2018 Annual Deployment Plan for Observers and Electronic Monitoring in the Groundfish and Halibut Fisheries off Alaska

December 2017

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Suggested Citation

NMFS (National Marine Fisheries Service). 2017. 2018 Annual Deployment Plan for Observers and Electronic Monitoring in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802.

Contents

Executive Summary

This 2018 Annual Deployment Plan (ADP) documents how the National Marine Fisheries Service (NMFS) intends to assign fishery observers and electronic monitoring to vessels fishing in the North Pacific during the calendar year 2018.

- On August 8, 2017, NMFS published a final rule to integrate electronic monitoring (EM) into the North Pacific Observer Program.
    - Funds available for EM deployment in 2018 are the combination of federal funding ($1M) and anticipated funding from external sources such as the U.S. National Fish and Wildlife Foundation.
    - A total of 145 vessels requested to be in the EM selection pool for 2018. Four vessels were determined to be ineligible, due to their history of fishing with trawl gear, and were not approved by NMFS.
    - NMFS approved the 141 eligible vessels in the EM selection pool for 2018 and notified all vessel owner/operators through the Observer Declare and Deploy System (ODDS). Of the 141 vessels in the EM pool, 69 vessels are new to the EM program and do not have an EM system installed, and 72 vessels are previous participants that have EM systems installed.
- Trip selection will be the sole method of assigning both observers and EM to at-sea fishing events in 2018. Trip selection is facilitated through vessels logging their trips into the ODDS and being notified if the trip is selected for coverage.
- In 2018, the following strata will be in place for vessels in the partial coverage category for deployment of observers and EM:
    - *No-selection pool*: The no-selection pool is composed of—
        - Fixed-gear vessels less than 40 ft LOA and vessels fishing with jig gear;
        - Three vessels that are voluntarily participating in EM innovation research.
    - *EM selection pool*: 141 fixed gear vessels that were approved by NMFS and have an NMFS-approved Vessel Monitoring Plan.
    - *Trip Selection Pool*: The five sampling strata for deployment of observers are—
        - Trawl catcher vessels
        - Hook-and-line catcher vessels greater than or equal to 40 ft LOA
        - Pot catcher vessels greater than or equal to 40 ft LOA
        - Trawl vessels delivering to tenders
        - Pot vessels delivering to tenders
- NMFS will implement an observer deployment allocation strategy of 15% plus optimization based on discarded groundfish and halibut and Chinook. A minimum level of sampling is precautionary with respect to avoiding bias and providing data across all gear types. The 15% plus optimization allocation strategy provides a balance between the minimizing variability

of discard estimates and prioritization of PSC-limited fisheries and the need to reduce gaps in observer coverage in the partial coverage category.

- The available budget for observer deployment in 2018 is $5.54M. NMFS estimates 4,394 observer days can be deployed in 2018 and expects that 1,058 trips will be observed in the partial coverage category. This represents 43% increase from the number of days expected to be observed in 2017 (3,059).

- The deployment rates for strata in 2018 are—
    - No Selection – 0%
    - EM – 30%
    - Trawl – 20%
    - Hook-and-line – 17%
    - Pot – 16%
    - Tender trawl – 17%
    - Tender Pot – 17%

- 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 will remain unchanged; trips that are randomly selected for observer coverage 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.

1. Introduction

Purpose and Authority

This 2018 Annual Deployment Plan (ADP) documents how the National Marine Fisheries Service (NMFS) intends to assign at-sea and shoreside observers and electronic monitoring to vessels and processing plants engaged in fishing operations in the North Pacific. This plan is developed under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the Fishery Management Plan for Groundfish of the Bering Sea and Aleutian Islands Management Area (BSAI FMP), the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP), and the Northern Pacific Halibut Act of 1982. Details on the legal authority and purpose of the ADP are found in the Final Rule for Amendment 86 to the BSAI FMP and Amendment 76 to the GOA FMP (77 FR 70062, November 21, 2012).

The ADP describes the science-driven method for observer deployment to support statistically reliable data collection. The ADP is a core element in implementation of section 313 of the MSA (16 U.S.C 1862), which authorizes the North Pacific Fishery Management Council (Council) to prepare a fisheries research plan that requires the deployment of observers into the North Pacific fisheries and establishes a system of fees. The purpose of the research plan is to collect data necessary for the conservation, management, and scientific understanding of the groundfish and halibut fisheries off Alaska.

Data collection by observers contributes to the best available scientific information used to manage the fisheries in the North Pacific. Information collected by observers provides a reliable and verifiable method for NMFS to gain fishery discard and biological information on fish, and data concerning seabird and marine mammal interactions with fisheries. Observers collect biological samples such as species composition, weights, and tissue samples and information on total catch, including bycatch, and interactions with protected species. Managers use data collected by observers to manage groundfish catch and bycatch limits established in regulation and to document fishery interactions with protected resources. Managers also use data collected by observers to inform the development of management measures that minimize bycatch and reduce fishery interactions with protected resources. Scientists use observer-collected data for stock assessments and marine ecosystem research. Much of this information is expeditiously available (e.g., daily or at the end of a trip, depending on the type of vessel) to ensure effective management.

On August 8, 2017, NMFS published a final rule to integrate electronic monitoring (EM) into the North Pacific Observer Program (82 FR 36991). An EM system uses cameras, video storage devices, and associated sensors to record and monitor fishing activities. The final rule established a process for owners or operators of vessels in the partial coverage category using nontrawl gear (i.e. hook and line or pot gear) to request to participate in the EM selection pool beginning with the 2018 fishing year. Vessels that are approved to participate in the EM selection pool will be required to log fishing trips and comply with EM deployment requirements; these vessels will not be required to carry an observer. The Council and NMFS developed EM for data collection for the nontrawl gear fisheries to address their desire for an alternative way to collect fisheries data in consideration of the operating requirements in these

fisheries. EM systems can collect at-sea data for NMFS to estimate discards of fish, including halibut, and mortality of seabirds.

This ADP describes the method for deployment of observers and EM in the partial coverage category (50 CFR 679.51(a); 679.51(f)) in the halibut and groundfish fisheries off Alaska in 2018.

Process and Schedule

On an annual basis, NMFS develops an ADP to describe how observers and EM will be deployed for the upcoming calendar year and prepares an annual report that evaluates the performance of the prior year's ADP implementation. 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 ADP specifies the selection rate—the portion of trips (or vessels) that are sampled—and NMFS and the Council recognized that selection rates for any given year would be dependent on available revenue generated from fees on groundfish and halibut landings. The selection rates can change from one calendar year to the next to achieve efficiency, cost savings, and data collection goals. The annual decision about how to apportion fees between observer deployment and EM system deployment is also made during the ADP process. The ADP process allows NMFS to adjust deployment in each year so that sampling can be achieved within financial constraints.

Some aspects of deployment can be adjusted through the ADP, including the assignment of vessels to a specific partial coverage selection pool, and the allocation strategy used to deploy observers and EM in the partial coverage category. The ADP also defines the criteria for vessels to be eligible to participate in the EM selection pool and can include factors such as gear type, vessel length, home or landing port, and availability of EM systems.

The Council's role in the annual deployment plan process is described in the analysis that was developed to support the restructured observer program (NPFMC 2011) and in the preamble to the proposed rule to implement the restructured observer program (77 FR 23326). The preamble to the proposed rule notes that: "NMFS would consult with the Council each year on the deployment plan for the upcoming year. The Council would select a meeting for the annual report consultation that provides sufficient time for Council review and input to NMFS. The Council would likely need to schedule this review for its October meeting. The Council would not formally approve or disapprove the annual report, including the deployment plan, but NMFS would consult with the Council on the annual report to provide an opportunity for Council input. The final deployment plan would be developed per NMFS' discretion to meet data needs for conservation and management. (77 FR 23344 & 23345)."

The annual analysis and evaluation of the data collected by observers and the ADP development is an ongoing process and this ADP follows the process envisioned by the Council and NMFS when the restructured observer program was developed and implemented. NMFS is committed

to working with the Council throughout the annual review and deployment cycle to identify improved analytical methods and ensure Council and public input is considered. The schedule for the 2018 ADP is as follows:

- **June 2017:** NMFS presented the 2016 Annual Report (AFSC/AKR 2017) to the Council and the public. The 2016 Annual Report provided a comprehensive evaluation of Observer Program performance including costs, sampling levels, issues, and potential changes for the 2018 ADP. The 2016 Annual Report identified areas where improvements are recommended to 1) collect the data necessary to manage the groundfish and halibut fisheries, 2) maintain the scientific goal of unbiased data collection, and 3) accomplish the most effective and efficient use of the funds collected through the observer fees. This review informed the Council and the public about how well various aspects of the program are working.

- **August 2017:** NMFS published a final rule to integrate EM into the North Pacific Observer Program (82 FR 36991) and sent a letter to vessels notifying them of the 2018 EM selection pool.

- **September 2017:** Based on information and analyses from the 2016 Annual Report and Council recommendations, NMFS prepared and released this draft 2018 ADP containing recommendations for deployment methods in the partial coverage category.

- **September – October 2017:**

    - *Review of the draft ADP*: The Council and its Scientific and Statistical Committee reviewed the draft 2018 ADP and the associated Observer Advisory Committee recommendations. Based on input from its advisory bodies and the public, the Council provided recommendations for the final 2018 ADP (Appendix A). NMFS reviewed and considered these recommendations; however, extensive analysis and large-scale revisions to the draft 2018 ADP are not feasible. This constraint is due to the short time available to finalize the 2018 ADP prior to the December 2017 Council meeting, and practical limitations on planning for deployment and associated processes that need to be in place by January 1, 2018.

    - *Requests to participate in EM selection pool:* Any vessel interested in being in the 2018 EM selection pool were required to request to participate using the Observer Declare and Deploy System (ODDS) by November 1, 2017.

    - NMFS notified the vessel owner whether that vessel has been approved or denied for the EM selection pool through ODDS.

- **December 2017:** NMFS finalizes the 2018 ADP and release it to the public prior to the Council meeting.

In June 2018, NMFS will present the 2017 Annual Report that will form the basis for the 2019 ADP.

2. Annual Report Summary

As described in the previous section, NMFS releases an annual report in June of each year that evaluates observer deployment under the ADP and includes an overview of the fees and budget associated with deployment, enforcement of the Observer Program regulations, a summary of public outreach events, and a scientific evaluation of observer deployment conducted by the Observer Science Committee (OSC) (e.g. Faunce et al. 2017). NMFS has released four annual reports starting with the 2013 Annual Report (NMFS 2014), which was presented to the Council in June 2014, and most recently the 2016 Annual Report (AFSC/AKR 2017), which was presented to the Council in June 2017. This draft 2018 ADP builds on NMFS recommendations in the annual reports and input from the Council (Appendix A).

