2024 Annual Deployment Plan for Observers and Electronic Monitoring in the Groundfish and Halibut Fisheries off Alaska

November 2023

Fisheries Monitoring and Analysis Division, Alaska Fisheries Science Center
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115

National Marine Fisheries Service, Alaska Regional Office
P.O. Box 21668
709 W. 9th Street
Juneau, Alaska 99802

Accessibility of this Document: Every effort has been made to make this document accessible to individuals of all abilities and compliant with Section 508 of the Rehabilitation Act. The complexity of this document may make access difficult for some. If you encounter information that you cannot access or use, please email us at Alaska.webmaster@noaa.gov or call us at 907-586-7228 so that we may assist you.

Suggested Citation

NMFS (National Marine Fisheries Service). 2023. 2024 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 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 during the calendar year 2024.

The North Pacific Observer Program is the largest observer program in the country and is responsible for monitoring a fleet of nearly a thousand vessels that fish a combination of hook-and-line, pot, and trawl gear across the Alaska Exclusive Economic Zone (EEZ) area of roughly 3.77 M km^2. Fishing activities are classed as belonging to either partial or full coverage components of the program. In the full coverage component of the program, every trip is monitored by 1 or 2 observers and the vast majority of groundfish harvest is covered by this portion of the program. In 2024, NMFS expects to monitor 2,833 trips, consisting of an estimated 16,817 days, in the full coverage component of the program, and 1,006 trips and 5,025 days in the partial coverage component. The ADP mainly focuses on the partial coverage component of the program and outlines the science-driven method for deployment of observers and EM systems to support statistically reliable data collection. Specifically, the ADP describes the scientific deployment design and selection rate—the portion of trips that are sampled by observers and EM— for the partial coverage category.

Deployment Design

The deployment design for the partial coverage component of the program involves three elements: 1) the selection method to accomplish random sampling; 2) division of the population of partial coverage trips into selection groups or strata; and 3) the allocation of deployment among strata.

Selection method

In 2024, observers and EM will be deployed to vessels to monitor catch at-sea or to monitor shoreside deliveries using a random trip selection method. Trip-selection refers to the randomized method of selecting fishing trips which are the sampling unit. Under trip selection, vessel operators and owners log their trips into the Observer Deploy and Declare System (ODDS) and are notified if the trip is selected for coverage by either an observer or EM. In the Gulf of Alaska (GOA), Trawl EM offloads will be randomly selected for sampling by observers in shoreside processing facilities.

Sampling strata

Fishing trips are broadly divided into groups, or selection pools, defined by whether monitoring is required on either all trips or a subset of trips as well as whether the trips will be monitored by observers or EM. Selection pools may be further split into sampling strata, based on the FMP (BSAI, GOA) area, and a gear that combines Hook-and-line and pot gear (Fixed, Trawl). NMFS will implement 10 sampling strata in 2024.

Fixed Gear EM:

- Overall in 2024, the fixed gear EM stratum will include 177 vessels approved by NMFS. This includes 174 vessels that were previously approved by NMFS and 3 new vessels that requested to be added to the EM stratum and were approved by NMFS.
    - A total of 10 new vessels requested to be added to the EM stratum in 2024, and three were accepted. Each vessel was evaluated for cost-efficiency and the potential to cause

data gaps. The predominant reason for not accepting vessels into the EM stratum was a lack of fishing effort in prior years. Boats can request to opt-in again for 2025 and will be re-evaluated.
    - Four vessels which had participated in the EM strata in the past opted out in 2024.
    - One vessel has been removed from the EM stratum based on continued failure to adhere to their NMFS-approved VMP.
- Prior to fishing, all EM vessels are required to submit and follow a NMFS-approved Vessel Monitoring Plan (VMP) for each gear type used while in the EM strata.

Trawl EM EFP:

- The goal of the EFP is to use EM for compliance monitoring of catch under maximized retention definitions. Catch accounting for the vessel's catch and bycatch is done via eLandings reports and shoreside plant observers. Industry applied for National Fish and Wildlife Foundation (NFWF) funding to support the project that includes catcher vessels, tender vessels, and shoreside processors. In 2024, 108 catcher vessels are expected to participate in this pool.

