2020 Annual Deployment Plan for Observers and Electronic Monitoring in the Groundfish and Halibut Fisheries off Alaska

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Contents

Executive Summary

This 2020 Annual Deployment Plan (ADP) documents how the National Marine Fisheries Service (NMFS) intends to assign fishery observers and electronic monitoring (EM) to vessels fishing in the partial observer coverage in the North Pacific during the calendar year 2020.

Sampling 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; and 3) the allocation of deployment trips among strata.

- **Selection method:**
  - Trip selection will be the sole method of assigning both observers and EM to at-sea fishing events for vessels in the partial observer coverage category in 2020. Trip selection is facilitated through vessels logging their trips into ODDS and being notified by the system if the trip is selected for coverage.
  - In 2020, NMFS will continue to implement EM trip-selection where trips are randomly selected prior to departure and the vessel is be required to use the EM system for each selected trips. NMFS will continue to evaluate the monitoring effect in the EM selection pool through the Annual Report process and, in the future, the agency may recommend that EM systems are used for all trips and there is post-selection of trips that are reviewed.

- **Selection pools:**
  - *No-selection pool*: As in previous deployment plans, the no-selection pool will be composed of: 1) fixed-gear vessels less than 40 ft LOA and vessels fishing with jig gear, which includes handline, jig, troll, and dinglebar troll gear; 2) vessels voluntarily participating in EM innovation and research.
  - *EM trip-selection pool:*
    - Vessels fishing with non-trawl gear may submit a request before November 1, 2019, to opt into or out of the EM selection pool. Any vessel that did not request to participate by this deadline is not be eligible for the 2020 EM selection pool and will be in the observer trip-selection pool for the duration of the year.
    - The size of the EM pool in 2020 is based on funds available. At the time of finalizing this ADP, the known budget for EM is $1M, which will maintain the existing EM selection pool, plus about $30K in remaining NFWF funds, which will equip 3 additional vessels.
    - NMFS has approved 169 vessels for the EM selection pool for 2020. Of these, 165 vessels were in the EM pool previously. Sixteen new vessels requested to be in the EM pool in 2020. Of these, 3 new vessels were selected using a prioritized list based on: vessel size, fishing effort, minimizing data gaps, and cost efficiency. An additional new vessel was allowed in with an EM system taken off an opted out vessel with the same owner.
    - Additional funding has been requested through the NFWF grant process that could support the Council's recommendation to expand the EM selection pool further. However, at the time of this final ADP, NFWF has not announced their

awards. Until the outcome of NFWF funding process is known, NMFS cannot approve the 12 additional vessels that requested to be in the EM pool.

- *Observer trip-selection pool*: in 2020, the following sampling strata for the deployment of observers:
  - Hook-and-line vessels greater than or equal to 40 ft LOA,
  - Pot vessels greater than or equal to 40 ft LOA, and
  - Trawl vessels making a trip not covered by the EM EFP, including all trips using non-pelagic gear.
- *Trawl Electronic Monitoring Trip-Selection Pool*: NMFS is reviewing an Exempted Fishing Permit (EFP) application that proposes to evaluate the efficacy of EM on pollock catcher vessels using pelagic trawl gear in the Bering Sea and Gulf of Alaska. The goal for EM would be compliance monitoring and the accounting for the vessel's catch and bycatch would be done via eLandings reports and shoreside plant observers. If NMFS approves the EFP application and fishing occurs in 2020, then vessels will be placed in the trawl EM trip-selection pool and carry EM systems in lieu of observers. The specific requirements for vessels in the trawl EM trip-selection pool will be determined through the permit approval process.

- **Allocation Strategy:** NMFS will implement an observer deployment allocation strategy of 15% plus optimization based on discarded groundfish and halibut PSC, and Chinook 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.

Deployment rates

- The budget for observer deployment in 2020 is $3.66M. NMFS estimates 2,513 observer days can be deployed in 2020 and expects that 536 trips will be observed in the partial coverage category.
- The deployment rates (rounded to the nearest whole number) for strata in 2020 are—
  - No Selection – 0%
  - Trawl – 20%
  - Hook-and-line – 15%
  - Pot – 15%
  - Fixed-Gear EM – 30%
  - Trawl EM EFP–100% at-sea EM; plus: 30% shoreside monitoring in GOA or 100% shoreside monitoring in BS

Chinook Salmon Sampling

- NMFS will continue to collect genetic samples from salmon caught as bycatch in groundfish fisheries to support efforts to identify stock of origin.
- If the Trawl EM EFP is approved for 2020, then the sampling protocol for Chinook salmon for the vessels participating in the EFP will be determined by NMFS in concert with the EFP applicants. The EFP application outlines the use of EM on both tender and non-tender trips to enable shoreside observers to conduct offload monitoring at shoreside processing facilities.
- For vessels that are not participating in the EFP and deliver 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 outside of the trawl EFP and delivered to tender vessels and the 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.

Introduction

Purpose and Authority

This 2020 Annual Deployment Plan (ADP) describes how the National Marine Fisheries Service (NMFS) intends to assign at-sea and shoreside fishery observers and electronic monitoring (EM) to vessels and processing plants engaged in halibut and groundfish fishing operations in the North Pacific. NMFS developed this plan 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). Details on the integration of EM deployment into the ADP process are found in the final rule to integrate electronic monitoring into the North Pacific Observer Program (82 FR 36991).

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 and EM contributes to the best available scientific information used to manage the fisheries in the North Pacific. Information collected by observers and EM provides a reliable and verifiable method for NMFS to gain information on total catch, including fishery discard and bycatch. Managers use these data to manage groundfish catch and bycatch limits established in regulation. Observers also collect biological samples such as species composition, weights, and tissue samples, and data concerning seabird and marine mammal interactions with fisheries. Managers use data collected by observers to inform the development of management measures that minimize bycatch and reduce fishery interactions with protected resources. Scientists also use these 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.

Process and Schedule

On an annual basis, NMFS develops an ADP to describe how the agency will deploy observers and EM in 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 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 2020 ADP is as follows:

- **June 2019:** NMFS presented the 2018 Annual Report (AFSC and AKRO 2019) to the Council and the public. The Annual Report process informs the Council and the public about how well various aspects of the program are working. The review highlights 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. The 2018 Annual Report provided a comprehensive evaluation of Observer Program performance including costs, sampling levels, issues, and potential changes for the 2020 ADP.

- **September 2019:** Based on information and analyses from the 2018 Annual Report and Council recommendations, NMFS prepared and released a draft 2020 ADP containing recommendations for deployment methods in the partial coverage category.

- **September – October 2019:**
    - *Review of the draft ADP*: The Council and its Scientific and Statistical Committee will reviewed the draft 2020 ADP and any associated Plan Team and Fishery Monitoring Advisory Committee recommendations. Based on input from its advisory bodies and the public, the Council provided recommendations for the final 2020 ADP (Appendix A). NMFS reviewed and considered these recommendations; however, extensive analysis and

large-scale revisions to the draft 2020 ADP are not feasible. This constraint is due to the short time available to finalize the 2020 ADP prior to the December 2019 Council meeting, and practical limitations on planning for deployment (including modifying a federal contract with the observer provider) and associated processes that need to be in place by January 1, 2020.
    - *Requests to participate in EM selection pool*: The deadline for vessels in the partial coverage category using fixed to request to be in the 2019 EM selection was November 1, 2019.

- **December 2019:** NMFS finalizes and releases the 2020 ADP to the public during the Council meeting.

The analysis and evaluation of the data collected by observers and the ADP development is an ongoing process; in June 2020, NMFS will present the 2019 Annual Report that will form the basis for the 2020 ADP.

Annual Report Summary

As described in the previous section, NMFS releases an annual report in June of each year that evaluates observer and EM deployment relative to the sampling plan described in the ADP. The annual report 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. Ganz et al. 2018). NMFS has released six annual reports starting with the 2013 Annual Report (NMFS 2014), which was presented to the Council in June 2014, and most recently the 2018 Annual Report (AFSC and AKRO 2019), which was presented to the Council in June 2019. This draft 2020 ADP builds on NMFS recommendations in the annual reports and input from the Council (Appendix A).

There were 11 at-sea 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.

Coverage rates met expected values in the full coverage and five of the eight partial coverage strata. Rates were higher than expected in the tender trawl stratum 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 of finishing the remaining trips from 2018.

