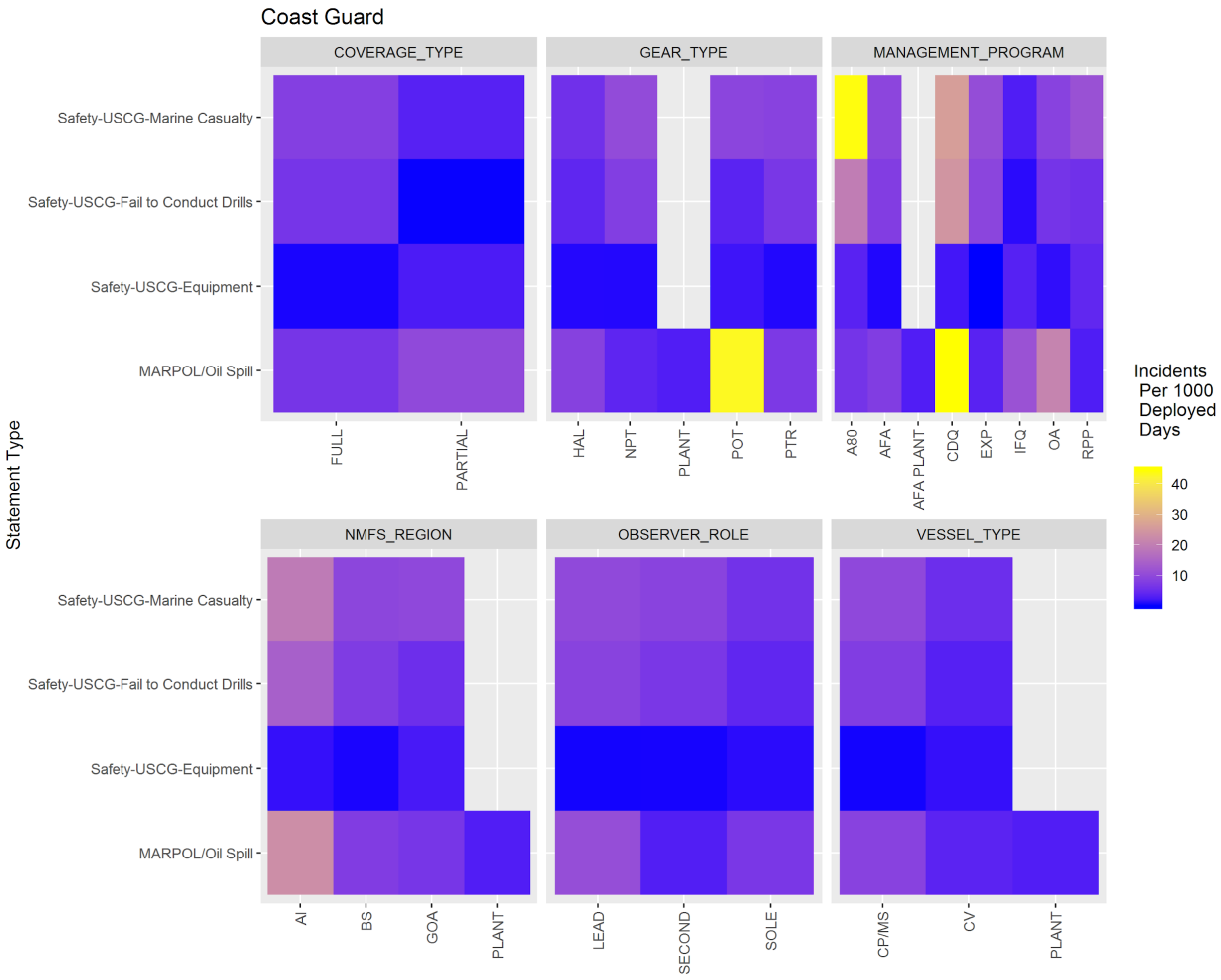
Appendix Figure D-3. -- Heat map showing the relative number of incidents per 1,000 deployed days for Limited Access Programs statement types.