Allocation Strategy:

- In 2024, the NMFS will implement the Proximity allocation method to deploy observers and EM. This method is precautionary with respect to obtaining data from all types of fishing activity (decreasing data gaps) while protecting against high variance associated with low sample sizes. The Proximity allocation method is designed to spread sampled trips throughout the fisheries to increase the proportion of trips that are sampled or near a sampled neighbor and to be consistent between strata within a specified budget, while also protecting against small sample sizes within a stratum. This allocation method applies to all sampled strata (i.e., does not apply to zero selection stratum) except the trawl EM stratum.
- For the Trawl EM strata in the GOA, NMFS will implement a sampling rate of EM deliveries by shoreside fishery observers of 33%. In the BSAI, all offloads from Trawl EM trips are to be sampled for salmon, halibut, and biological data.

Partial Coverage Selection Rates

The 2024 budget for EM and observer deployment in the partial coverage component of the program is $5.819M, which can maintain the fixed-gear EM program and funds at-sea monitoring by observers. The selection rates (rounded to the nearest whole number) for strata in 2024 are listed in Table 1.

Table 1. Summary of selection rates and the number of trips expected to be monitored by observers and/or EM in each sampling stratum in 2024.

Component	Pool	Stratum	Selection Rate (%)	Number of Trips Expected to be Observed
Partial Coverage	**Observer Trip Selection**	Fixed-gear BSAI	44	123
		Fixed-gear GOA	13	264
		Trawl BSAI	72	22
		Trawl GOA	21	82
	Fixed-Gear EM trip selection	Fixed-gear EM GOA	24	232
		Fixed-gear EM BSAI	74	43
	Trawl EM EFP	Trawl EM GOA	33% shoreside monitoring (plus 100% EM coverage at-sea)	241
	No selection	Zero Coverage	0	0
Full Coverage	**Observer Full Coverage**	Observer	100	1,172
	Trawl EM EFP	Trawl EM BSAI	100% shoreside monitoring (plus 100% EM coverage at-sea)	1,661

Dockside Monitoring

Observers will continue to collect genetic samples from salmon caught as bycatch in groundfish fisheries to support efforts to identify stock of origin. Dockside monitoring by observers occurs in the pollock fishery to enable complete enumeration of salmon and Pacific halibut bycatch and to conduct biological sampling from salmon and other species. For all trips in the Bering Sea Aleutian Islands (BSAI) trawl pollock fishery, a census of salmon will be completed during the offload. Offload monitoring for salmon, halibut, and biological data collections will also take place for vessels in the Trawl EM pool that deliver to either a tender or a shoreside processor. In the Gulf of Alaska (GOA), Trawl EM offloads will be randomly selected for sampling by observers in shoreside processing facilities. For vessels that do not participate in the Trawl EM pool and deliver to shoreside processors in the GOA pollock fishery, trips that are randomly selected for at-sea observer coverage will be completely monitored for Chinook salmon bycatch by the vessel observer during offload of the catch at the shoreside processing facility.

Introduction

Purpose and Authority

This 2024 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. This plan is developed under the authority of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) (16 U.S.C. 1862), 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. The ADP outlines the science-driven method for deployment of observers and EM systems to support statistically reliable data collection. The ADP is a core element in implementation of section 313 of the Magnuson-Stevens Act, which authorizes the North Pacific Fishery Management Council (Council) to prepare a fishery research plan in consultation with NMFS.

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 ADP follows the process envisioned by the Council and NFMS when the restructured observer program was developed and implemented. As a result, both the ADP development and the evaluation of data collected by observers and EM is an ongoing process. 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.

More 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). Further details on the integration of EM deployment into the ADP process are found in the final rule to integrate EM into the Observer Program (82 FR 36991).

North Pacific Groundfish and Halibut Observer Program

NMFS implements the Council's fishery research plan through the North Pacific Groundfish and Halibut Observer Program (Observer Program). The Observer Program provides the regulatory framework and support infrastructure for stationing observers and EM systems to collect data necessary for the conservation, management, and scientific understanding of the commercial groundfish and

Pacific halibut fisheries of the BSAI and GOA management areas. EM is broadly defined as technological tools which collect fishing data to support stock assessment and fishery management. In the North Pacific, EM is usually more specifically referencing video imagery and sensors to provide catch and discard information and compliance monitoring after video review.