NMFS recommended 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. However, NMFS recommendation that the draft 2020 ADP include a re-examination of tendering strata (tender pot and tender trawl). In 2018, observers were deployed using a 15% baseline plus optimization based on discarded groundfish, Pacific

halibut PSC, and Chinook salmon PSC. NMFS recommended continuing using the same method to allocate observer deployment in 2020. 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.

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 GOA. NMFS supported 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. For vessels not participating in the trawl EM Exempted Fishing Permit in 2020, NMFS recommended maintaining the status quo for dockside monitoring.

2020 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.

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 will be the sole method of assigning both observers and EM to at-sea fishing events in 2020. 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. In addition to logging each of their trips, vessels in the EM selection pool will also use ODDS to close each trip following the instructions in their Vessel Monitoring Plan (VMP).

In 2020, NMFS will implement EM trip-selection where trips are randomly selected prior to departure and the vessel is be required to use the EM system for each selected trips. NMFS will continue to

evaluate the monitoring effect in the EM selection pool through the Annual Report process and, in the future, the agency may recommend that EM systems are used for all trips and there is post-selection of trips that are reviewed.

Selection Pools (Stratification Scheme)

The division of the population of partial coverage trips into selection pools, or strata, is the stratification scheme. Each year, the ADP defines the deployment strata and how vessels are assigned to specific partial coverage selection pools.

Electronic Monitoring (EM) Selection Pool:

Vessels in the partial coverage category using fixed gear had the opportunity to request to be in the 2020 EM selection pool using ODDS. Any vessel in the EM selection pool in 2019 remains eligible to be in the EM selection pool unless a request is submitted to leave the EM selection pool, NMFS has disapproved the vessel's VMP, or if vessel operator has repeat problems with EM system reliability or video quality or has failed to comply with the requirements in their VMP. All the requests to be in or out of the EM selection pool for 2020 must have be received by November 1, 2019. Any vessel that did not request to participate by this deadline will not be eligible for placement in the 2020 EM selection pool and will be in the partial coverage trip selection pool for observer coverage.

The size of the EM pool in 2020 is based on funds available. At the time of finalizing this ADP, the known budget for EM is $1M, which will maintain the existing EM selection pool, plus about $30K in remaining NFWF funds, which will equip 3 additional vessels.

NMFS has approved 169 vessels for the EM selection pool for 2020. Of these, 165 vessels were in the EM pool previously. Sixteen new vessels requested to be in the EM pool in 2020. Of these, 3 new vessels were selected using a prioritized list based on: vessel size, fishing effort, minimizing data gaps, and cost efficiency. An additional new vessel was allowed in with an EM system taken off an opted out vessel with the same owner.

Additional funding has been requested through the NFWF grant process that could support the Council's recommendation to expand the EM selection pool further. However, at the time of this final ADP, NFWF has not announced their awards. Until the outcome of NFWF funding process is known, NMFS cannot approve the 12 additional vessels that requested to be in the EM pool.

Vessel owner/operators receive notification of NMFS approval of their placement in the EM pool by logging into ODDS. Once approved, that vessel will remain in the EM selection pool for the duration of the calendar year. Each year, all the vessels in the EM selection pool— including those there were previously in the pool —are required to submit and follow an NMFS-approved Vessel Monitoring Plan[1].

EM system installations will be scheduled in the primary ports of Sitka, Homer, Kodiak, and 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

[1] The 2020 VMP template is available at: https://alaskafisheries.noaa.gov/fisheries/electronic-monitoring

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.

Trip-Selection Pools for Observer Deployment:
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.

The draft ADP (NMFS 2019) provided an evaluation of the tendering strata (tender pot and tender trawl) and showed that the implementation of tender strata did not substantially change the expected rates of coverage. Additionally, optimization weightings for tender strata are lower than optimization weightings for non-tendered strata, which means that combining tendered and non-tendered trips into one stratum is unlikely to result in a decline in the number of observed tendered trips. Furthermore, if the trawl EM EFP project is implemented in 2020 it is likely to substantially decrease the number of tender trips in the observer trip-selection pool. NMFS will not implement tender-based strata in 2020 and there will be three observer trip selection strata defined only by gear: 1) Trawl; 2) Hook-and-Line; and 3) Pot.

Trawl Electronic Monitoring Trip-Selection Pool:
NMFS is reviewing an Exempted Fishing Permit (EFP) application that proposes to evaluate the efficacy of EM on pollock catcher vessels using pelagic trawl gear in the Bering Sea and Gulf of Alaska[2]. Industry is seeking NFWF funding to support the project that is anticipated to support approximately 49 catcher vessels and 9 tender vessels. The goal for EM would be compliance monitoring and the accounting for the vessel's catch and bycatch would be done via eLandings reports and shoreside plant observers. If NMFS approves the EFP application and fishing occurs in 2020, then vessels will be placed in the trawl EM trip-selection pool and carry EM systems in lieu of observers. The specific requirements for vessels in the trawl EM trip-selection pool will be determined through the permit approval process.

Summary of 2020 Deployment Strata:
The following deployment 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 2020:

- ***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 2019 fishing season. These vessels are:
    - fixed-gear vessels less than 40 ft LOA[3] and vessels fishing with jig gear, which includes handline, jig, troll, and dinglebar troll gear; and
    - four fixed-gear vessels voluntarily participating in EM innovation and research (Appendix D).
- ***Electronic monitoring (EM) trip-selection pool:*** NMFS has approved 169 fixed gear vessels in the EM selection pool in 2020. Once NMFS approves a vessel for the EM selection pool, that

[2] EFP application available at: https://www.fisheries.noaa.gov/alaska/resources-fishing/exempted-fishing-permits-alaska
[3] Length overall (LOA) is defined in regulations at 50 CFR 679.2 and means the centerline longitudinal distance, rounded to the nearest foot.

vessel will remain in the EM selection pool for the duration of the year. Prior to fishing, each vessel must have a NMFS-approved VMP.

- ***Observer Trip-Selection Pool:*** There are 3 sampling strata in the trip-selection pool for the deployment of observers:
    - ***Hook-and-line:*** This pool is composed of all 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 vessels in the partial coverage category that are greater than or equal to 40 ft LOA that are fishing pot gear.
    - ***Trawl***: This pool is composed of all vessels in the partial coverage category fishing trawl gear making a trip not covered by the EM EFP, including all trips using non-pelagic gear.
- ***Trawl EM trip-selection pool:*** If the EFP application is approved and fishing occurs in 2020, this pool would be composed on all vessels fishing under the EFP permit.

Allocation Strategy

Allocation strategy refers to the method of allocating deployment trips among strata. Starting in 2018, NMFS has implemented the observer allocation strategy of 15% hurdle plus optimization where observer sea days are first allocated equally up to a threshold coverage rate and the remaining sea-days are allocated using an optimal allocation algorithm that maximizes precision for chosen metrics (such as discards or retained catch) for the least cost.

The draft ADP and previous ADPs have provided more information on the hurdle approach and the methods used to evaluate the chances of data being available to inform inseason management under varying observer coverage levels (NMFS 2019; 2018a; 2018b). The draft 2019 ADP also provided an evaluation of hurdle thresholds to evaluate whether the 15% threshold would be appropriate for all gear-specific strata. The analysis showed that while 15% coverage would be sufficient to meet a 50% probability of observing three trips or more per year in most areas for the hook-and-line and trawl strata, it would not achieve this probability of observation in the other strata[4]. 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 areas. While it is possible to pool data across areas to produce bycatch estimates, these estimates suffer from lower resolution and variance estimates cannot be produced. The hurdle approach with 15% minimum level of sampling for all strata is precautionary with respect to avoiding bias and increasing the chance of getting data across all gear types and areas.

In 2020, NMFS will implement an observer deployment allocation strategy of 15% plus optimization based on discarded groundfish and halibut PSC, Chinook 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.

[4] Note that the 15% minimum threshold does not guarantee that all areas will have at least 3 observed trips. Instead, it represents the point at which many (<u>but not all</u>) areas have a greater than 50% chance of at least 3 observed trips in a year.

Estimated Deployment Rates

The trip selection rate for vessels in the EM selection pool is based on recommendations from the Council (Appendix A) and the selection rate will be 30% of trips in 2020.