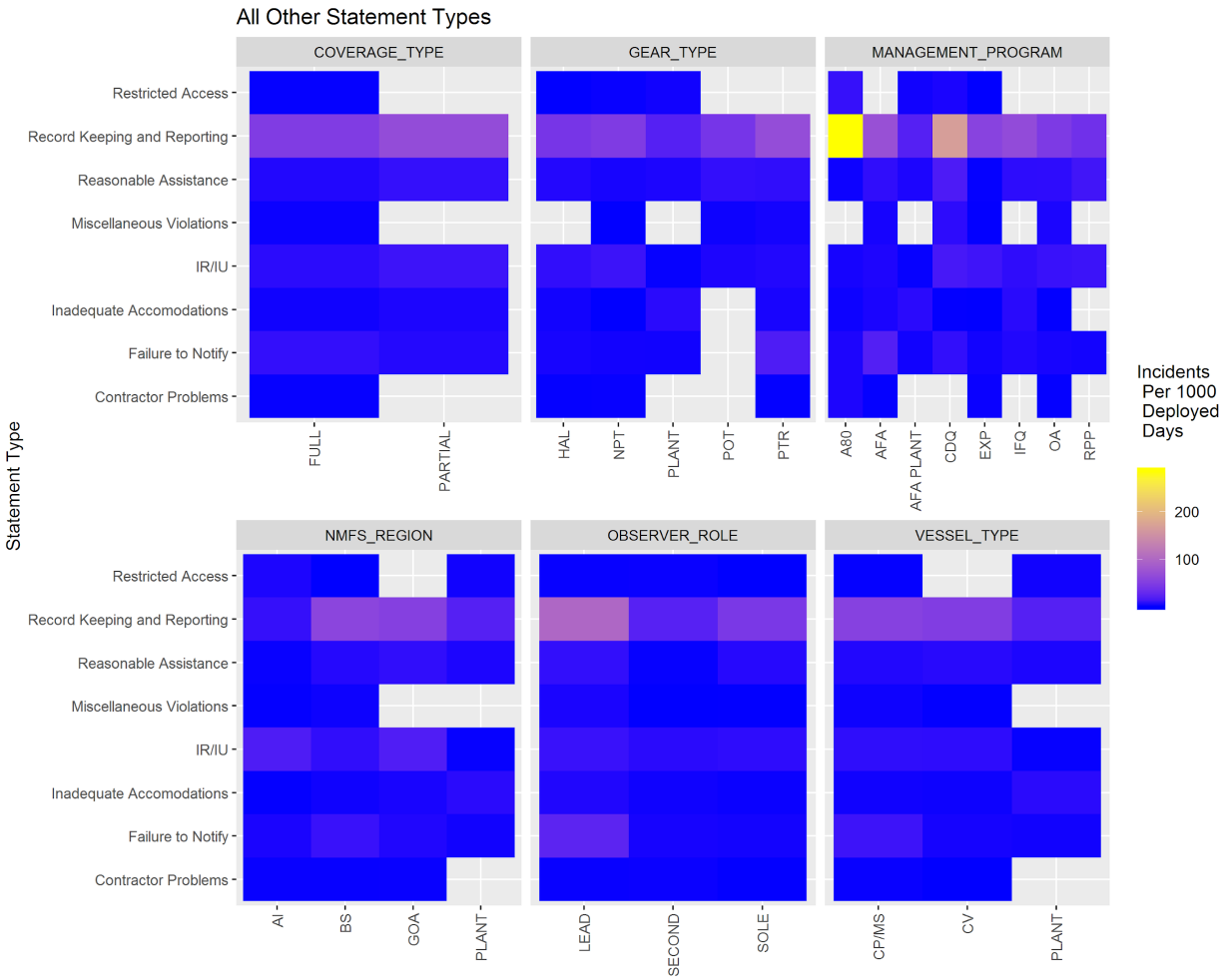
Appendix Figure D-4. -- Heat map showing the relative number of incidents per 1,000 deployed days for Protected Resources and Prohibited Species statement types.