The Observer Program is the largest observer program in the country and is responsible for monitoring a fleet of nearly a thousand vessels that fish a combination of hook-and-line, pot, and trawl gear across the Alaska Exclusive Economic Zone (EEZ) area of roughly 3.77 M km^2. The deployment of monitoring assets (observers and/or EM) is the first stage of a hierarchical sampling design (Cahalan and Faunce 2020). Since 2013, the trip has been the primary sampling unit. Fishing trips made by vessels are assigned to either full and partial coverage.

In full coverage, every trip is monitored by 1 or 2 observers if monitoring is completed at sea, or by an EM system at sea and an observer at the processing plant receiving the trip's catch. For full coverage trips, vessel and processing plant owners/operators are responsible for procuring observer and EM hardware services directly through NMFS-authorized companies. There are currently three NMFS-permitted observer service provider companies and two NMFS-approved EM hardware companies.

For partial coverage trips, vessel owners/operators declare each trip in a NMFS database and if the trip is selected for coverage, a NMFS-contracted observer provider company arranges for coverage. Funding for partial coverage is obtained from an ex-vessel fee on landings from the prior year and is used by NMFS to pay for observer and EM services. In the partial coverage component, the ADP specifies the scientific sampling design and the selection rate—the portion of trips that are sampled. NMFS and the Council recognized that selection rates in partial coverage, for any given year, would be dependent on available revenue generated from fees on groundfish and halibut landings. The annual apportionment of the budgets for observer deployment and EM system deployment is also reflected in the ADP process. The ADP process allows NMFS to adjust deployment in each year so that sampling can be achieved within financial constraints. While fisher participation in observer monitoring is automatic, if a vessel wishes to participate in at-sea EM they must volunteer, be approved by NMFS, and follow a vessel monitoring plan. Cost efficiency of an EM vessel may change over time, but hardware infrastructure cannot be easily or cheaply modified to respond to different fishing effort patterns. As a result of these different rules of participation, NMFS evaluates each vessel volunteering for EM for cost efficiency, minimization of data gaps, and vessel size (as a proxy for ability to carry an observer) prior to accepting them into the EM strata.

Observer Program Data Collection

Data collection through the Observer Program 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. These data contribute to the best available scientific information used to manage the fisheries in the North Pacific. The design of the holistic monitoring program that meets mandates of the Magnuson-Stevens Act, Marine Mammal Protection Act (MMPA), and Endangered Species Act (ESA) ensures that multiple monitoring programs are not required on the fleet. Observers and EM systems provide fishery-dependent information that is used to estimate total catch and interactions with protected species. Managers use these data to manage groundfish and prohibited species catch within established limits and to document and quantify fishery interactions with protected species. 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. Scientists also use fishery-dependent data to assess fish stocks, evaluate marine mammal and seabird interactions with fishing gear, characterize fishing impacts on habitat, and provide data for fisheries and ecosystem research and fishing fleet behavior. While both observers and EM systems provide fishery-dependent data, these monitoring methods provide different information on catch and interactions with protected species. Table 2 summarizes the broad suite of data collection through the different monitoring approaches under the Observer Program.

ADP Process

On an annual basis, NMFS develops an ADP to explain 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 this ADP / Annual Report process to provide flexibility in the deployment of monitoring assets used to gather reliable data for estimation of catch in the groundfish and halibut fisheries off Alaska.

The Annual Report is presented to the Council in June each year and 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.

A draft ADP that outlines sampling for the upcoming year is prepared in October each year and a final ADP is completed in December. The ADP allows for partial coverage strata definitions, participation requirements, allocation methods, and selection rates to change each year. Strata help define how trips will be monitored (for example which vessels belong to observer or EM selection pools and the requirements necessary to participate in each) and may be based on factors such as gear type, vessel length, home or landing port, availability of EM systems, funding, and monitoring goals. Since 2013, aspects of deployment have been adjusted through the ADP (e.g., NMFS 2022; AFSC and AKR 2022). The modifications have included moving types of partial coverage trips between selection pools or strata, varying the selection unit from vessel to trip, and changes in selection rates used to deploy observers and EM in the partial coverage category.

The flexibility offered by the ADP allows NMFS and the Council to achieve transparency, accountability, and efficiency from the Observer Program to meet its myriad objectives. 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 Observer Program is accountable to operate within annual financial constraints that are dependent on the amount of fee revenue collected from groundfish and halibut landings in the prior year and the anticipated future costs of monitoring and fishing effort.