To determine the deployment rates for the observer-deployment strata, NMFS uses the available sea-day budget and estimates of anticipated fishing effort. The budget is set with the goal of stabilizing observer coverage rates across years to avoid having very high coverage rates driven by high revenue years followed by low coverage rates in years with low revenue. For observer deployment in 2020, the budget was set at $3.66M, comprised of $2.86M from observer fees and $800K of NMFS supplementary funds.

The second piece of information used to determine deployment rates is an estimate of anticipated fishing effort. Fishing effort in 2019 was used to predict effort for 2020. However, at the time of completing the final 2020 ADP, fishing effort in 2019 was known through the end of October. To project effort for the remainder of the year, trends in the fishing effort in November and December from previous years were examined by stratum, Fishery Management Plan (FMP) area (GOA or BSAI), and target species (halibut, Pacific cod, pollock, or sablefish) (Appendix B). In addition, projected effort in the Pacific cod fishery in the GOA was adjusted to account for the most recent stock assessment (Barbeaux et al. 2019). After a population of trips was created for 2019, a simulation analysis was completed to estimate trip durations.

In order to predict the expected number of trips in the GOA pelagic trawl pollock fishery, NMFS assumed that trawl EM EFP project will occur in 2020. Vessels participating the EFP will have the ability on a trip-by-trip basis to "opt-out" of the EFP and remain in the observer trip selection pool. It was assumed that approximately 10 percent of the trips will opt out of the trawl EM EFP and be in the observer trip-selection pool.

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 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 2,513 observer days can be deployed in 2020 (Appendix B) and expects that 536 trips will be observed in the partial coverage category (Table 1). A net decrease in observer days is expected between 2019 (3,109 observer days expected; NMFS 2018) and 2020 (2,513 observer days expected; Table B- 2). This coincides with a decrease in the total number of partial-coverage trips in the observer pool from 3,652 expected in 2019 (NMFS 2018) to 3,182 expected in 2020 (Table 1). Drivers of these decreases include the anticipated implementation of the trawl EM EFP and the reduction in effort in the directed Pacific cod fishing in the GOA. The trawl EM EFP resulted in a significant change to deployment between 2019 and 2020. Trawl vessels targeting pollock in the GOA represent the single largest domain in terms of number of trips taken, so moving a portion of those trips into EM results in a

considerable increase in the proportion of trips covered by EM. This shift resulted in higher coverage rates for trips that remained in the partial-coverage observer pool compared to the rates that would have been possible with the same budget and no trawl EM EFP. However, because monitoring aboard trawl EM EFP vessels will be funded by external grants in 2020, additional costs would be expected if trawl EM were ever made part of the regulated program. Cost-efficiencies would then depend on the cost of monitoring trawl trips.

The deployment rates (rounded to the nearest whole number) for strata in 2020 are—

- No Selection – 0%
- Trawl – 20%
- Hook-and-line – 15%
- Pot – 15%
- Fixed-Gear EM – 30%
- Trawl EM EFP–100% at-sea EM; plus: 30% shoreside monitoring in GOA or 100% shoreside monitoring in BS

Table 1. Summary of total trips, allocation weights, deployment rates, and the number of trips expected to be observed in each observer-sampling stratum in 2020.

Stratum	Total Number of expected trips	Allocation Weight	Deployment Rate (%)	Number of trips expected to be observed
Trawl	1,108	0.78	19.59	217
Hook-and-line	1,602	0.19	15.40	247
Pot	472	0.03	15.23	72
Total	3,182	1		536

Chinook Salmon Sampling in the Gulf of Alaska

If the Trawl EM Exempted Fishing Permit (EFP) is approved for 2020, then the sampling protocol for Chinook salmon for the vessels participating in the EFP will be determined by the Alaska Fisheries Science Center's Fisheries Monitoring and Analysis Division in concert with the EFP applicants. The EFP application outlines the use of EM on both tender and non-tender trips to enable shoreside observers to conduct offload monitoring at shoreside processing facilities.

For vessels that do not participate in the EFP and deliver to shoreside processors in the in the GOA pollock fishery, the sampling protocol for Chinook salmon will remain unchanged from previous years. 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 (outside of the EFP) 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.

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. Eight catcher/processors requested, and NMFS approved, placement in the partial coverage category for the 2020 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, 2019 for the 2020 fishing year. NMFS published the list of 32 catcher vessels that have been approved to be in the full coverage category in 2020 on the website at: https://www.fisheries.noaa.gov/resource/document/bsai-trawl-catcher-vessels-cvs-full-coverage.

Observer Declare and Deploy System (ODDS)

For 2020, the user experience in ODDS will not change for a vessel operator unless they are operating in the trawl EM EFP. As in 2019, there will be a selection box to indicate whether the vessel will be delivering to a tender, however the response will not affect selection rates. 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 randomly selected for a third consecutive observer trip. Any observed trip that is canceled would automatically be inherited on the next logged trip. 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 the ODDS call center (1-855-747-6377). As NMFS has described in the previous three Annual Reports, there are improvements to the programming in ODDS that would allow vessels to change the dates for future observed trips, rather than having the current cancel and inherit process. This modification is a priority for NMFS and the Council, however due to limitations in staff resources, the programming changes to ODDS have not yet been evaluated.

Vessels Participating in Halibut Deck Sorting

On October 24, 2019, NMFS published a final rule to implement regulations allowing halibut to be sorted on deck of trawl catcher/processors in the non-Pollock fisheries off Alaska. Fishing under the new regulations will begin on January 20, 2020.

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[5] The form for small catcher/processors to request to be in partial coverage is available at: https://www.fisheries.noaa.gov/webdam/download/85047638

[6] Instructions for catcher vessels to request to be in full coverage using ODDS are available at: https://www.fisheries.noaa.gov/resource/document/bsai-trawl-catcher-vessel-annual-full-observer-coverage-request

Prior to this rule going into place, participating vessels conducted many years of fishing under an Exempted Fishing Permit (EFP) allowing the practice of deck-sorting halibut. The EFP permitted the vessels and NMFS to test different data collection methods and time limits for discarding. The final rule implementing this program under regulation is silent on the amount of time allowed for vessel crew to sort, and observers to discard, deck-sorted halibut, allowing NMFS to adjust sorting times in response to new information.

In 2020, NMFS will allow all vessels operating under these regulations 35 minutes to deck-sort and discard halibut. This uniform time allowance is compatible with the fact that there are no data to support vessel-specific deviations from the time limit established in the 2019 EFP.

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:

- Frequently Asked Questions related to Observer deployment are available at https://www.fisheries.noaa.gov/alaska/fisheries-observers/north-pacific-observer-vessel-plant-operator-faq
- Frequently asked Questions about Fixed Gear EM are available at: https://www.fisheries.noaa.gov/alaska/resources-fishing/frequent-questions-electronic-monitoring-em-small-fixed-gear-vessels
- For technical information and Frequently Asked Questions regarding ODDS go to https://chum.afsc.noaa.gov:7104/apex/f?p=140:101:::NO:::

NOAA Office of Law Enforcement (OLE) will continue outreach with industry to discuss any compliance concerns, especially as related to observer working conditions. There will also be an outreach event with observer providers in early 2020. NMFS Observer Program staff are also available for outreach meetings upon request by teleconference and/or video conferencing 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 Jennifer Ferdinand at 1-206-526-4076 or Jennifer.Ferdinand@noaa.gov.

References

Alaska Fisheries Science Center (AFSC) and Alaska Regional Office (AKRO). 2019. North Pacific Observer Program 2018 Annual Report. AFSC Processed Rep. 2019-04, 148 p. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115. Available at: https://www.afsc.noaa.gov/Publications/ProcRpt/PR2019-04.pdf

Ganz, P., S. Barbeaux, J. Cahalan, J. Gasper, S. Lowe, R. Webster, and C. Faunce. 2018. Deployment performance review of the 2017 North Pacific Groundfish and Halibut Observer Program. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-379, 77 p. Document available: https://www.afsc.noaa.gov/Publications/AFSC-TM/NOAA-TM-AFSC-379.pdf.

NMFS (National Marine Fisheries Service). 2019. Draft 2020 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Available at

https://www.fisheries.noaa.gov/resource/document/draft-2020-annual-deployment-plan-observers-and-electronic-monitoring-groundfish

NMFS. 2018a. 2019 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Available at https://www.fisheries.noaa.gov/resource/document/2019-annual-deployment-plan-observers-groundfish-and-halibut-fisheries-alaska

NMFS. 2018b. Draft 2019 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Available at https://www.fisheries.noaa.gov/resource/document/draft-2019-annual-deployment-plan-observers-groundfish-and-halibut-fisheries

NMFS. 2014. North Pacific Groundfish and Halibut Observer Program 2013 Annual Report. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Available at https://alaskafisheries.noaa.gov/sites/default/files/annualrpt2013.pdf.