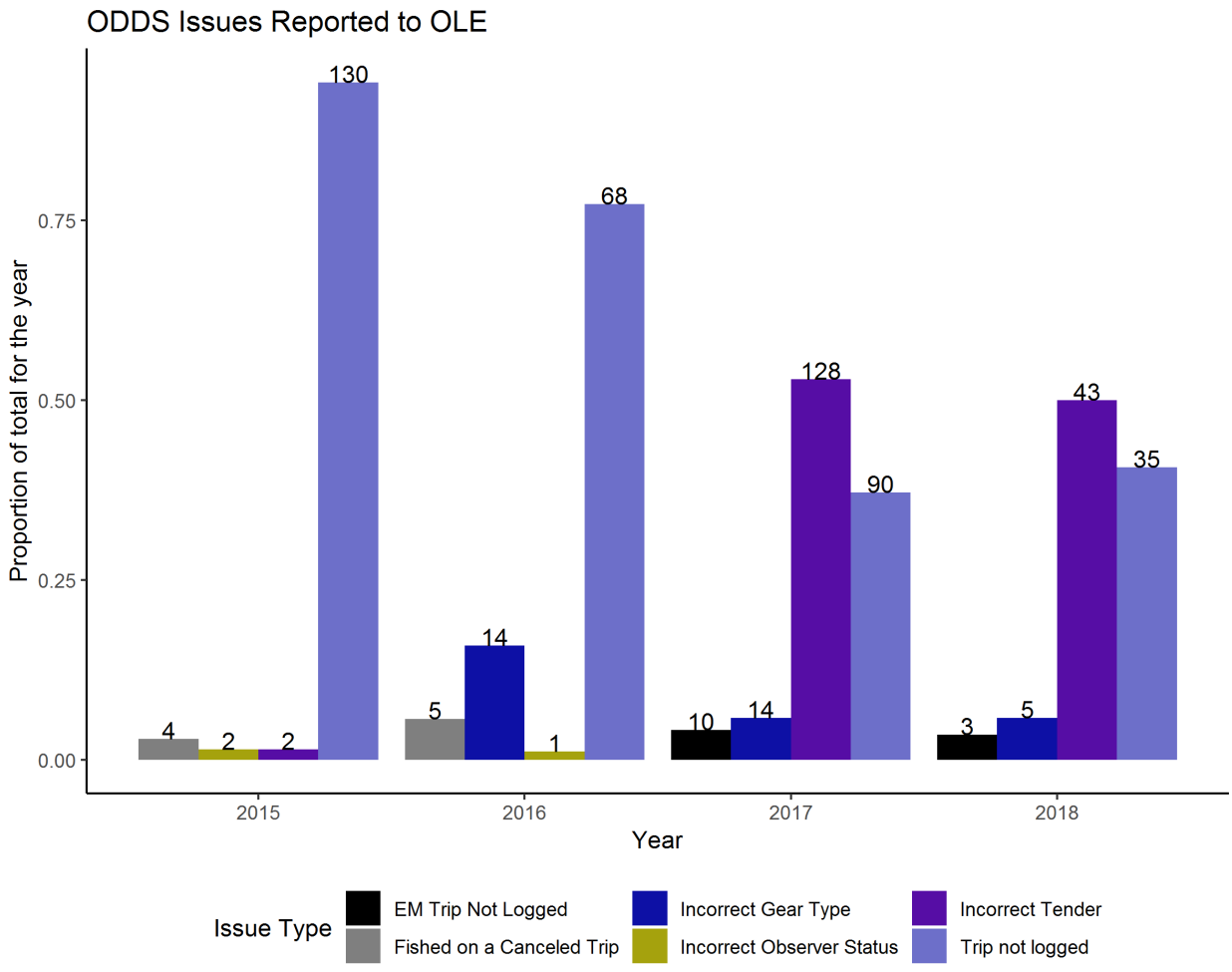
Appendix Figure D-5. -- Heat map showing the relative number of incidents per 1,000 deployed days for Coast Guard statement types.



Appendix Figure D-6. -- Heat map showing the relative number of incidents per 1000 deployed days for All Other Statement Types.



Appendix Figure D-7. -- The proportion(bars), and number of ODDS-related issues reported by FMA to OLE 2015-2018. Tendering strata were introduced in 2017.



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