In 2016 the sampling design used for dockside monitoring remained unchanged from previous years; in the GOA the goal was to obtain counts of salmon caught as bycatch during offloads of pollock trawl catcher vessels from observed trips and to obtain tissue samples to enable stock of origin to be determined using genetic techniques. This information is important for the management of Chinook salmon prohibited species catch (PSC) and is used by the Alaska Fisheries Science Center (AFSC) to identify the stock of origin of Chinook salmon caught as bycatch in groundfish fisheries (e.g., Guyon et al. 2015). The 2016 Annual Report evaluated the results from dockside monitoring and concluded that while observers could conduct their normal duties onboard vessels delivering to tenders, they could not monitor the associated offload due to the act of delivering to the tender. Based on these results, NMFS recommended maintaining *status quo* for dockside monitoring of pollock deliveries to shoreside processing plants with no offload monitoring on tendered deliveries.

In the longer term, the annual report recommended considering broader solutions for monitoring Chinook salmon PSC for trawl trips delivering to tenders in the GOA. Longer term solutions could include:

- Establishment of an alternative program for obtaining genetic tissues for stock-of-origin estimates given that these estimates have been stable over the past 5 years in the GOA.
- Plant monitoring of offloads, including tender offloads, combined with EM for compliance monitoring purposes and full retention of all catch (or maximized retention, recognizing some species might still continue to be discarded). This approach would need take into consideration tender deliveries mixing catch from multiple vessels.

The Annual Report evaluated three trip selection strata (Trawl, Hook-and-line, and Pot) that were used for observer deployment in partial coverage in 2016. The program met expected rates of coverage in all strata and there was no evidence of temporal bias in observer deployments. However, some spatial bias was evident in all three gear-types and observer effects (different trip characteristics between observed and unobserved trips) were found in hook and line and trawl gear types. Differences between observed trips that delivered to a tender and unobserved trips delivered to a tender were also evident in trawl.

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 annual report evaluated sample size with a gap analysis to determine whether

enough samples were collected to ensure adequate spatial and temporal coverage. The results in 2016 were similar to previous years and illustrated that the likelihood of at least one observation is increased with fishing effort and the probability of no observer data within a NMFS Reporting Area increased at low observer coverage rates. These results reinforce the results of simulated sampling evaluations of 2014 data that showed that most observer data gaps disappeared or were severely minimized at deployment rates greater than or equal to 15% (relative to a 50% probability of a post-strata being empty; NMFS 2015c).

Based on these results, the Annual Report recommended that, within budget constraints, sampling rates be high enough in each stratum to reasonably expect three observed trips in each NMFS Area. Further, NMFS recommended and the Council supported (Appendix A) that this 2018 draft ADP include evaluation of a 15% coverage rates across all strata and equal coverage rates that can be afforded. The results of the analysis were provided in the draft ADP (NMFS 2017).

The Observer Declare and Deployment System (ODDS) continued to perform as expected in 2016. An evaluation of selection rates showed no temporal bias in realized trips. However, the report found differential cancellation rates between selected and unselected trips. Based on these results, 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.

Recognizing the challenging logistics of putting observers on small vessels and low levels of catch by these vessels, NMFS has placed vessels less than 40 ft LOA and jig vessels in the no-selection pool for observer coverage since 2013. However, each Annual Report (AFSC/AKR 2017, NMFS 2016; 2015b) and the supplement to the environmental assessment for the restructured Observer Program (NMFS 2015c) have highlighted the data gaps caused by not having any observer information on vessels less than 40 ft LOA. In recognition of both the challenging logistics and data gaps, the Annual Report supported the Council's recommendation to develop a discussion paper about incorporating vessels less than 40 ft LOA in the EM selection pool.

3. 2018 Deployment Methods

The Observer Program uses a stratified hierarchical sampling design where trips and vessels represent the primary sampling units. Observers and EM are deployed into strata that are defined through a combination of regulations and the annual deployment process. Subsequent and lower levels of the sampling design at sea include the sampling of hauls, conducting species composition, obtaining lengths and biological tissues including those used for ageing, sexual maturity and genetics. Dockside monitoring consists solely of conducting complete enumerations of salmon bycatch within the pollock fishery.

At-Sea Deployment Design

The sampling design for at-sea deployment of observers and EM in the partial coverage category involves three elements: 1) the selection method to accomplish random sampling; 2) division of

the population of partial coverage trips into selection pools or strata (stratification scheme); and 3) the allocation of deployment trips among strata (allocation strategy).

Selection Method

Trip-selection refers to the method of selecting fishing trips as the sampling unit. Trip selection is facilitated through vessels logging their trips into the Observer Declare and Deploy System (ODDS) and being notified if the trip is selected for coverage. Trip selection will be the sole method of assigning both observers and EM to at-sea fishing events in 2018. Trips must be logged by contacting the ODDS call center at 1-855-747-6377 or using the web at: http://odds.afsc.noaa.gov.

Selection Pools (Stratification Scheme)

Electronic Monitoring (EM) Selection Pool

Following the publication of new regulations (82 FR 36991), electronic monitoring (EM) has been incorporated into the at-sea deployment design in the partial coverage category in 2018. Any vessel that was interested in being in the 2018 EM selection pool was required to request to participate using the Observer Declare and Deploy System (ODDS) by November 1, 2017. Any vessel that did not request to participate by this deadline is not be eligible for the 2018 EM selection pool and is in the partial coverage observer pool.

A total of 145 vessels requested EM for 2018. The recent fishing history of the vessels was evaluated (Appendix D) and any vessels that used trawl gear were not eligible to participate in the EM selection pool for 2018[1]. Four vessels were determined to be ineligible were not approved by NMFS to be in the EM pool.

The draft ADP provided an analysis of the EM budget, estimated costs, and anticipated number of vessels with EM systems that might participate in the EM pool (NMFS 2017). Appendix D provides an updated analysis based on revised budget and the actual vessels that requested to participate. Of the 141 vessels eligible to be in the EM pool, 69 vessels are new to the EM program and do not have an EM system installed, and 72 vessels are previous participants that have EM systems installed. The funds available for EM deployment in 2018 are the combination of federal funding ($1M) and anticipated funding from external sources such as the U.S. National Fish and Wildlife Foundation and NMFS estimates can support all of the 141 eligible vessels that requested to participate.

NMFS approved 141 vessels in the EM selection pool for 2018 and notified all vessel owner/operators through ODDS whether they had either been approved or denied. Once NMFS approves a vessel for the EM selection pool, that vessel will remain in the EM selection pool for the duration of the calendar year.

Vessels in the EM selection pool will be required to submit and follow an NMFS-approved Vessel Monitoring Plan (VMP)[2]. The EM service providers are working with EM participants to

[1] The Council has requested (Appendix A) NMFS to evaluate the EM eligibility criteria to determine if it is possible, in the future, to allow vessels to be in the EM pool for fixed gear and in the observer pool for trawl gear in the same

[2] The 2018 VMP template is available at: https://alaskafisheries.noaa.gov/fisheries/electronic-monitoring

ensure that they have an EM system installed and an approved VMP prior to their first fishing trip in 2018. EM system installations will be scheduled in the primary ports of Homer, Kodiak, and Sitka for longline vessels, and in Homer, Kodiak, and Sand Point for pot vessels. Secondary ports such as Juneau, Petersburg, Sand Point, King Cove, and Dutch Harbor may have periodic EM installation services available. Vessels not available during scheduled dates of EM installation in a secondary port will be required to travel to a primary port for EM installation services prior to the date of their first logged trip in ODDS. Primary and secondary port services apply to EM equipment installation and servicing only, there are no restrictions on where a vessel may make landings associated with this program. Once installed, the EM sensors and cameras will remain on the vessel until either 1) the boat opts out of the EM pool for the following year; or 2) NMFS determines that the vessel will not be eligible to participate in the EM selection pool the following year.

In 2018, the EM data collected from longline vessels will be used to account for all discarded catch in the NMFS Catch Accounting System and used for inseason management of the fisheries. The EM data collected from pot trips will be used to refine catch handing and video review protocols and to develop the methods to estimate total catch. Of the 141 vessels in the EM pool, 108 have a history of fishing with longline gear, 9 vessels fish with pot gear, and 24 vessels fish both pot and longline gear.

As described in the previous section, vessels in the EM selection pool will use ODDS to log all of their fishing trips. In addition, vessels in the EM selection pool must use ODDS to close each trip following the instructions in their VMP. For 2018 the VMP specifies that vessel operators are required to close their trips prior to logging another trip or within 2 weeks of the end of the trip, whichever is sooner. The requirement to close a trip in ODDS provides the ability to instruct the vessel to send the video storage device after the trip to ensure the timeliness of EM data for management. In addition, requiring a vessel operator to close the trip provides a mechanism to avoid monitoring bias by requiring 100 percent recording of trips and using a post-trip selection process through ODDS to randomly select trips for video review.

In the draft ADP, NMFS described the agency's intention to implement a post-trip selection process for EM in 2019. The EM Workgroup and the Council raised concerns regarding logistical and cost considerations with this approach, particularly on vessels fishing with pot gear where the extra time is required for catch handling on an EM selected trip. The Council requested that NMFS evaluate the cost and operational implications, for vessels and EM service providers (Appendix A). In 2018, NMFS will work with EM service providers and vessel operators using pot gear to determine the amount of time required to sort catch on EM-monitored trips compared to non-EM-monitored trips. NMFS will also examine the costs of recording video on 100 percent of trips and the logistics of developing efficient hard drive delivery protocols for all gear types.

Trip-selection pools for Observer Deployment

The draft ADP analyzed the performance of two stratification designs for observer deployment, one defined by gear and the second defined by both gear and tender/non-tender deliveries (NMFS 2017). The designs were evaluated using gap analysis (i.e., exploring situations where no observer data would be available). The gap analysis was used to determine which sampling designs would have a 50 percent probability of having at least one and three observed trips.

Using this metric, the gear-based stratification schemes outperformed the schemes that include tenders. However, in the draft ADP (NMFS 2017) NMFS recommended continuing the gear/tender stratification scheme for several reasons. First, this stratification scheme, which was first implemented in 2017, has not been fully evaluated in the Annual Report process. Maintaining this stratification scheme for another year, while improving the allocation design, would enable analysis of the effects and performance of the designs. Further, as discussed in the Annual Report Summary, tendering activity in pollock trawl fisheries continues to represent a sampling challenge. Although it has yet to be evaluated whether the addition of the tender strata fully alleviates this problem, it does ensure a certain level of coverage for those trips.

In reviewing the draft ADP, the Council noted that there were only 7 trips for hook-and-line vessels delivering to tenders and that only 1 trip was expected to be observed. For this gear type, a separate tender stratum may not improve the data quality and the Council recommended having a single stratum for hook-and-line gear (Appendix A). For 2018 there will be five trip-selection strata for observer deployment: 1) Trawl; 2) Hook-and-line; 3) Pot; 4) Trawl vessels delivery to tenders; and 5) Pot vessels delivery to tenders.