NPFMC (North Pacific Fishery Management Council). 2011. Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis for Proposed Amendment 86 to the Fishery Management Plan for Groundfish of the Bering sea/Aleutian Islands Management Area and Amendment 76 to the Fishery Management Plan for Groundfish of the Gulf of Alaska: Restructuring the Program for Observer Procurement and Deployment in the North Pacific. March 2011. 239 p. plus appendices. Available at http://alaskafisheries.noaa.gov/analyses/observer/amd86_amd76_eariririfa0311.pdf.

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Appendix A. Council motions related to Annual Report and ADP

Agenda Item C3: Observer Program Annual Report & FMAC Report
June 7, 2019

1. The Council supports the NMFS recommendations listed in section 7.1 (pg. 92) of the 2018 Annual Report.

2. Based on input from the Fishery Monitoring Advisory Committee (FMAC), AP, and SSC the Council also recommends the following:

    - If external funds can be leveraged, expand the Electronic Monitoring (EM) selection pool in 2020 by 30 vessels and include testing of alternative EM systems and data service delivery models.
    - In the 2019 Annual Report (to be presented in June, 2020), the Council recommends that NMFS:
        - Continue to refine the cost metrics and funding information presented in Chapter 2 to better characterize costs and allow comparisons between observer and EM costs in the full and partial coverage categories.
        - Continue to include an evaluation of observer effects in pelagic and non-pelagic trawl within the trawl stratum.
        - Incorporate the analysis of observer statement incident rates (presented in Appendix D) in future reports.
    - NMFS work with the FMAC and industry prior to implementing potential future changes to the Observer Declare and Deploy System (ODDS).

3. Regarding the Observer Analytical Tasks, the Council supports the FMAC's recommendations to:

    - Remove the task "Observer Disembark Location" and take no further action on this item.
    - Prioritize the project to assess how biological information currently collected by observers is used in stock assessment.
    - Initiate a discussion paper to scope a shoreside sampling program, in conjunction with some minimal level of at-sea observer coverage, to complement Fixed Gear EM.

Agenda Item C3: Observer Program Annual Deployment Plan
October 5, 2019

The Council supports NMFS' recommendations for the three gear-based deployment strata and allocation scheme of 15% plus optimized allocation based on discarded groundfish and halibut PSC and Chinook PSC as described in the Draft 2020 Annual Deployment Plan (ADP).

The Council recommends that NMFS continue to evaluate coverage levels achieved on vessels delivering to tenders using EM and observers in the Annual Report.

The Council recommends that if additional funds become available that NMFS expand the EM trip selection pool with 30 additional vessels, using the order of priority as presented in the Draft 2020 ADP.

To the extent possible, consider expansion of the zero selection pool to include vessels unlikely to cause data gaps. A more robust assessment should be included in the 2019 annual report (provided to the Council in June 2020).

Agenda Item C3: Observer Recruitment and Retention
October 5, 2019

The Council continues to highlight the importance of finding solutions to observer recruitment and retention issues, and will continue to provide support for this priority issue whenever applicable.

Agenda Item C2: Observer Fee Analysis
October 5, 2019

The Council identifies cost efficiency as its highest priority for work on the partial coverage observer program. Immediate efforts should focus on:

- Pelagic trawl EM combined with shoreside sampling (Analytical tasks 14,16);
- Integrated monitoring plan for fixed gear that combines EM, shoreside sampling, and at-sea observer coverage as needed (e.g., consider whether the 15% hurdle is still the appropriate baseline level for observer coverage in combination with EM coverage; develop average weight protocols to support use of EM, Analytical tasks 18, 19);
- Optimizing the size and composition of the fixed gear observed and EM fleets, taking into account both cost priorities and data needs for average weights and biological samples (including consideration of expansion of the zero-coverage pool to include vessels fishing from remote ports harvesting small amounts of fish).

The Council requests that staff work with the agency to provide a detailed workplan with timelines for each priority.

Appendix B. Calculation of the Selection Rates for 2020

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 2020 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 electronically. There is also a telephone number that many fishermen use to log 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 strata for the purposes of observer or EM deployment, 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 for the upcoming calendar year.

Alternative deployment designs are evaluated in draft versions of the ADP. The draft 2020 ADP contained an evaluation of two alternative designs for the deployment of observers into the partial-coverage fleet (NMFS 2019). The draft 2020 ADP was slightly atypical in that, in addition to evaluating two alternative deployment designs, it also had to evaluate several scenarios regarding which vessels would be participating in EM in 2020. This was necessary due to the fact that funds for expanding fixed-gear EM were uncertain and the fact that the trawl EM EFP, if approved, would move a considerable number of vessels out of the partial-coverage observer trawl stratum and into a new partial-coverage trawl EM stratum. In total, two deployment designs, each with four EM scenarios, were evaluated in the draft 2020 ADP (NMFS 2019).

While the draft ADP is focused on comparing alternative designs, the final ADP is 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 2019 meeting regarding the Draft 2020 ADP.

Deployment design in 2020

Fixed-gear EM Coverage

The rules governing fixed-gear EM participation are specified in 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 2020 was instead guided by the EM Workgroup of the Council and is set at 0.3, or 30% of trips. In the draft 2020 ADP, coverage rates for observers were calculated under two different scenarios regarding the number of vessels participating in fixed-gear EM: 1) that participation would remain at the 2019 level of up to 168 vessels, or 2) that participation would expand by 30 vessels to a total of up to 198 vessels (NMFS 2019). In the present analysis, the NMFS calculated selection rates based on a fixed-gear EM pool of 169 vessels. This number resulted from 165 vessels that remained in the EM pool; one new vessel with an EM system taken that was taken off a different vessel with the same owner;. and three new vessels that were added using remaining grant funds from previous years. The three new vessels approved for fixed-gear EM were chosen based on vessel size and review of their past fishing activity to evaluate their potential to create cost efficiencies for the program and their effect on data gaps if moved into EM. Separately, four vessels continued to volunteer for participation in federally funded fixed-gear EM Research (Appendix D) and will be placed in zero selection.

Trawl EM Coverage

The draft 2020 ADP included two scenarios to account for the potential implementation of the trawl EM EFP that was put forward following a collaboration between industry and the agency. These trawl EM scenarios assumed that either 1) the trawl EM EFP would not be implemented, and thus the partial-coverage trawl fleet covered by observers would remain unchanged, or 2) the trawl EM EFP would be implemented, and the pelagic trawl activity targeting Pollock by the participating vessels would move out of the partial-coverage observer trawl stratum and into a new partial-coverage trawl EM stratum. In the present analysis, the NMFS calculated selection rates under the assumption that the trawl EM EFP would be implemented, thereby moving a subset of trips by vessels listed within the EM EFP out of the partial-coverage observer trawl stratum and into the new partial-coverage trawl EM stratum.

Observer coverage

As stated above, separate regulations govern which fishing activities are to be covered by EM. Separate regulations also govern which fishing activities receive mandatory full coverage. What remains is the fishing activity to be covered by partial-coverage fisheries observers. It is this portion of fishing activity for which selection rates are determined in the present analysis. The chosen sampling design contains three partial-coverage observer 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)

The sample allocation strategy in this design follows that recommended by NMFS in the draft 2020 ADP (NMFS 2019). The decision to combine tendered trips into the broader gear-based strata was reached after consideration of Appendix B in the draft 2020 ADP (NMFS 2019). Sample sizes in the present analysis 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

Data preparation

All analyses were performed using the R language for statistical computing (R Core Team 2019). 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 amounts, fishing dates, locations, catch disposition, observation status, and associated ADP strata from 1 January 2013 to 26 October, 2019.

As in past ADPs, trip data were altered to reflect the expected fishing under partial coverage in the upcoming year. These alterations included: (1) using ODDS data to more accurately model the duration that observers are assigned to selected fishing trips (Appendix C) (2) labeling fishing activity by four 'historical low volume' Catcher-Processors as belonging to the partial-coverage category, (3) labeling fishing by AFA eligible trawl vessels targeting Pacific cod in the BSAI as belonging to the full coverage fleet if they indicated this was their preferred coverage for this activity in 2020, and (4) removing vessels with no probability of selection from the analysis (i.e., all trips corresponding to hook and line and pot gear on vessels < 40' LOA, as well as vessels fishing jig gear). Vessels that volunteered to participate in electronic monitoring in 2020 are included in the present analysis with a pre-determined selection rate of 30%.