Cost Efficiencies Analysis

At the October 2019 Council meeting, the Council recommended an increase in the observer fee percentage from 1.25 percent to 1.65 percent for the Partial Coverage Observer Program and dovetailed that recommendation with continued development of mechanisms to improve cost efficiency in the program as its highest priority moving forward. Specifically, the Council requested work to focus on:

- Pelagic trawl EM combined with shoreside sampling;

- 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 the use of EM);
- 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).

In January 2020, the Council's Partial Coverage Fishery Monitoring Advisory Committee (PCFMAC) reviewed a cost efficiencies work plan[1] that considered 6 potential options for improving cost efficiencies in the partial coverage program, including development of a pelagic trawl EM program.

Ongoing implementation of the pelagic trawl EM program has been addressed through an Exempted Fishing Permit (EFP)[2] to evaluate the efficacy of EM systems and shoreside observers. The trawl EM program is designed to use EM for compliance monitoring, meaning that EM video data does not directly feed into catch accounting or stock assessments. Instead, catch accounting uses industry-reported data (verified through EM) and data collected by shoreside observers. Maximized retention ensures that unsorted catch will be delivered and available to be sampled by shoreside observers, allowing for non-biased data to be collected at the trip level by shoreside observers at the processing plant. The project was a collaborative process among project partners that included NMFS staff, EFP permit holders, EM service providers, video reviewers, and observer providers. The Council's Trawl EM Committee also met multiple times to review progress and provide recommendations to the Council. In October 2022, the Council took Final Action to implement EM on pelagic trawl pollock catcher vessels and tenders delivering to shoreside processors in the Bering Sea and Gulf of Alaska. The intended timeline is to continue the EFP in 2024 and implement the regulatory program in 2025 to ensure there is no gap between the EFP and the regulated program.

In October 2023, NMFS presented the draft 2024 ADP (NMFS 2023) that included evaluation addressing the Council's priorities for improving cost efficiencies in the partial coverage program and outlined NMFS recommendations for the 2024 ADP that maintain a monitoring program that meets NMFS's data collection mandates. The overarching goal of the ADP is a fishery monitoring design that balances statistically rigorous data collection with minimizing the impacts on fishing operations while maximizing the amount of sampling conducted under a given budget. The total budget available for the partial coverage program is determined by the fee percentage and the resulting revenue from the fees that are collected. As such, the analysis in the draft 2024 ADP focused on the cost per unit of monitoring as opposed to dynamic total annual cost of the program and the intent is to collect the best and most data for a given budget.

The draft 2024 ADP evaluated the partial coverage category, including several stratification methods (ways to divide the sample population of trips into groups, or strata) and allocation approaches (how much to sample in each stratum). This integrated evaluation of data collection methods (observers and EM) incorporates the goal of spending the limited, available funding more efficiently such that the most

---

[1] https://meetings.npfmc.org/Meeting/Details/1224

[2] The EFP application, permits, and reports can be found under the heading "Electronic Monitoring - Trawl Catcher Vessels" on the NMFS website: https://www.fisheries.noaa.gov/alaska/resources-fishing/exempted-fishing-permits-alaska

coverage (both EM and observers) is achieved for a range of budgets. The analysis evaluated the trade-offs between different monitoring designs, including:

- Relative per unit cost efficiency of each design
- Statistical efficiency of each design
- Relative impact on data quality (e.g. timeliness, ability detect rare events)
- Relative scalability of each design

The Council reviewed the draft 2024 ADP and associated Plan Team and PCFMAC recommendations. Based on input from its advisory bodies and the public, the Council provided recommendations for the final 2024 ADP (Appendix A). Between October and November, NMFS incorporated this input, to the extent possible, finalized the 2024 budget, and estimated the anticipated fishing effort in order to develop this final ADP.

Table 2. Data types collected by at-sea observers, trawl EM with shoreside observers, and fixed gear EM. A green checkmark indicates that the data type is collected, a red x indicates that the data type is not collected, and blue arrows indicate that some aspects of the data type are collected.