Summary of 2018 Deployment Strata

The following strata will be in place for vessels in the partial coverage category for deployment of observers (50 CFR 679.51(a)) and electronic monitoring (50 CFR 679.51(f)) in 2018:

- ***No-selection pool*:** The no-selection pool is composed of vessels that will have no probability of carrying an observer on any trips for the 2018 fishing season. These vessels are divided into two categories:
    - Fixed-gear vessels less than 40 ft LOA[3] and vessels fishing with jig gear, which includes handline, jig, troll, and dinglebar troll gear.
    - Three vessels voluntarily participating in the EM innovation and research (Appendix E).

- ***Electronic monitoring (EM) selection pool:*** The EM selection pool in 2018 will be composed of 141 fixed gear vessels that were approved by NMFS and have an NMFS-approved Vessel Monitoring Plan. Once NMFS approves a vessel for the EM selection pool, that vessel will remain in the EM selection pool for the duration of the calendar year.

- ***Trip Selection Pool for observer coverage:*** There are five sampling strata in the trip-selection pool for the deployment of observers:
    - **Trawl**: This pool is composed of all catcher vessels in the partial coverage category fishing trawl gear.

[3] Length overall (LOA) is defined in regulations at 50 CFR 679.2 and means the centerline longitudinal distance, rounded to the nearest foot.

- **Hook-and-line:** This pool is composed of all catcher vessels in the partial coverage category that are greater than or equal to 40 ft LOA that are fishing hook-and-line gear.
- **Pot:** This pool is composed of all catcher vessels in the partial coverage category that are greater than or equal to 40 ft LOA that are fishing pot gear, including vessels fishing longline pot gear.
- **Trawl vessels delivering to tenders:** This pool is composed of all catcher vessels in the partial coverage category that are greater than or equal to 40 ft LOA that are fishing trawl gear and are delivering to tendering vessels.
- **Pot vessels delivering to tenders:** This pool is composed of all catcher vessels in the partial coverage category that are greater than or equal to 40 ft LOA that are fishing pot gear and are delivering to tendering vessels.

Allocation Strategy

Allocation strategy refers to the method of allocating deployment trips among strata. The draft ADP provided a comparison 3 allocation strategies: 1) equal allocation; 2) 15% plus optimization, which is a "hurdle" approach where observer sea days are first allocated equally up to a 15% coverage rate and the remaining sea-days are allocated using an optimal allocation; and 3) Optimized, where all samples are allocated among strata using an optimal allocation algorithm. For both the 15% plus optimized and the optimized strategies, two metrics for optimization were evaluated: 1) discards of groundfish and halibut PSC; 2) discards of Chinook PSC in addition to groundfish and halibut PSC. The algorithm maximizes precision for the these metrics for the least cost

The results in the draft ADP indicated that optimized allocation had the most gaps in observer coverage. Designs that used equal allocation or 15% plus optimized allocations result in far fewer gaps in coverage, and the potential gaps for these designs only occur when there is low fishing effort (NMFS 2017). Based on the analysis, the draft ADP recommended an observer deployment allocation strategy of 15% plus optimization based on discarded groundfish and halibut and Chinook PSC. During the Council's review of the draft ADP, however, they did not support the agency's approach and instead recommended the fully optimized allocation strategy (Appendix A), which would result in a lower coverage rate in the pot strata.

One of the concerns with the fully optimized approach was lower coverage rates in the pot strata and the agency wants to insure both biological data on Pacific cod and information on groundfish and PSC species is collected. During Council testimony the State of Alaska indicated it would modify collection of Pacific Cod samples at shoreside plants to mitigate losses due to reduced pot gear coverage. Shoreside sampling could be a viable approach to augment at-sea data; however, as this would be the first year of an expanded shoreside program, comparison of the shoreside data with the at-sea sampling information would be beneficial to demonstrate its suitability.

In developing this final ADP, NMFS considered the Council's recommendation. Decreased expected effort (see next section on Deployment Rates for more explanation) and updating the

vessels that have opted into the EM selection pool have impacted the number of trips and variability of the strata and therefore the allocation weighting and predicted coverage rates are different from the draft ADP. Appendix C provides updated information to compare the fully optimized and 15% plus hurdle allocation designs relative to what was provided in the draft ADP (NMFS 2017).

In 2018, NMFS will implement observer deployment using the allocation strategy of 15% plus optimization based on discarded groundfish and halibut and Chinook PSC. In their review of the draft ADP, the SSC supported a minimum level of sampling and noted that the method is precautionary with respect to avoiding bias and providing data across all gear types. The allocation strategy of 15% plus optimization 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 all strata in the partial coverage category.

Both the SSC and the Council commented that the minimum allocation necessary to meet a sufficient level of coverage may differ between strata and should be investigated further. NMFS will continue to improve the science behind the minimum coverage level for the hurdle approach and consider whether the base coverage may differ between strata.

Deployment Rates

The trip selection rate for vessels in the EM selection pool is based on recommendations from the Council's EM Workgroup and the Council[4] and the selection rate will be 30% of trips in 2018.

To determine the deployment rate for the observer-deployment strata, NMFS uses the available sea-day budgets, and estimates of anticipated fishing effort. The NMFS budget for observer deployment in 2018 is $5.54M. The budget is comprised of $3.54M in observer fees, $1M in NMFS supplementary funds, and $996K in end of year Federal funds and carryover funds from the previous contract option period. Using this updated budget information, the at-sea budget for the deployment of observers is set at 4,394 days.

The second piece of information used to determine deployment rates is an estimate of anticipated fishing effort. The most recent data (2017 and 2016) was used as a proxy for future fishing effort (Appendix B). The data set was then modified in an attempt to adjust for the potential reduction of fishing effort due to the recent stock assessment of Gulf of Alaska Pacific cod (Barbeaux et al. 2017) and the expectation that catch quotas are expected to be reduced between 75-80% from 2017 levels. After consultation NMFS Inseason management branch, two adjustments were made to anticipated effort: 1) hook-and-line and pot fishing effort in the Pacific cod fishery was reduced by 75%; 2) trawl fishing in the western Gulf of Alaska (NMFS area 610) was reduced by 100 trips (Appendix B).

NMFS uses the estimates of available sea-day budget and anticipated fishing effort as the primary inputs into simulation models used to generate anticipated outcomes from different

[4] See Appendix A and also: http://npfmc.legistar.com/gateway.aspx?M=F&ID=113c3395-7b72-41dd-b371-d60537d1894d.pdf

selection rates. Sample size (using "15% + Optimization" allocation) and resulting coverage rate estimates were generated through simulation following the approach used for previous ADPs in which each simulation trial mimics an ADP selection draw for the year (Appendix B). Each vessel in the sampling strata of the partial-coverage fleet does not undertake identical numbers of trips and days in a year; the simulation approach provides NMFS with a full range of potential outcomes from random sampling (selections) of different vessels and trips. The simulated deployment rates were determined from an evaluation of estimated annual program costs assessed against the risk of exceeding the Observer Program's available funds (Appendix B).

NMFS estimates 4,394 observer days can be deployed in 2018 (Appendix B) and expects that 1,058 trips will be observed in the partial coverage category (Table 1). This represents 43% increase from the number of days expected to be observed in 2017 (3,059). The deployment rates (rounded to the nearest whole number) for strata in 2018 are—

- No Selection – 0%
- EM – 30%
- Trawl – 20%
- Hook-and-line – 17%
- Pot – 16%
- Tender trawl – 17%
- Tender Pot – 17%

Table 1. Summary of allocation weights, deployment rates, and the number of trips expected to be observed in each observer-sampling stratum in 2018.

Stratum	Allocation Weight	Deployment Rate (%)	Number of trips expected to be observed
Trawl	0.782	20.18	670
Hook-and-line	0.190	17.26	316
Pot	0.017	16.21	53
Tender trawl	0.008	16.67	15
Tender Pot	0.002	17.39	4
Total	1		1058

Chinook Salmon Sampling in the Gulf of Alaska

For vessels delivering to shoreside processors in the in the GOA pollock fishery the sampling protocol for Chinook salmon will remain unchanged. Trips that are randomly selected for observer coverage will be completely monitored for Chinook salmon bycatch by the vessel observer during offload of the catch at the shoreside processing facility.

For trips in the GOA pollock fishery 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.

Conditional Release Policy

For 2018, NMFS will not grant any conditional releases or temporary exemptions to any vessels subject to observer coverage. The integration of EM into the Observer Program in 2018 is a mitigating factor in not granting any conditional releases. Vessels in the EM selection pool will carry EM equipment as described in their Vessel Monitoring Plan and will not be subject to carrying an observer.

Annual Coverage Category Requests

Partial coverage catcher/processors

Under Observer Program regulations at 50 CFR 679.51(a)(3), the owner of a non-trawl catcher/processor can request to be in the partial observer coverage category, on an annual basis, if the vessel processed less than 79,000 lb (35.8 mt) of groundfish on an average weekly basis in a particular prior year. The deadline to request placement in the partial observer coverage category for the following fishing year is July 1 and the request is accomplished by submitting a form[5] to NMFS. Six catcher/processors requested, and NMFS approved, placement in the partial coverage category for the 2018 fishing year.

Full coverage catcher vessels

Under Observer Program regulations at 50 CFR 679.51(a)(4), the owner of a trawl catcher vessel may annually request the catcher vessel to be placed in the full observer coverage category for all directed fishing for groundfish using trawl gear in the BSAI management area for the upcoming year. Requests to be placed into the full observer coverage in lieu of partial observer coverage category must be made in ODDS[6] prior to October 15, 2017 for the 2018 fishing year. For the 2018 calendar year, NMFS has placed the following 34 catcher vessels in the full observer coverage category for all directed fishing for groundfish using trawl gear in the BSAI management area. The list of catcher vessels that have been approved to be in the full coverage category is available on the website at: https://alaskafisheries.noaa.gov/fisheries/observer-program.

Observer Declare and Deploy System (ODDS)

For 2018, ODDS will be modified to add new functionality to incorporate EM into the observer program. These include the ability for vessels to request EM for the upcoming year, the ability for the NMFS to notify the EM provider of vessels requiring EM installation, the mutual tracking of EM installation and maintenance by EM provider and NMFS, and the storage and tracking of approved VMPs for vessels, providers and the NMFS.

The user experience in ODDS will not change for a vessel operator. As in 2017, there will be a selection box to indicate whether the vessel will be delivering to a tender. NMFS will retain the current business operating procedure of allowing vessels to log up to three trips in advance and programming that prevents a 40 – 57.5' fixed gear vessel from being selected for a third consecutive observer trip. Any observed trip that is canceled would automatically be inherited

[5] The form for small catcher/processors to request to be in partial coverage is available at: https://alaskafisheries.noaa.gov/sites/default/files/obspartialcovreq.pdf

[6] Instructions for catcher vessels to request to be in full coverage using ODDS are available at: https://alaskafisheries.noaa.gov/sites/default/files/bsaitrawlobsrequest.pdf

on the next logged trip. As described in the Annual Report Summary, NMFS has identified an improvement to the programming in ODDS that would allow vessels to change the dates for observed trips, rather than cancelling and inheriting observed trips. Although this modification is a priority for NMFS and the Council (Appendix A), the change will not go into effect in 2018. NMFS will consider whether it is feasible to include this programming change to ODDS in 2019.