Estimation of fishing effort in 2020

To estimate fishing effort for the upcoming year, trends in cumulative effort were examined by stratum, Fishery Management Plan (FMP) area (GOA or BSAI), and target species (halibut, Pacific cod, Pollock, or sablefish). Although 2019 fishing effort is used to predict effort for 2020, at the time of completing the final 2020 ADP, only data through 26 October, 2019 is available. In order to project 2019 fishing effort to the end of the year, we used the average ratio of total effort to effort through 26 October from previous years, and projections were made for each gear type, FMP, and target species combination. For instance, to predict total effort for POT Pacific cod in the BSAI, the cumulative number of trips through 26 October, 2019 was multiplied by 1.27, since effort at the end of the year was, on average, 27% higher than effort through mid-October for that gear-type, FMP, and species combination during years 2013 through 2018. For POT sablefish in the GOA, only the average ratio between 2017 and 2018 was used to project 2019 effort, since effort in 2017 and 2018 was so starkly different from other years. For other groups, a ratio of 1 was applied, since those fisheries were finished before 26 October. Once effort was projected through 2019, that was used as the estimate of effort to occur in 2020. One notable adjustment was that effort targeting Pacific cod in the GOA was set to 0, given that the most recent assessment for that stock estimates the population at a level below the threshold necessary for directed fishing to occur (Barbeaux et al. 2019).

Once we had an expected number of trips for each gear type, FMP area, and species, we created a simulated population of trips for 2019. We did this by appending 2018 trips that occurred after October 26th to 2019 trips that occurred before or on October 26th. Once this simulated population of trips was

created for 2019, we sampled from it in order to create 5000 simulated trip populations for 2020. To do this, we drew with replacement the expected number of trips by each gear type, FMP area, and target species. The main purpose of creating simulated populations is to obtain trip durations. By creating 5000 simulated populations, we create multiple distributions of trip durations within each stratum. An additional component of simulating populations for the 2020 ADP was moving trips out of the TRW stratum and into the EM trawl stratum to be covered by the trawl EM EFP. Of the sampled GOA pelagic trawl Pollock trips by vessels listed in the EM EFP, 9 out of 10 were taken out of the observer trip selection pool under the assumption that approximately 10 percent of such trips will opt out of the EFP.

Determining deployment rates for 2020

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. It is important to note that, while effort was predicted by stratum, FMP area, and target species, observers are only deployed by stratum. The optimal sample allocation weightings for each stratum were recalculated using an updated 2016 - 2019 data set by following the methods detailed in the draft 2019 ADP for the preferred design (NMFS 2019). 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 '2020' 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. The total cost of the program was calculated using the cost of an observer day and the distribution of trip durations. Cost per day was estimated in order to most closely match costing by the partial-coverage contract. Estimates of cost per day took into account whether the day was a guaranteed day (up to 2000 days) or an optional day, and estimated travel costs from a linear model using monthly days purchased against travel cost invoices. Total cost was then compared to the total budget available for the year. A total of 5,000,000 trials were conducted: 1000 ODDS sampling iterations for each of the 5000 simulated populations. The steps taken to calculate selection rates are depicted as a diagram in Figure B- 1.

The available budgets for partial-coverage observer deployment and fixed-gear EM were set at $3,660,124 and $1,000,000, respectively (Table B- 1). These budgets are to cover an expected 422 vessels in the partial-coverage observer pool and an expected 141 vessels in the fixed-gear EM pool (Table B- 1). Although the fixed-gear EM pool contains *up to* 169 vessels, we only expect effort from 141 since that is the number of fixed-gear EM vessels with a history of effort in the past calendar year after excluding directed fishing for Pacific cod in the GOA.

The expected difference between the available budget and the expended cost is depicted as a risk-profile in Figure B- 2. The average and most likely sea-day expenditure for 2020 is expected to be $1,156 over budget with a 95% confidence interval of being between $269,694 under budget and $272,006 over budget. Due to the variation in the sampled predictions of fishing effort, some populations tended to result in total costs that were frequently above or below the budget. In such cases, the expected number of observed trips was adjusted up or down by 3 trips, and the resulting deployment rates were recalculated. The ODDS simulations (and additional adjustments, if necessary) were repeated (Figure B- 1) until approximately 50% of the iterations resulted in total costs that were below budget (Figure B- 2).

It is estimated that 536 trips totaling 2,513 days will be observed in 2020 (Table B- 2). These numbers cannot be directly compared to any scenarios evaluated in the draft 2020 ADP, since an EFP probability of 90% is assumed in the present analysis, compared to EFP probabilities of 50% and 100% assumed in the draft 2020 ADP (NMFS 2019). The EFP probability is the probability that Pollock trips taken by vessels in the trawl EM EFP will be monitored at sea instead of observed. Various EFP probabilities had to be considered since the trawl EM EFP allows for vessels to choose to be observed instead of monitored on a trip-by-trip basis. The draft 2020 ADP scenario most similar to the scenario and design evaluated in the present analysis is the scenario in which the trawl EM EFP is implemented with an EFP probability of 100%, the size of the fixed-gear EM fleet remains stable, and sampling is allocated using the 15% plus optimization design. In the draft 2020 ADP, that combination of scenario and design resulted in estimates of 701 observed trips, 2,867 observed days, and deployment rates that were all within 1% of the deployment rates calculated in this analysis (Table B- 2).

Discussion

A net decrease in observer days is expected between 2019 (3,109 observer days expected; NMFS 2018) and 2020 (2,513 observer days expected; Table B- 2). This coincides with a decrease in the total number of partial-coverage trips in the observer pool from 3,652 expected in 2019 (NMFS 2018) to 3,182 expected in 2020 (Table B-2). Drivers of these decreases include the anticipated implementation of the trawl EM EFP and the closure of directed Pacific cod fishing in the GOA. Deployment rates in 2020 for the partial-coverage observer pool are expected to clear the 15% minimum hurdle and be slightly lower than 2019 deployment rates, due in part to a more conservative budget.

The trawl EM EFP resulted in a significant change to deployment between 2019 and 2020. Trawl vessels targeting Pollock in the GOA represent the single largest domain in terms of number of trips taken, so moving a portion of those trips into EM results in a considerable increase in the proportion of trips covered by EM. This shift resulted in higher coverage rates for trips that remained in the partial-coverage observer pool compared to the rates that would have been possible with the same budget and no trawl EM EFP. However, because monitoring aboard trawl EM EFP vessels will be funded by external grants in 2020, additional costs would be expected if trawl EM were ever made part of the regulated program. Cost-efficiencies would then depend on the cost of monitoring trawl trips.

Literature Cited

Barbeaux, S. Aydin, K., Fissel, B., Holsman, K., Laurel, B., Palsson, W., Rogers, L., Shotwell, K. Yang, Q., and Zador, S. 2019. Assessment of the Pacific cod stock in the Gulf of Alaska. Available online at: https://www.afsc.noaa.gov/refm/stocks/plan_team/2019/GOApcod.pdf.

Cochran, W. G. 1977. Sampling Techniques (Third Edition), New York, NY: John Wiley & Sons.

NMFS (National Marine Fisheries Service). 2019. *Draft* 2020 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. Available online at: https://www.fisheries.noaa.gov/resource/document/draft-2020-annual-deployment-plan-observers-and-electronic-monitoring-groundfish.

NMFS. 2018. 2019 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska

99802. Available online at: https://www.fisheries.noaa.gov/resource/document/2019-annual-deployment-plan-observers-groundfish-and-halibut-fisheries-alaska.

R Core Team. 2019. R: A language and environment for statistical computing (Version 3.6.1). R Foundation for Statistical Computing, Vienna, Austria. https://www.R-project.org/.

Table B- 1. Differences in budgets and vessel participation the draft 2020 ADP and this analysis. Funding is listed for sectors that are funded through the observer fee and NMFS funds. The number of vessels participating is defined as vessels in partial-coverage (not including zero coverage) in the last complete year. For the draft ADP, the number of vessels was based on 2018. For this analysis, the number of vessels is based on a 2020 proxy year.