Data Types Collected		At-sea Observers	Trawl EM + Shoreside Observers	Fixed Gear EM
Catch				
	Trip Characteristics (e.g. duration, total effort)	✔	✔	✔
	Haul Characteristics (e.g. location, effort, depth, gear performance)	✔	⇔	⇔
	Haul Level Species Composition - Counts	✔	✖	✔
	Haul Level Species Composition - Weights	✔	✖	✖
	Trip Level Species Composition - Counts	✔	✔	✔
	Trip Level Species Composition - Weights	✔	✔	✖
	Speciation of Similar Species (e.g. large red rockfish, king crabs)	✔	✔	✖
	Haul Specific Salmon PSC Enumeration	✔	✖	⇔
	Trip Specific Salmon PSC Enumeration	✔	✔	⇔
	USCG Marine Casualty Information	✔	⇔	⇔
Biologicals				
	Sex Length Data (fish and crab)	✔	✔	✖
	Pacific Halibut Size and Mortality Assessment	✔	✔	✖
	Trip Specific Age Structures (e.g. otoliths, scales, fin rays)	✔	✔	✖
	Trip Specific Tissue for Genetic Analyses	✔	✔	✖
	Tagged Organism Information	✔	✔	✖
	Stomach Samples (trophic interactions)	✔	⇔	✖
	Maturity Information	✔	⇔	✖
Protected Species				
	Marine Mammal Injury and Mortality	✔	⇔	⇔
	Marine Mammal Tissue (genetics, trophic information, contaminants)	✔	✖	✖
	Marine Mammal Interactions (non-lethal, non-injury)	✔	✖	⇔
	Marine Mammal Sightings	✔	✖	✖
	Verify Use of Seabird Avoidance Methods	✔	n/a	✔
	Seabird Mortality (catch by gear)	✔	✔	✔
	Seabird Mortality (vessel interactions)	✔	⇔	⇔
	ESA-Listed Seabird Carcass	✔	⇔	✖

2024 Deployment Methods

Selection Method

For 2024, NMFS will implement trip selection from all ports throughout Alaska as the method of assigning both observers and EM to at-sea fishing events for vessels in the partial observer coverage category. Trip-selection refers to the use of the fishing trip as the primary sampling unit, and is accomplished using the Observer Declare and Deploy System (ODDS; Faunce et al. 2021). In addition to logging each of their trips, vessels in the fixed-gear EM selection pools will also use ODDS to close each trip following the instructions in their Vessel Monitoring Plan (VMP). In the Gulf of Alaska (GOA), Trawl EM offloads will be randomly selected for sampling by observers in shoreside processing facilities.

Selection Pools and Stratification Scheme

Fishing trips are broadly divided into groups, or selection pools, defined by whether monitoring is required on either all trips or a subset of trips as well as whether the trips will be monitored by observers or EM. Selection pools may be further split into sampling strata, each with a specified monitoring rate. In 2024, NMFS will implement the following selection pools and strata:

<u>Full Coverage Pool (Selection rate = 100%)</u>
Vessels and processors in the full observer coverage category must comply with observer coverage requirements at all times when fish are harvested or processed. Specific requirements are defined in regulation at 50 CFR § 679.51(a) (2). The full coverage stratum includes the following:

- Catcher/processors (with limited exceptions).
- Motherships.
- Catcher vessels (CVs) participating in programs that have transferable prohibited species catch (PSC) allocations as part of a catch share program, which includes Bering Sea pollock (both American Fisheries Act and Community Development Quota (CDQ) programs), the groundfish CDQ fisheries (CDQ fisheries other than Pacific halibut and fixed-gear sablefish; only vessels greater than 46 ft LOA), and the Central GOA Rockfish Program.
- CVs using trawl gear that have requested placement in the full coverage category for all fishing activity in the BSAI for one year.
- Inshore processors receiving or processing Bering Sea pollock.

New Full coverage vessels in 2024: NMFS published a final rule (88 FR 53704, August 8, 2023) to implement the Pacific Cod Trawl Cooperative (PCTC) Program starting in January 2024. Catcher vessels harvesting PCTC quota are required to be in full observer coverage (except for CVs delivering unsorted codends to motherships, in which case, the mothership is in full coverage).

<u>No-selection pool (selection rate = 0%)</u>
The no-selection stratum is composed of vessels that will have no probability of carrying an observer on any trips for the 2024 fishing season. These vessels are:

- fixed-gear vessels less than 40 ft length overall, where length overall is defined in regulations at 50 CFR 679.2 and means the centerline longitudinal distance, rounded to the nearest foot; and
- vessels fishing with jig gear, which includes handline, jig, troll, and dinglebar troll gear.