Vessels are allowed to cancel or change any unobserved trips (logged trips that have not been selected to carry observer coverage) themselves, but any observed trips (logged trips that have been selected for observer coverage) that must be rescheduled need to be coordinated by contacting A.I.S., Inc., through the ODDS call center (1-855-747-6377).

eLandings Electronic Reporting System

NMFS modified the eLandings system in 2016 to enable the ODDS trip number to be entered on a groundfish landing reports in eLandings. When vessels log trips in ODDS, they are given an ODDS trip receipt with a unique trip number. When landing reports are entered in eLandings at the end of the trip, the vessel operators are asked to provide their ODDS trip number so that it can be entered on the landing report. Having ODDS trip numbers entered on groundfish landing reports facilitates data analysis and provides better linkage between ODDS and eLandings. Although many processors are now submitting this information, it is not consistently reported. In 2018, NMFS will continue further outreach to processors to increase reporting of the ODDS trip number.

4. Communication and Outreach

NMFS will continue to communicate the details of the ADP to affected participants through letters, public meetings, and information on the internet:

- Information about the Observer Program is available at https://alaskafisheries.noaa.gov/fisheries/observer-program
- Frequently Asked Questions are available at https://alaskafisheries.noaa.gov/sites/default/files/observer-prog-faq.pdf
- For Frequently Asked Questions regarding ODDS go to: http://odds.afsc.noaa.gov and click the "ODDS FAQ" button.
- Information about EM, including the VMP template and Frequently Asked Questions are being developed and will be added to the NMFS website at: https://alaskafisheries.noaa.gov/fisheries/electronic-monitoring.

In addition, Observer Program staff are available for outreach meetings upon request by teleconference and/or WebEx pending staff availability and local interest. A community partner would be needed to organize a location and any necessary equipment to facilitate additional meetings. To request a meeting or suggest a topic for discussion, please contact Chris Rilling at 1-206-526-4194.

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Appendix A. Council motions on the Annual Report and ADP

Agenda Item C-1: Observer Program Annual Report & OAC Report
June 9, 2017

1) The Council recommends that the draft 2018 Annual Deployment Plan include the following:

- Maintain status quo for:
  - Dockside monitoring of observed pollock trips (see comments below for longer term solutions for tender offloads).
  - The trip-selection method to assign observers to vessels in partial coverage and continue to deploy observers in the trip selection pools defined by gear (pot, hook-and-line, and trawl).
  - Programming in ODDS that prevents a 40 – 57.5' fixed gear vessel from being selected for a third consecutive observer trip.
  - Allowing vessels to log up to three trips in advance in ODDS.
  - Continuing to place vessels less than 40 ft in the no selection pool.
- Evaluate:
  - Whether to continue the tender strata definition in 2018.
  - Comparing the following alternative deployment designs: 1) 15% coverage rates across all strata; 2) equal coverage rates that can be afforded with available funding; and 3) optimization allocations based on discards that includes prioritization of PSC limited fisheries in the weighting schemes.
  - A preliminary evaluation of the method to split the fee budget between EM and human deployment.
- For the EM pool:
  - If funding is insufficient to expand the EM pool up to 165 vessels, prioritize deployment in the EM pool as follows: 1) longline vessels, whose data will be used for inseason management; 2) vessels that are already equipped with EM systems; and 3) vessels 40-57.5 ft LOA where carrying a human observer is problematic due to bunk space or life raft limitations
  - To the extent possible, the Council recommends that NMFS consult with the EM Workgroup and/or the OAC on policy choices made during the transition to an integrated EM program in the 2018 ADP.
- Reprogram ODDS to allow vessels to change the dates for observed trips, rather than cancelling and inheriting observed trips.

2) The Council recommends that NMFS incorporate the following in future annual reports:

- Evaluate pelagic trawl and non-pelagic trawl trips for evidence of observer effect;
- Include information on progress toward estimating variance of catch and bycatch;
- SSC comments, as appropriate.

3) The Council is concerned about the increase in Observer Program complaints for OLE priority issues of safety and creating a hostile work environment, and encourages the industry to work with OLE and observer providers to proactively engage in education and outreach effort to reduce the number of complaints.

4) The Council appreciates NOAA Acquisition and Grants Office (AGO) efforts to accommodate stakeholder input on the Statement of Work for the next partial coverage observer provider contract, including presentations at the OAC meeting. The Council requests that AGO schedule their upcoming outreach events during the October Council meeting.

5) Regarding tasking of observer projects:
   - Low sampling rates: The Council approves the OAC's recommendation to create an OAC subgroup over the summer to scope out potential solutions for addressing low coverage rates.
   - Tendering and dockside monitoring: The Council tasks staff to develop a discussion paper identifying specific data concerns with respect to vessels engaged in tendering, and to work with industry groups to develop both short term and long-term solutions, including potential regulatory changes.

6) The Council remains concerned about the combined effects of decreased funding and sequestration and other delays in release of the fees. The Council recommends that NMFS consider provide supplementary funds to help alleviate shortage in funding for observer deployment as well as continue to pursue solutions that remove these funds from sequestration rules and streamline the release of the collected funds.

Agenda Item C-6: Draft 2018 Annual Deployment Plan
October 7 , 2017

The Council supports the following recommendations for the draft 2018 Annual Deployment Plan (ADP):

Continue the trip-selection method, definition of the "no-selection pool", the policy of not granting exemptions, and ODDS logging procedures described in the draft 2018 ADP.

Use the following sampling strata for 2018:

- EM selection pool: Fixed gear vessels that have opted-in and been approved to be in the EM selection pool and have an approved VMP.
- Hook-and-line vessels greater than or equal to 40 feet (ft) length overall (LOA)
- ~~Hook-and-line vessels greater than or equal to 40 ft LOA delivering to tenders~~
- Pot vessels greater than or equal to 40 ft LOA
- Pot vessels greater than or equal to 40 ft LOA delivering to tenders
- Trawl vessels
- Trawl vessels delivering to tenders

Use an observer deployment allocation strategy of full optimization based on discarded groundfish and halibut PSC (as described in Appendix C of the draft 2018 ADP).

Continue to collect salmon genetic samples, and use the methodologies for vessels delivering shoreside or to tender vessels described in the draft 2018 ADP

The Council suggests analysts consider the impacts of reduced Pacific cod TACs on fishing effort and coverage rates in the BSAI and GOA. Information from the November groundfish plan team meetings be used to guide the analysts.

Based on the information at the time the draft ADP was prepared, the Council supports the following preliminary deployment rates for the trip-selection strata in 2018:

- No selection - 0%
- EM selection pool - 30%
- Hook-and-line - 19%
- ~~Tender hook-and-line - 15%~~
- Pot - 4%
- Tender Pot - 6%
- Trawl - 22%
- Tender trawl - 12%

For the 2017 Annual Report (provided in June 2018) and the 2019 Annual Deployment Plan:

- In coordination with the OSC, consider the comments from the SSC and the AP to include an evaluation of gear specific "hurdle" approaches, incorporate crab PSC estimates, and develop additional metrics for optimization in the annual evaluation process, to the extent possible.
- Evaluate the impacts of mixed gear trips on future sampling designs with the implementation of sablefish pot fishery.

- Consider the recommendations from the OAC to separate EM stratum information by gear type.
- Evaluate the cost implications and operational implications, for vessels and EM service providers, of deploying EM on 100% of trips in the EM selection pool, with selection for video review occurring after the trip is completed.

The Council requests that NMFS reprogram ODDS and CAS to allow vessels to be in the EM pool for fixed gear and in the observer pool for trawl gear in the same year. The prioritization will be determined in staff tasking.

The Council requests staff to provide the EM/ER Strategic Plan of 2013 and descriptions of proposed EM projects. This information will help the Council prioritize projects, and determine whether and when an EM workgroup should be appointed to shepherd new projects.

Appendix B. Calculation of the Selection Rate for 2018

Introduction

The sampling design hierarchy used by the North Pacific Observer Program has several levels. The deployment of observers or Electronic monitoring equipment (EM) as specified in Annual Deployment Plans (ADP) only apply to the first, and top-most level of this hierarchy. The 2018 ADP specifies that the method known as "trip-selection" be the sole method of assigning observers and EM within the 'partial-coverage' category of the fleet. In this analysis, the partial-coverage fleet is defined to only include those vessels for which sampling rates will be greater than zero and less than 100% (i.e., the portion that is sampled at the trip-level).

Trip-selection is accomplished through the Observer Declare and Deploy System (ODDS). Partial coverage trip-selection participants are sent a letter prior to the start of the calendar year with their username and password so that they may access the ODDS and log planned fishing trips. Each logged trip is assigned a random number of four digits ranging from 0 to 1. This random number is evaluated against a pre-programmed selection rate in ODDS. If the random number is below or equal to the selection rate, then a trip is selected for observation. For this reason, two key elements of the sampling design are required to be known before fishing begins in a given calendar year: (1) how fishing activities are divided into groups for the purposes of observer or EM deployment (hereafter termed stratification schemes), and (2) how available funds are to be used to divide sampling effort among participants (hereafter termed allocation strategy). In addition, a representation of fishing activity that is thought to represent the upcoming year needs to be developed in order for selection rates to be calculated known in advance of the upcoming calendar year.

Alternative deployment designs are evaluated in draft versions of the ADP. The draft 2018 ADP contained an evaluation of ten alternative designs for the deployment of observers into the partial-coverage fleet (NMFS 2017). While the draft ADP analyses is focused on comparing alternative designs, analyses in support of the final version of the ADP are focused on creating a representation of future fishing activity and determining what selection rates for the upcoming year result from the preferred design. The analysis that follows is based on the decisions made by NMFS after consultation with the North Pacific Fishery Management Council (NPFMC or Council) at their October 2017 meeting regarding the Draft 2018 ADP.

Deployment design in 2018

EM Coverage

The rules governing EM participation are specified in new regulations published in 2017. Participation in EM is voluntary. Between September 1 and November 1 of each year, vessels can request to participate in EM through ODDS. After November 1, NMFS approves or denies EM requests based on vessel eligibility and the available funding.

The selection rate for EM was not determined by analysis. The selection rate for EM for 2018 was instead guided by the EM Workgroup of the Council and is set at 0.3, or 30% of trips. In the draft 2018 ADP it was assumed that all pre-wired vessels would participate in EM and there would be an additional $1M for dedicated funding for up to 110 vessels total (NMFS 2017). For the final 2018 ADP, funding for EM is anticipated to exceed $2M and should be ample to allow

141 vessels to participate (Appendix C). In addition, three vessels volunteered for participation in federally funded EM Research (Appendix D) and will be placed in zero selection. Since the EM selection rates have been set and an analysis of their costs considered in Appendix C, this analysis only considers selection rates for observers.