	Draft 2020 ADP	Final 2020 ADP
Total anticipated funding ($)		
Observer	4,150,000	3,660,124
Fixed-gear EM	1,000,000	1,000,000
Trawl EM	Funded by external grants	Funded by external grants
Vessels participating (partial-coverage)		
Observer	447	422
Fixed-gear EM	153	141
Trawl EM	34	33

Table B- 2. Comparison of the predicted number of trips in a stratum (N_h), the optimal sample weighting (W_{hopt}), predicted observed or monitored trips (n_h), days (d_h), and coverage rates (r_h) resulting from the deployment sampling design described in the text.

Stratum (*h*)	N_h	W_h	n_h	d_h	r_h (%)
Draft 2020 ADP					
HAL	1,819	0.29	332	1,594	16.12
POT	629	0.02	102	454	15.17
TRW	1,270	0.70	267	819	19.46
Total	3,718	1.00	701	2,867	18.85
Final 2020 ADP					
HAL	1,602	0.19	247	1,498	15.40
POT	472	0.03	72	348	15.23
TRW	1,108	0.78	217	667	19.59
Total Observer Strata	3,182	1.00	536	2,513	16.84
EM HAL	806	-	242	1,204	30.00
EM POT	113	-	34	159	30.00
Total Fixed-gear EM Strata	919		276	1,363	30.00
EM TRW GOA	496	-	149	401	30.00
Zero Coverage	1,964	-	0	0	0.00
Full	2,939	-	2,939	15,601	100.00
Full – EM TRW BS*	450	-	450	961	100.00
Total Full Coverage	3,389	-	3,389	16,562	100.00

Figure B- 1. Process diagram for the analyses contained in this appendix. Green boxes indicate inputs and blue boxes indicate iterative and random processes.

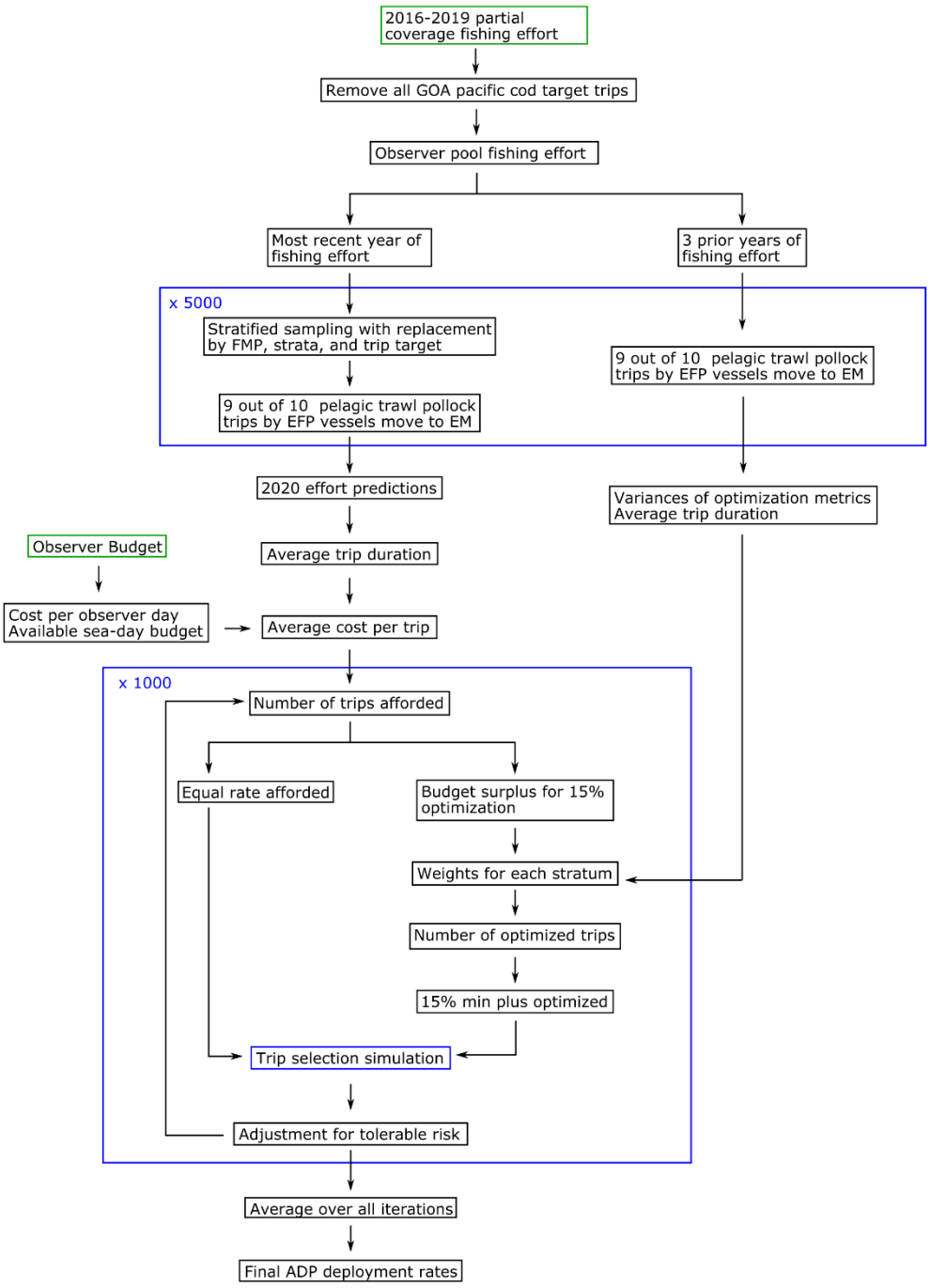
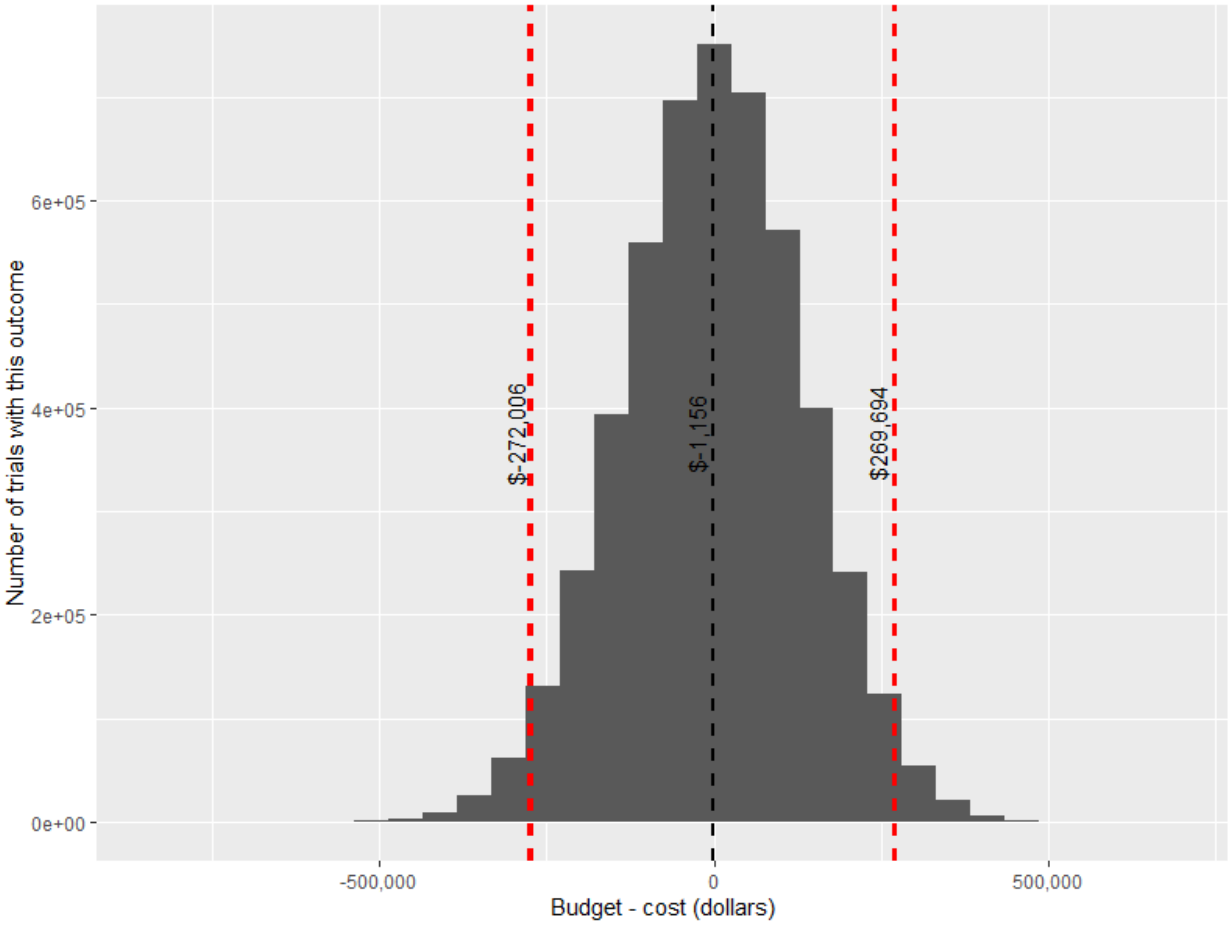