Observer coverage

Separate regulations govern which fishing activities receive mandatory full coverage and those activities are not the focus of this analysis. The sampling design used for partial coverage in this analysis consists of five strata:

1. **TRW**: Trawl vessels
2. **POT**: Pot vessels greater than or equal to 40 ft LOA
3. **HAL**: Hook-and-line vessels greater than or equal to 40 feet (ft) length overall (LOA)
4. **Tender POT**: Pot vessels greater than or equal to 40 ft LOA delivering to tenders
5. **Tender TRW**: Trawl vessels delivering to tenders

This stratification scheme differs from that recommended by NMFS in the draft 2018 ADP in that it does not contain a stratum for Hook-and-line vessels greater than or equal to 40 ft LOA delivering to tenders.

The sample allocation strategy in this design follows that recommended by NMFS in the draft 2018 ADP. Sample sizes are determined from a "15% + Optimization" allocation. In this method, only available sample days above those needed to achieve 15% coverage are allocated through an optimization routine. The optimization routine is a blended or compromise one (Cochran 1977). Allocations arise from an equally weighted blend of three optimal allocations among strata that each consider trip cost and variance in either discarded groundfish, Pacific halibut Prohibited Species Catch (PSC), or Chinook salmon PSC.

Methods and Results

Changes in methods from last year

All analyses were performed using the R language for statistical computing (R Core Team 2016) following the same general procedures and operating under the same general assumptions used in previous Annual Deployment Plans. These include the selection of appropriate deployment rates through iterative simulated sampling and the generation of "risk-profiles" of going over budget. In this analysis the budget for 2018 is set so that the ADP is economically solvent without Federal Funds through June 16, 2019 given stable fee collection funding each year and a fixed travel budget[7]. Details in budget forecasting can be found in a section by that name in the draft 2018 ADP (NMFS 2017). The method to determine future fishing effort has changed from the previous ADP and is described in later sections.

Data preparation

A dedicated dataset developed by the staff of the Sustainable Fisheries Division of the Alaska Regional Office (AKRO) and the Fisheries Monitoring Division (FMA) of the Alaska Fisheries Science Center was used in this analysis. Briefly, these data consist of species-specific catch

[7] The travel budget is confidential due to contractual agreements.

amounts, fishing dates, locations, catch disposition, observation status, and associated ADP strata from 1 January 2013 to 19 November, 2017.

As in past ADPs, trip data were altered to reflect the expected fishing under partial coverage in the upcoming year. As in prior versions of the ADP these alterations include: (1) adding an additional day to trips that occurred in the trawl pollock fishery to account for the additional cost of monitoring associated offloads for salmon bycatch and genetic tissue collections[8], (2) fishing activity by seven 'historical low volume' Catcher-Processors were labeled as belonging to the partial-coverage category, (3) fishing by AFA eligible trawl vessels targeting Pacific cod in the BSAI were relabeled as belonging to the full coverage fleet if they indicated this was their preferred coverage for this activity in 2018, and (4) vessels with no probability of selection were removed from the analysis following the draft 2018 ADP (i.e., all trips corresponding to hook and line and pot gear on vessels < 40' LOA, vessels fishing jig gear, and vessels that volunteered to participate in electronic monitoring in 2018). Data from 2013 were excluded from the draft 2018 ADP and this analysis since the method used to define tendering trips was improved in 2014 to include methods such as "geo-fencing" to help define fishing trips.

Estimation of fishing effort in 2018

To estimate fishing effort for the upcoming year, a population of proxy 2018 fishing trips was created in the following manner. First, trips from 19 November 2016 to 31 December 2016 were considered reflective of these dates in 2018, and these data were added to trips from 1 January 2017 to 18 November 2017, which were considered reflective of these dates in 2018. This approach was chosen because lacking additional information or a model, the most recent data should be the best proxy for future fishing effort. Next, an anticipated reduction of fishing effort was attempted following the recent stock assessment of Gulf of Alaska Pacific cod (Barbeaux et al. 2017). Three adjustments were made to the '2018' partial-coverage trip data: Hook-and-Line and Pot fishing effort in the Pacific cod fishery was reduced by 75%, and Trawl fishing in the western Gulf of Alaska (NMFS area 610) was reduced by 100 trips. These reductions were determined in consultation with the Fisheries Monitoring Division of the AFSC and the Sustainable Fisheries Division of the AKRO and were deemed appropriate given that Pacific cod catch quotas in the Gulf of Alaska are expected to be reduced between 75-80% from 2017 levels. Reductions of '2018' data for trawl gear were conducted such that the proportion of trips belonging to the TRW and Tender TRW 2018 strata were conserved.

It is necessary to ensure that the reduced '2018' data accurately reflects the properties of the full '2018' data set. Two statistical methods were used to help ensure this property for each reduced subset of the '2018' data (Hook-and-line, Pot, and Trawl). First, a Kolmogorov–Smirnov test was used to determine if the distribution of fishing days among trips in the reduced subset could be considered the same as that from the full subset. This test was necessary since the cost of observation is related to trip duration. Second, a two-sided test of proportions was conducted to examine whether the ratio of trips in each half of the year were identical between the reduced subset and the full subset. This test was necessary because annual funding by NMFS for observer and EM deployment occurs on a fiscal year schedule that is 6-months different from the calendar year, and the estimated cost for each half of the year is needed by NMFS to inform funding for contracts. New reduced subsets were created and new tests were performed until the

[8] More details on observer sampling methods for salmon bycatch in Faunce (2015).

p-value from both tests in all subsets exceeded 0.95. At this point, the '2018' data was considered final and was used for simulated sampling.

Determining deployment rates for 2018

The selection rate that can be afforded in the coming year depends on several factors. These include the amount of fishing that is expected to occur and the available budget. The available budget for observer deployment in 2018 was set to $5,538,372.

The optimal sample allocation weightings for each stratum were recalculated following the methods detailed in the draft 2018 ADP for the preferred design described in previous sections (NMFS 2017). These recalculations were warranted since there are substantial changes in strata membership between this and the draft version of the 2018 ADP (Table B-1). As in past ADPs, the analysis of potential deployment rates was conducted through iterative simulated sampling of proxy trips representing the upcoming year. Stratified random sampling without replacement of the '2018' trip data constituted one trial of one simulation. Sample sizes among strata for all trials and simulations were set in terms of fishing trips and were set equal to the sum of two elements: the base rate of 15% multiplied by the total number of trips in the stratum, and the allocation weighting multiplied by the total number of trips available for optimal allocation after the days available for base-rate coverage had been accounted for among all strata. In each trial, the total number of days in sampled trips was summed for both the first half of the year (defined as 1 January to 16 June for NMFS contracting and budget considerations) and for the entire year, and compared to the available sea-days for the entire year. In addition, the days were expressed as a cost and compared to the total budget available for the year. A total of 10,000 trials were conducted for each simulation.

The initial number of trips afforded in this analysis was set from the sum of multiplying the coverage rates expected for each stratum from the draft 2018 ADP by the expected number of trips in each stratum in 2018 determined in this analysis. This initial number of trips afforded for observer deployment only serves as a starting point for budgetary evaluations and several versions of the simulations were conducted. In each successive simulation (hereafter termed 'increments'), the total number of trips that could be sampled was incrementally increased by 5. In each increment, the number of trials that exceeded the available budget were enumerated and expressed as a proportion of the number of trials.

The results from each increment are presented in Table B-2 and Figure B-1. **Based on these results, the rates resulting from the eighth increment are recommended for use in the final 2018 ADP since they represent values that should result in a minimal number of extra days under the constraint that the risk of over-spending by the NMFS be no more than one in ten**. The distribution of expected deployment days for the first half of the year and the full year of 2018 from the selected iteration are presented in Figure B-2. It is estimated that 1,058 trips totaling 4,394 days will be observed in 2018 (with 2,190 days occurring between January 1 and June 16, 2018). This compares with 1,034 trips and 4,064 days estimated in the Draft 2017 ADP (Table B-3). The expected difference between the available budget and the expended budget under the selected increment and Table B-2 is depicted as a risk-profile in Figure B-3. The average and most likely sea-day expenditure for 2018 is expected to be $80,430 under budget with the possibility of being between $261,473 under budget and $364,328 over budget.

Discussion

Net increases in observer days and coverage percentages are expected in 2018 compared to 2017. These changes are the combined result of a one-time increase in federal funding, increased participation in EM, expected decreases in fishing effort in some sectors and changes in optimization weights. It is expected that 4,394 observer days can be deployed in 2018. This represents 43% increase from the number of days expected to be observed in 2017 (3,059)[9].

There was considerable variability in optimal allocation weightings between the draft 2018 ADP and this analysis. The smallest relative change of +0.34% occurred in the POT stratum and the largest change of -59% occurred in the Tender + TRW stratum. The Tender + TRW stratum has considerable variability in catch depending on whether trawl vessels target pollock or Pacific cod. The relatively large drop in allocation weighting in the Tender + TRW stratum likely resulted from a decrease in the number of anticipated trips in the Pacific cod fishery that will occur in 610, which reduced the variance in this stratum.

Despite the relatively large relative difference in the optimization weighting in some strata, the resulting observation rates were much less changed between the draft 2018 and this analysis. For example the Tender + TRW stratum change in relative coverage rates only increased by 3.8%, and the largest among strata was in the Tender + POT stratum that increased by 12.4%. This is because of the use of the baseline coverage rates in the preferred design - large fluctuations in optimal allocation weighting are dampened depending on how much above the baseline coverage can be afforded - the more total sea days, the more coverage rates will change due to changes in optimal allocation weighting.

An evaluation of alternative baseline coverage levels among strata within the partial coverage fleet including EM is expected to be prepared by the AFSC and reviewed by the Observer Science Committee in 2018.

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[9] From the sum of actual expenditures January 1 - June 16th 2017 and the estimated observed sea-days for the remainder of the year from the Final 2017 ADP (NMFS 2016).

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Table B-1. Differences in budgets, participation, and total coverage estimated to be between the 2018 Draft ADP and this analysis. The numbers of vessels requesting and receiving Electronic Monitoring (EM) coverage was estimated for the Draft 2018 ADP, whereas actual participants were known in this analysis. For observed vessels, the number of vessels participating is defined as vessels in partial coverage (non including zero coverage) in the last complete year. For the draft ADP, the number of vessels was based on 2016. For this analysis, the number of vessels is based on a 2018 proxy year.

	Draft 2018 ADP	This analysis
Total anticipated funding ($)		
EM	1,000,000	2,361,850*
Observer	5,365,603	5,538,372
Vessels participating		
EM	110	141
Observer	557	510

*Assumes external funding sources such as National Fish and Wildlife Foundation are received.

Table B-2. Comparison of the number of days (d), and trips (n) expected to be observed, the days afforded that remain in excess (d_R) after deployment, and proportion of trials that were under budget (P_{PF}) resulting from 10,000 simulated sampling trials. In each increment the number of trips is increased. The recommended increment (highlighted) is that which results in the greatest number of observed trips while having less than 10% of trials going over budget. FH: First half of the year (for contracting purposes).

Increment	d_{FH}	d	d_R	n	P_{PF}
1	2124	4259	211	1023	1.000
2	2134	4279	191	1028	0.998
3	2144	4299	171	1033	0.998
4	2153	4317	153	1038	0.993
5	2166	4342	128	1044	0.982
6	2173	4356	114	1048	0.965
7	2181	4375	95	1053	0.938
8	**2191**	**4394**	**76**	**1058**	**0.898**
9	2200	4410	60	1062	0.832
10	2210	4429	41	1067	0.751

Table B-3. Comparison of the number of trips in a stratum (N_{h2018}), the optimal sample weighting (W_{hopt}), preliminary predicted observed trips (n_h), days (d_h), and coverage rates (r_h) resulting from the deployment sampling design described in the text.

Stratum (*h*)	N_{h2018}	W_{hopt}	n_h	d_h	r_h (%)
Draft 2018 ADP					
TRW	2,427	0.751	480	1,571	19.78
HAL	2,231	0.210	364	1,781	16.34
POT	858	0.017	131	456	15.28
Tender TRW	259	0.020	42	182	16.06
Tender HAL	7	0.000	1	4	15.42
Tender POT	105	0.003	16	70	15.46
This analysis					
TRW	3,320	0.782	670	2,354	20.18
HAL	1,831	0.190	316	1,680	17.26
POT	327	0.017	53	238	16.21
Tender TRW	90	0.008	15	92	16.67
Tender HAL	This stratum was removed.				
Tender POT	23	0.002	4	29	17.39

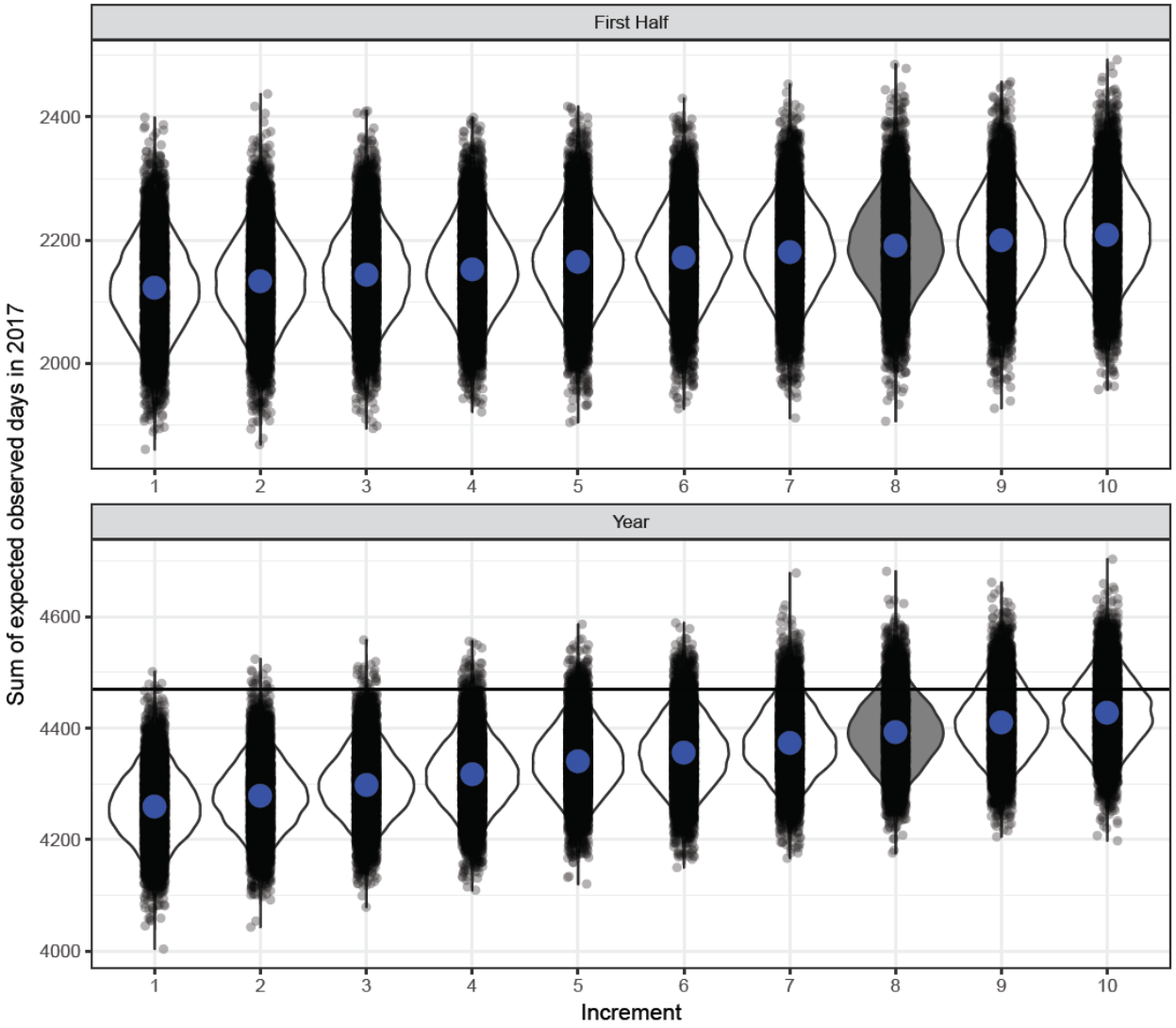

Figure B-1: The total number of days expected to be observed in the first half of 2018 (top panel) and the entire calendar year of 2018 (bottom panel) for incremental increases in the total number of trips in which observers were deployed. For each increment, the outcome of a single trial is depicted as a black dot. The average of the 10,000 trials for each increment are depicted as blue dots. The number of outcomes are expressed by the width of the oval for each increment. In this way, the mean is a good approximation of the most likely outcome. The black horizontal line represents the available budget. The selected increment is depicted by a shaded oval.

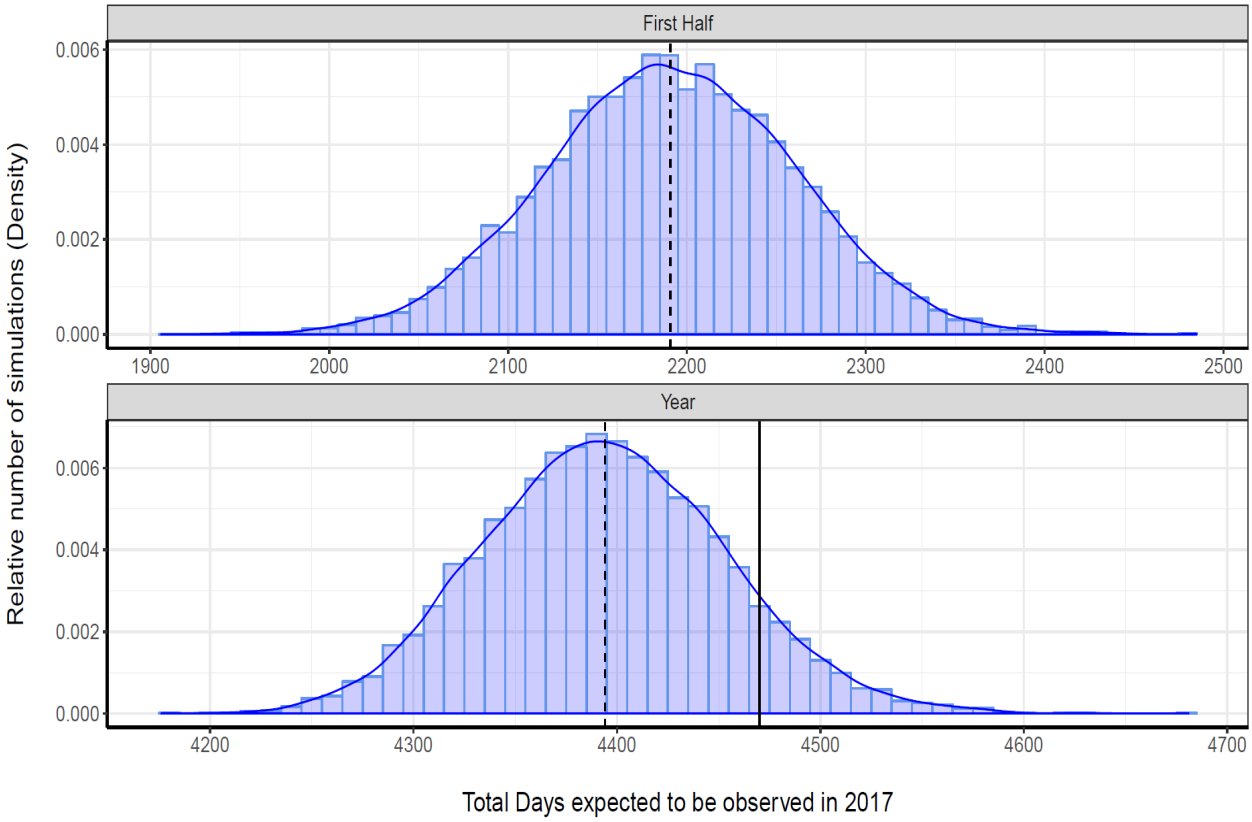

Figure B-2: Summary of 10,000 outcomes of simulated sampling from the preferred increment from the prior figure showing the number of observed days expected for the first half (top panel) and entire year of 2018 (lower panel). Dashed lines denote average outcomes from the simulations while the solid black line depicts the number of days corresponding to the available budget.