Figure B- 2. Summary of 5 million outcomes of simulated sampling showing the total cost of the program expected for 2020 subtracted from the available budget. Vertical lines depict the mean difference (dashed black line) and 95% confidence limits (dashed red lines).



Appendix C. Evaluation of Trip Duration

Introduction

Estimates of afforded observer deployment rates within the partial coverage program rely on reliable estimates of the duration that an observer will be assigned to observe a selected trip. In prior versions of the ADP, observed trip durations were estimated as the number of days between a fishing trip's start and end date. Additionally, trips in the trawl pollock fishery had an additional day to account for the costs of monitoring associated offloads for salmon bycatch and genetic tissue collection. However, observer assignments are currently counted by the half-day, and any bias in the estimates of trip durations may result in under- or overestimation of afforded deployment rates and/or influence optimization weights. Actual observer assignment durations in ODDS were compared with the trip start and end dates of the same fishing trips for years 2016-2019 to validate the current methods of estimating observed trip durations and to determine if model-based estimates may provide more accurate and/or less biased estimates.

Methods and Results

The current methods for estimating observed trip duration overestimated yearly totals of observed days by 1.8% to 6.6% (Table C- 1). Pelagic gear trip durations were overestimated, but those for hook-and-line, and non-pelagic gear types were underestimated (Table C- 2). Additionally, there was a high degree of inter-annual variability in estimates for pot gear, which underestimated trip duration by an average of 0.386 days in 2016, but overestimated by 0.719 days in 2019 (Table C-2). Altogether, these biases would result in an underestimation of the total number of trips that may be afforded to be observed, and the general overestimation of trawl gear trip duration (and therefore cost) would result in underestimated optimization weights for the stratum.

A linear model was built to try to account for the variability between gear types, fishing years, and tender status:

DAYS ~ RAW + GEAR*ADP + RAW* GEAR *TENDER

where 'DAYS' is the estimated number of observed days for a given trip, 'RAW' is the difference in a trip's start and end date in days, 'GEAR' is the trip's gear type (i.e. hook-and-line, pot, non-pelagic trawl or pelagic trawl) and 'TENDER' indicates whether the trip tendered or not. The interaction terms account for inter-annual variability differentially between gear types and variability in tender activity between gear types while also accounting for differences in shorter versus longer trips. Model estimates were rounded to the nearest half day. Yearly totals of observed days based on model estimates were less biased, ranging from only –0.16% to –0.78% (Table C- 1) and gear/year-specific biases were all lesser as well (Table C- 2, Figure C- 1). Residuals, which are the differences between what the model predicts and what was actually observed, are evenly distributed and unbiased (Figure C- 2). Some model-based estimates for several gear/year combinations had slightly higher variability in deviations from actual observed trip durations, but the majority had lesser variances than those generated using the current method.

In summary, model-based estimates of observed trip duration showed lesser bias and variability than those resulting from the current method. Additionally, the model-based approach provides higher-resolution estimates (by half-day) and accounts for variability between fishing years, gear type, and

tender status. The model will be applied to all observer-pool partial coverage trips within the dataset informing the ADP (2016-2019) and should improve estimates of strata weightings and afforded deployment rates.

Figure C- 1. Biases and variances of the current and modeled methods for estimating observed trip duration (in days) by year and gear type, relative to actual observer assignment durations in ODDS. Metrics that were improved by the model relative to the current method are highlighted in blue and metrics that worsened are highlighted in orange.

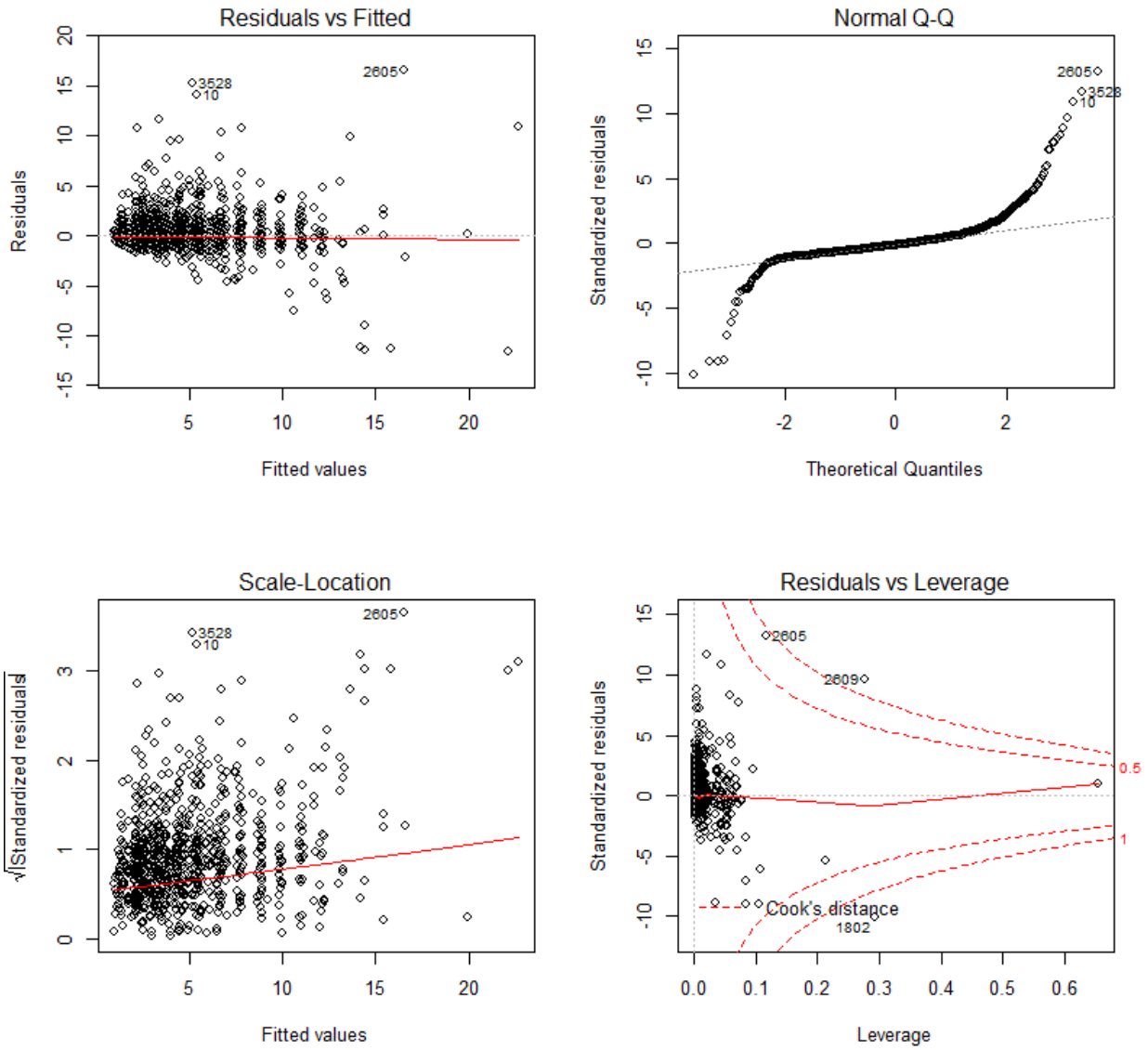


Figure C- 2. Regression diagnostic plots for model-based estimates of observed trip duration.