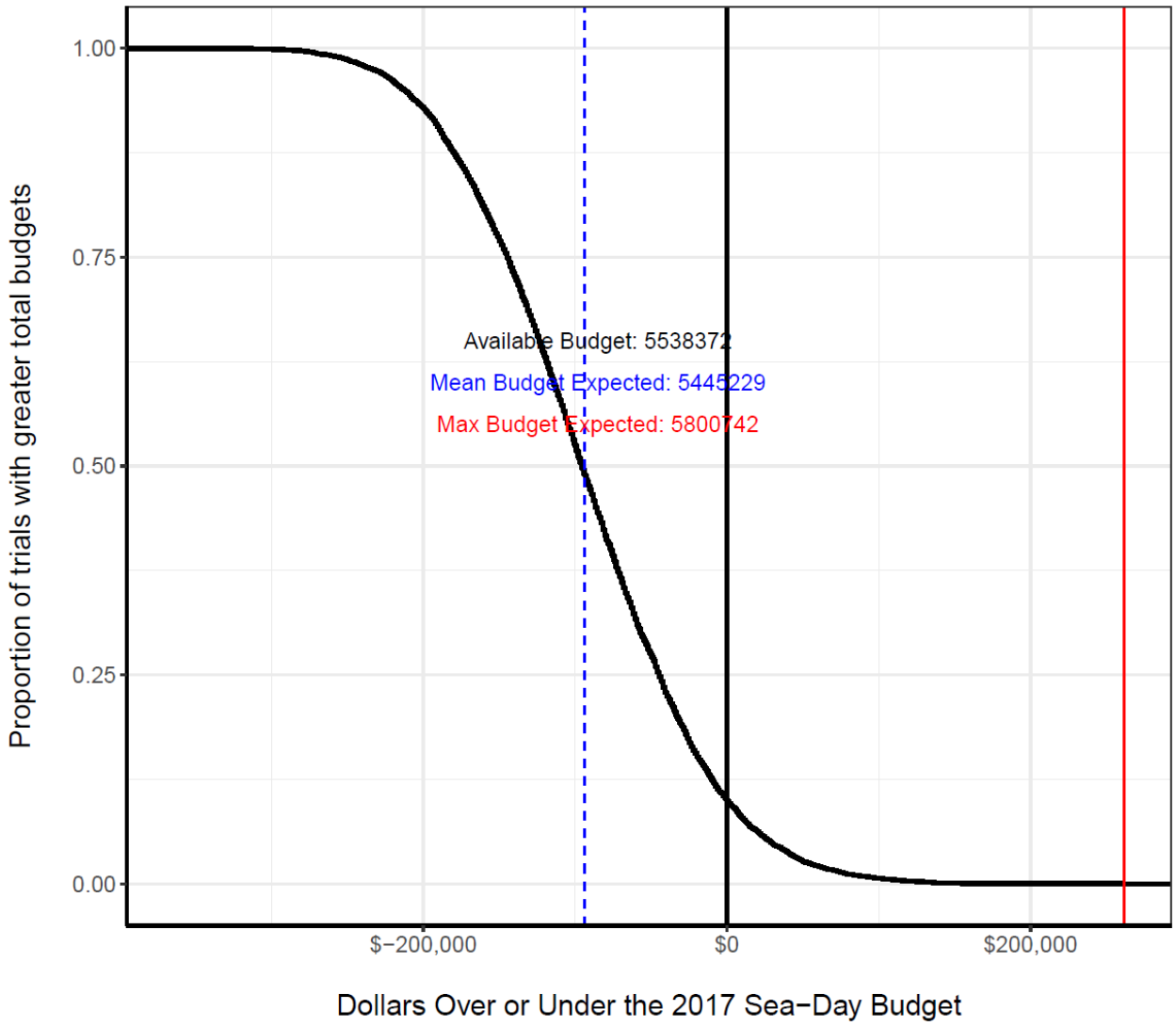

Figure B-3 The risk profile showing the proportion of 10,000 trials from the selected simulation increment with annual observer day budgets greater than and lower than the available budget. The mean outcome is depicted in the blue dashed line, the available budget is depicted by the black solid line, and the maximum outcome is depicted by the vertical red line to the right.

Appendix C. Comparison of optimized and 15% plus optimization allocation strategies

This appendix provides an updated comparison of the Optimized and 15% plus optimization allocation strategies showing the number of trips in the stratum (N_h), the optimal sample weighting (W_{hopt}), predicted observed trips (n_h) and observer coverage rates.

This comparison uses the updated list of vessels in the EM selection pool and revised fishing effort for 2018 (as described in Appendix B). Values between the optimized and 15% + optimized designs within this table are directly comparable.

Stratum (h)	Metric	N_h	W_{hopt}	n_h	Rate
Optimized					
TRW	Discards w/ halibut PSC	3320	0.588	622	18.73
HAL	Discards w/ halibut PSC	1831	0.348	368	20.10
POT	Discards w/ halibut PSC	327	0.030	32	9.79
Tender_TRW	Discards w/ halibut PSC	90	0.028	30	33.33
Tender_POT	Discards w/ halibut PSC	23	0.006	6	26.09
15% + Optimized					
TRW	Combined: discards w/ halibut PSC + Chinook PSC	3320	0.782	670	20.18
HAL	Combined: discards w/ halibut PSC + Chinook PSC	1831	0.190	316	17.26
POT	Combined: discards w/ halibut PSC + Chinook PSC	327	0.017	53	16.21
Tender_TRW	Combined: discards w/ halibut PSC + Chinook PSC	90	0.008	15	16.67
Tender_POT	Combined: discards w/ halibut PSC + Chinook PSC	23	0.002	4	17.39

Appendix D. Determination of the EM stratum participants for 2018

Introduction

On August 8, 2017, NMFS published a final rule to integrate electronic monitoring (EM) into the North Pacific Observer Program (82 FR 36991). For the first time, EM will be incorporated into the at-sea deployment design in 2018 and will be used to collect data to account for retained and discarded catch for fixed-gear vessels. To be considered for EM, a vessel must have requested to participate using the Observer Declare and Deploy System (ODDS) by November 1, 2017.

Since EM and human observer funds are limited, the amount of coverage that can be afforded must be determined. Two methods have emerged in recent ADPs as the result of NMFS and Council input. In the first method, the deployment rate is determined from the maximum number of observed trips that can be afforded given available funds. In the second method, the maximum number of vessels that can be included in the program is determined given a fixed deployment rate. In the draft and final ADP for 2018, human observer coverage is determined using the first strategy, while EM coverage is determined by the second strategy.

In June 2017, the Council supported expanding EM participation to 165 vessels in 2018 (Appendix A). If funding was insufficient to achieve this goal, then the Council recommended prioritizing deployment in the EM pool as follows: 1) longline vessels, whose data will be used for in-season management; 2) vessels that are already equipped with EM systems; and 3) vessels 40-57.5 feet length overall where carrying a human observer is problematic due to bunk space or life raft limitations.

In the draft 2018 ADP, NMFS estimated that a maximum number of 110 vessels could be included in EM selection pool in 2018 given available funding and a 30% EM review rate (NMFS 2017a). This value represented a "best-case" scenario since it was made under the assumption that all vessels that had participated in prior EM trials and were pre-wired would also participate in EM during 2018, and pre-wired vessels were assumed to be less expensive to deploy EM than new vessels. However it was noted that external funding sources, such as those from the National Fish and Wildlife Foundation would likely become available to supplement NMFS support of EM deployment in 2018.

The final ADP necessitates the calculation of anticipated budgetary expenditures to compare with available funds for EM. Such calculations are necessary to determine the amount of additional funding (either federal or external funds) that would be required to allow all vessels to participate in EM or to estimate savings. This appendix conducts these calculations.

Methods

A dataset developed by the staff of the Sustainable Fisheries Division of the Alaska Regional Office (AKRO) and the Fisheries Monitoring Division (FMA) of the Alaska Fisheries Science Center was used to calculate past fishing effort by EM requesting vessels in this analysis. Briefly, these data consist of species-specific catch amounts, fishing dates, locations, catch disposition, observation status, and associated ADP strata from 1 January 2013 to 19 November,

2017. Data from 2013 were excluded from this analysis since the method used to define tendering fishing trips was improved in 2014 to incorporate methods such as "geo-fencing".

Fishing histories of all EM requesting vessels were tabulated by gear type and year. The draft ADP outlined that vessel that uses trawl gear within the year are not eligible to participate in the EM selection pool for 2018 (NMFS 2017a). Therefore, any vessel that had used trawl gear from 1 January 2016 to 11 November 2017 was excluded from consideration for EM in 2018. The remaining EM requesting vessels were considered EM eligible.

Vessels were categorized as belonging to four categories based on their fishing history: pre-wired, new hook-and-line, new mixed gear (a combination of hook-and-line and pot gear histories), and new pot gear. Vessels were then placed into an ordered list by increasing length overall in each of these categories.

Prior cost information from the 2017 and 2018 EM provider Archipelago Marine Research, Inc. was used to generate a model to estimate the cost of running an EM program of various sizes as a function of the number of new EM vessels and total number of vessels. Details on the source data and the construction of this model can be found in (NMFS 2017b). This model was constructed under the assumption that 75 pre-wired vessels would be present within the total EM fleet in 2018. This assumption was evaluated against the number of pre-wired eligible EM vessels, and the model was adjusted by first multiplying the difference in the number of pre-wired EM eligible vessels and 75 by the cost of a pre-wired vessel from the model and the adding this to prior model outputs.

An estimate of the cost to review each sampled EM trip were also obtained following NMFS (2017b). Following guidance from the Council's Electronic Monitoring Workgroup and the Council (Appendix A), the sample selection rate for EM review was set at 0.3 or 30%.

The cost of monitoring the 2018 EM eligible vessels was obtained through a combination of model estimates related to the number of new vessels and total program size, and iterative sampling following the methods detailed in NMFS (2017b) with one exception. In that analysis the number of new vessels was also estimated through iterative sampling whereas in this analysis the vessels participating in the EM program are known. Briefly, the methods for each iteration are summarized into the following steps: step 1 - a number of vessels corresponding to the iteration number is drawn from the ordered list of EM eligible vessels and the associated trips for that vessel are obtained; step 2 - the trips are randomly sampled at 30% and the cost of an EM review day is multiplied by the sum of days in the sample and this process is repeated 100 times; step 3 - the cost of running an EM monitoring program is obtained from the cost model for the number of pre-wired and new vessels in step 1 for the model fit (the 50th percentile) and the 90% confidence bounds (i.e. the 5th and 95th percentiles); step 4 - costs from steps 2 and 3 are combined. At the completion of step 5 the iteration number is increased by one and steps 1-5 are repeated until the entire list of EM eligible vessels is evaluated. At this point, the results of this exercise were compared to the available funds estimated for EM deployment in 2018. EM funds for 2018 are the combination of federal funding ($1,000,000) and anticipated funding from external sources such as the U.S. National Fish and Wildlife Foundation.

Results

A total of 145 vessels requested EM for 2018. Of these, 141 were considered EM eligible and of these, 72 were pre-wired. Since the number of pre-wired vessels was very close to the number estimated in NMFS (2017b), the impact of cost adjustments to the model were minor (Figure D-1).

The result of cost estimates is presented in Figure D-2. The impacts of model uncertainty and sampling uncertainty can be seen from this figure. The Low (5th percentile), middle (model fit, 50th percentile) and high estimates (90th percentile) costs of EM programs appear as clearly separated bands as the number of vessels included is increased. The fact that the distribution of costs associated with trip sampling (depicted as colored 'hills' in Figure D-2) do not cross these bands is evidence that model uncertainly exceeds sampling uncertainly. Better estimates of EM program costs should be explored in the future.