Table C- 1. Totals of observed days by fishing year. Percent differences of estimates versus actuals are also displayed.

Year	Actual	Current	Model	Current (% difference)	Model (% difference)
2016	4652.0	4799.0	4615.5	3.16	-0.78
2017	2742.5	2924.0	2723.5	6.62	-0.69
2018	3151.0	3208.0	3136.5	1.81	-0.46
2019	3113.0	3173.5	3108.0	1.95	-0.16

Table C- 2. Totals of observed days by fishing year and gear type. Percent differences of estimates versus actuals are also displayed.

Year	Gear	Actual	Current	Model	Current (% difference)	Model (% difference)
2016	HAL	2124.5	1926.0	2124.5	-9.34	0.00
2016	POT	685.0	621.0	685.5	-9.34	0.07
2016	PTR	1208.5	1633.0	1172.5	35.13	-2.98
2016	NPT	634.0	619.0	633.0	-2.37	-0.16
2017	HAL	1375.0	1221.0	1382.5	-11.20	0.55
2017	POT	267.5	294.0	265.0	9.91	-0.93
2017	PTR	768.0	1104.0	749.0	43.75	-2.47
2017	NPT	332.0	305.0	327.0	-8.13	-1.51
2018	HAL	1532.5	1420.0	1528.0	-7.34	-0.29
2018	POT	514.0	482.0	514.0	-6.23	0.00
2018	PTR	800.0	1019.0	789.0	27.38	-1.38
2018	NPT	304.5	287.0	305.5	-5.75	0.33
2019	HAL	1518.5	1360.0	1528.5	-10.44	0.66
2019	POT	391.5	449.0	393.5	14.69	0.51
2019	PTR	752.5	933.5	735.5	24.05	-2.26
2019	NPT	450.5	431.0	450.5	-4.31	0.00

Appendix D. Electronic Monitoring Innovation Research in 2020

Introduction

In 2020, the Fisheries Monitoring and Analysis Division of the Alaska Fisheries Science Center (AFSC) will continue research and development of innovative electronic monitoring (EM) technologies. This research supports NOAA Fisheries policy encouraging the development of electronic technologies for fishery dependent data collection to complement or improve existing data collection programs. The overall objective is to develop machine vision systems that automate the count, measurement and identification of fish at the source of data collection. Ideally, video/imagery would not necessarily have to be transferred, reviewed, and stored because an onboard application will complete the processing of both sensor and image data into species enumeration and lengths. This type of system would reduce time lags and costs associated with current EM systems and post processing methods. The overall goal of the project is to help address challenges for collecting scientific data remotely to better support bycatch estimation and ecosystem based fisheries monitoring while reducing monitoring costs.

Deployment in 2020

EM innovation research in 2020 will build upon previous work by improving system reliability and machine learning algorithms to provide greater accuracy for length estimation and species identification. Four vessels will participate in EM research and will be in zero coverage: the F/V's *Middleton*, *Kariel*, *Predator* and *Defender*.

The 2020 EM research deployment plan will be:

- Deployment of EM stereo cameras on 3 of the volunteering fishing vessels (F/V *Middleton*, *Kariel*, and *Predator*)
- Deployment of EM stereo cameras on AFSC sablefish survey
- Deployment of an EM Lite system (no cameras) on 1 volunteering fishing vessel (F/V *Defender*)
- Deployment of camera chute system on 2-3 trawl vessels that will be fishing and doing halibut deck sorting
- Potential deployments of stereo-camera chute system on a NMFS survey vessel
- The following additional video collection systems may be deployed as time, funding, and industry cooperation allow:
    - IP cameras monitoring shoreside pollock deliveries at a range of plants
    - trawler deck and net video
    - IP cameras monitoring onboard processor catch handling

The image data collected in 2020 will be used to improve the current suite of machine learning algorithms for automated assessment of image quality, catch count, length measurement, and species identification for longline, trawl, plant, or pot gear applications.

Specific 2020 EM laboratory research objectives include:

- <u>EM using stereo rail cameras and standard IP cameras</u>
    - Improve catch event detection reliability
    - Improve length measurement reliability and accuracy

- Test wheelhouse monitor for real-time image quality and system health checks
- Incorporate satellite communications to automate system health checks in real time
- Continue to build an image library training dataset for species identification
- Evaluate image-based, real-time sensing of haul retrieval - this approach would improve ease and cost of installation since we would no longer have to install hydraulic/drum sensors
- Improve/develop algorithms to detect the presence and locations of crew on deck from standard IP camera images, in order to indicate events to monitor more directly
- Improve/develop algorithms to accurately collect lengths from halibut on a sorting table using standard IP camera images

- 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
  - Integrate satellite communications to automate delivery of haul information and system health.

- Camera chute systems
  - Improve length measurement reliability and accuracy
  - Develop procedures, software, and hardware to summarize results from the halibut measurement chutes and transmit them for management use
  - Develop algorithms to segment, track, and identify individual fish passing through chutes (or conveyors) when many are present simultaneously
  - Improve camera chutes based on standard IP cameras (rather than stereo cameras) for durability, accuracy, and ease-of-use

- Integration with Observers
  - Improve/develop machine learning to distinguish between Blackspotted and Rougheye Rockfish
  - Begin development of phone/tablet application that will eventually be deployed with observers to aid in species identification
  - Integration of observer-collected species images into the image libraries

- Develop automated image system to monitor offloads for PSC
  - Continue to develop/improve automated processing of video of catches entering plants to detect passing salmon
  - Improve adaptation of camera chute technology to distinguish Chinook salmon from other species
  - Deployments in 2020 will test these automated tools in Kodiak plants to monitor the effectiveness of plant sorting and reporting processes

Continuing Research

Our team continues to widen our exploration of applications for automated video analyses to assess catches in other close-packed conveyor belt situations, which are very common in onboard and shoreside fish-handling situations. The ability to detect particular species (especially salmon, crab, and halibut) could be very useful for bycatch monitoring. Development of general tools with such detection capabilities should also have significant applications in other regions and nations. In 2020, additional video, annotated to locate target species, will be provided to our partners with the Information

Processing Lab (IPL) at the University of Washington's Electrical and Computer Engineering Department for further detector and species identifier development.

Acknowledgements

Collaboration with vessel crews 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 to improve image quality. This project would not be possible without collaboration with the University of Washington's Electrical and Computer Engineering Department.

Publications resulting from EM innovation project research

G. Wang, J. N. Hwang, C. Rose, and F. Wallace, "Uncertainty Based Active Learning via Sparse Modeling for Image Classification" IEEE 20th International Workshop (in press). IEEE, 2018.

T,. Huang, J.N. Hwang, Fellow, IEEE, S. Romain, and F. Wallace, 2019. Fish Tracking and Segmentation from Stereo Videos on the Wild Sea Surface for Electronic Monitoring of Rail Fishing. In Circuits and Systems for Video Technology, IEEE Transactions on, pp. 3146-3158. IEEE, 2019.

G. Wang, J. N. Hwang, C. Rose, and F. Wallace, 2017. "Uncertainty sampling based active learning with diversity constraint by sparse selection," In Multimedia Signal Processing (MMSP), IEEE 19th International Workshop on (pp. 1-6). IEEE, 2017.

T. Huang, J.N. Hwang, J., S. Romain and F. Wallace. 2016. Live Tracking of Rail-Based Fish Catching on Wild Sea Surface. In Computer Vision for Analysis of Underwater Imagery (CVAUI), 2016 ICPR 2nd Workshop on, pp. 25-30. IEEE, 2016.

W. Goang, J.N. Hwang, K. Williams, F. Wallace, and C. Rose, 2017. Shrinking Encoding with Two-Level Codebook Learning for Fine-Grained Fish Recognition. In Computer Vision for Analysis of Underwater Imagery (CVAUI), 2016 ICPR 2nd Workshop on, pp. 31-36. IEEE, 2016.

F., Wallace, K. Williams, R. Towler, and K. McGauley. 2015. Innovative Camera Applications for Electronic Monitoring. In: G.H. Kruse, H.C. An, J. DiCosimo, C.A. Eischens, G.S. Gislason, D.N. McBride, C.S. Rose, and C.E. Siddon (eds.), Fisheries Bycatch: Global Issues and Creative Solutions. Alaska Sea Grant, University of Alaska Fairbanks. http://doi.org/10.4027/fbgics.2015.06