The results of Figure D-2 illustrate that even high estimates of program costs should not exceed $1,573,769. The total budget for EM in 2018 was estimated in excess of $2,000,000. From this **it is concluded that all 141 eligible vessels may be afforded and considered as participants in the EM stratum for 2018.**

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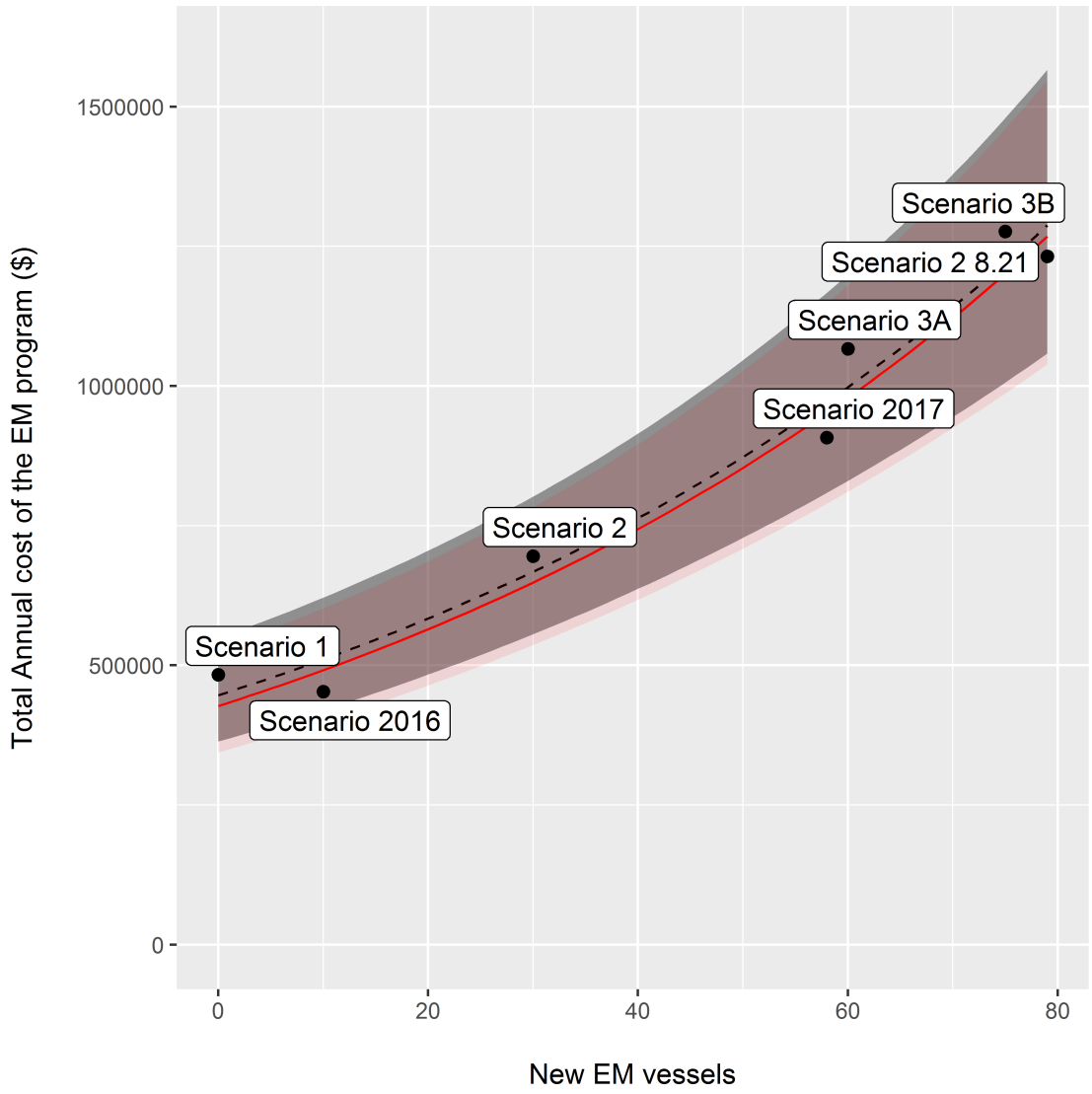

Figure D-1. Cost model from NMFS (2017b) depicting the cost of an EM program and the number of new EM vessel before (gray bands and black line) and after adjustment for the actual number of pre-wired EM vessels (red bands, red line). Scenarios refer to cost estimates from NMFS (2017b).

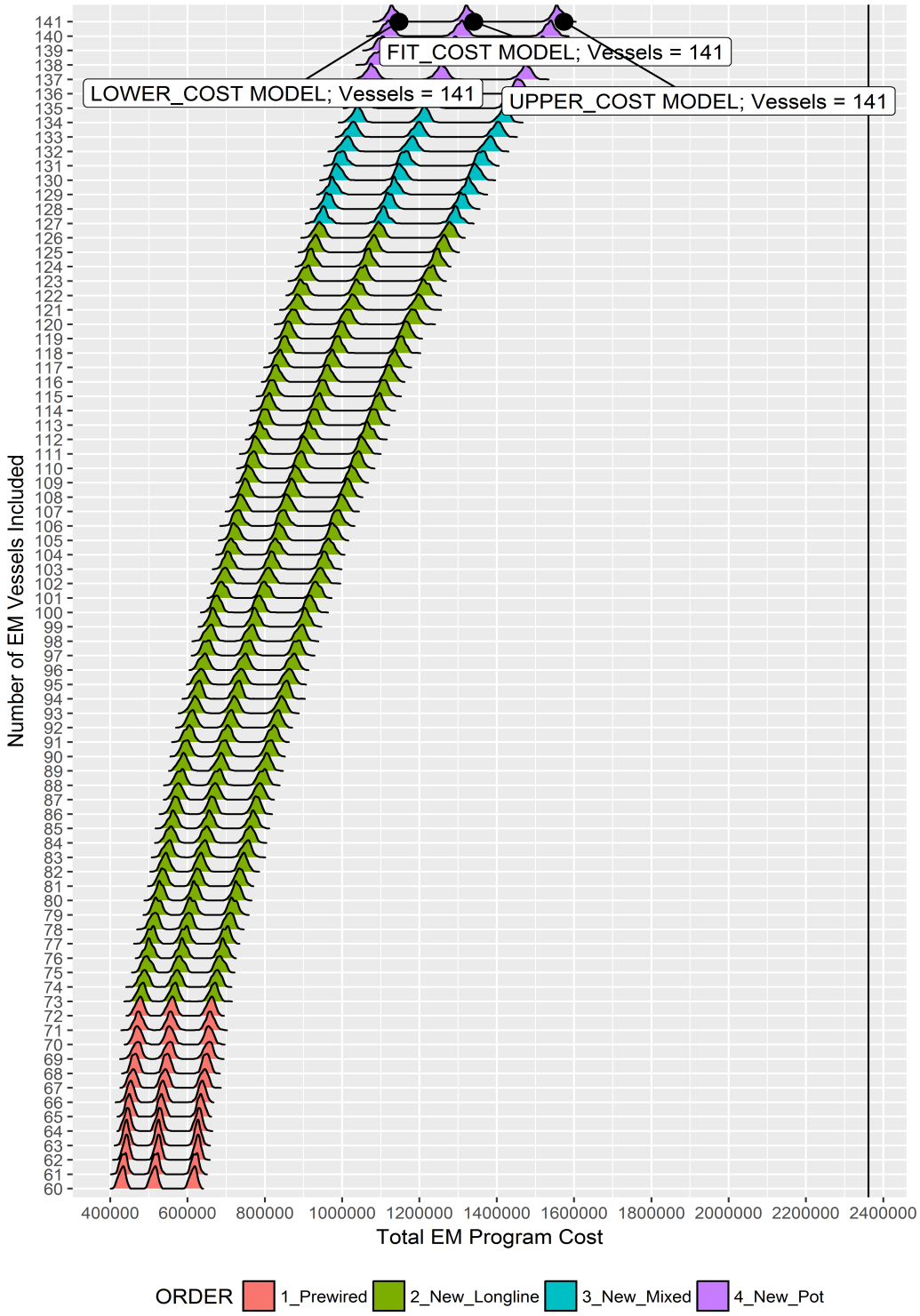

Figure D-2. Cost of monitoring EM vessels for programs of various sizes. Low, medium, and high model estimates of EM program costs are depicted as three bands and variation due to the cost of EM review are depicted as colored hills for EM programs of various sizes. The available funding is depicted as the solid vertical line.

Appendix E. Electronic Monitoring Innovation Research in 2018

Introduction

In 2018, the Observer Program at Alaska Fisheries Science Center will continue research and development of innovative electronic monitoring (EM) technologies. This research supports NMFS policy encouraging the development of electronic technologies for fishery dependent data collection to complement or improve existing data collection programs. The objective is to develop an intelligent monitoring system (IMS) that incorporates machine-learning applications that automate the count, measurement and identification of fish. Machine learning is a type of artificial intelligence (AI) similar to facial recognition and the intent of this research is to have AI functionality embedded on the system running in real time creating an "intelligent" monitoring system. Ideally, video would not necessarily have to be transferred, reviewed, and stored because an onboard application will complete the processing of both sensor and image data. An IMS that could automate data collection in real time would reduce time lags and costs associated with current monitoring and post processing methods. The overall goal of the project is to help address challenges for collecting scientific data to support bycatch estimation while reducing monitoring costs.

Deployment in 2018

EM research in 2018 will build upon previous work (Goang et al. 2017; Huang et al. 2017; Huang et al. 2016; Wallace et al. 2015; Chuang et al. 2013,) on non-camera (sensor) and camera-based (image) systems while leveraging machine vision methods.

The 2018 EM research deployment plan will be:

- Deployment of Stereo vision IMS on 2 fishing vessels (Middleton and Kariel).
- Deployment of an EM Lite system on 1 fishing vessel (Defender).
- Deployment of an IMS that includes a Chute on 4-8 trawl vessels that will be fishing under a halibut deck sorting EFP and also potentially a fishing vessels and/or a NMFS survey vessel.
- Planning is also underway to deploy IMS on 2-3 International Pacific Halibut Commission (IPHC) survey vessels. A 'special project request' is currently under review by IPHC and will likely be dependent on which vessels get contracted for the survey and whether or not there is space for another sea sampler.

The image data collected in 2018 will be used to develop machine learning algorithms to develop automated assessment of image quality, catch count, length measurement and species identification for both longline or pot gear applications. Specific research objectives in 2018 include:

- Stereo Vision IMS
    - Improve catch event detection reliability
    - Improve length measurement reliability and accuracy
    - Test wheel house monitor for real time image quality and system health checks
    - Continue to build in image library training dataset for species identification

  - Evaluate image based real time sensing of haul-back (this approach will improve ease and cost of installation since we will not longer have to install hydraulic/drum sensors)
- EM Lite
  - Test a system that is designed to collect only sensor data (hydraulic pressure and RFID tags) to determine effort (number of hauls) and fishing area.
- Chute IMS
  - Improve length measurement reliability and accuracy
  - Test wheel house monitor for real time image quality and system health checks
  - Continue to build in image library training dataset for species identification
  - Potentially deploy chute on fishing vessel to validate Saltwater species count and length
  - Potentially deploy belt system on a NMFS survey vessels to collect training dataset for species ID and Length measurement

Collaboration with the vessel crew is an important element of this project and we are grateful for their participation. Feedback from vessel operators will be used to improve system design for ease of use, ease of installation, and improve image quality.

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