Observer Trip-Selection Pool

There are 4 observer trip-selection strata based on gear and FMP area for 2024. Details on how selection rates were determined are provided in Appendix B.

- *Trawl gear in the GOA* (selection rate = 20.58%) – This stratum is composed of all trawl trips in the partial coverage category that are not in Trawl EM where the vessel declared in ODDS that they intend to harvest the majority of catch on the trip in the GOA.
- *Trawl gear in the BSAI* (selection rate = 72.28%) – This stratum is composed of all trawl trips in the partial coverage category that are not in Trawl EM where the vessel declared in ODDS that they intend to harvest the majority of catch on the trip in the BSAI.
- *Fixed-gear in the GOA* (selection rate = 13.17%) – This stratum is composed of trips in the partial coverage category on vessels that are greater than or equal to 40 ft LOA, fishing pot or hook-and-line gear, and where the vessel declared in ODDS that they intend to harvest the majority of catch on the trip in the GOA.
- *Fixed-gear in the BSAI* (selection rate = 43.97%) – This stratum is composed of trips in the partial coverage category on vessels that are greater than or equal to 40 ft LOA, fishing pot or hook-and-line gear, and where the vessel declared in ODDS that they intend to harvest the majority of catch on the trip in the BSAI.

Fixed-Gear EM Trip Selection Pool

The fixed-gear EM selection pool consists of two sampling strata:

- *Fixed-gear EM in the GOA* (selection rate = 24.20%) – This stratum is composed of vessels in the fixed-gear EM selection pool, fishing pot or hook-and-line gear, where the vessel declared in ODDS that they intend to harvest the majority of catch on the trip in the GOA.
- *Fixed-gear EM in the BSAI* (selection rate = 74.29%) – This stratum is composed of vessels in the fixed-gear EM selection pool, fishing pot or hook-and-line gear, where the vessel declared in ODDS that they intend to harvest the majority of catch on the trip in the BSAI.

Vessel owner/operators receive notification of NMFS approval of their placement in the fixed-gear 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 that were previously in the pool —are required to submit and follow an NMFS-approved Vessel Monitoring Plan[3] (VMP).

As part of the VMP approval, NMFS will assess a vessel's past adherence to their approved VMP. For example, does a vessel operator have recurring issues (such as obstructing the camera view or consistently not addressing camera cleanliness) that have resulted in unusable or very poor quality EM data? The quantity and severity of compliance issues that impact the quality and use of that data will be used to assess the standing of a vessel and their eligibility to participate in the fixed gear EM program. NMFS will notify the vessel operator of their status through a cover letter attached to the VMP approval on an annual basis. A vessel with poor standing will be placed into probation status and the vessel owner/operator will be notified of specific issues they need to address in order to bring the vessel into compliance. Failure of a vessel operator to address these issues or comply with other conditions of the

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

VMP may result in the vessel not being eligible to participate in the EM pool in the following year. Vessels which are removed from the fixed-gear EM pool automatically revert to the observer pool.

Any vessel in the fixed-gear EM selection pool in 2023 remained eligible to be in the EM selection pool for 2024 unless:

- the vessel operator submitted a request to leave the EM selection pool;
- NMFS has disapproved the vessel's VMP; or
- the vessel owner/operator was placed into probation status due repeated problems with EM system reliability, video quality, and failure to adhere to the requirements in their VMP, they were notified of specific issues needed to bring the vessel into compliance, and the vessel owner/operator failed to address the problems.

All the requests to be in or out of the EM selection pool for 2024 must have been received in ODDS by November 1, 2023. This year, four vessels opted out of the fixed-gear EM pool and one vessel was removed from the fixed-gear EM by NMFS. The vessel was removed after it was put into probation status at the start of 2022 and was kept on the probation list in 2023. The vessel owner/operator was informed of repeated issues with video quality, catch handling issues, and failure to adhere with the requirements in their VMP, and failed to address the problems throughout 2023.

The fixed-gear EM pool in 2024 will consist of 177 vessels approved by NMFS. This includes 174 vessels that were previously approved by NMFS and 3 new vessels that requested to be added to this pool in 2024. An additional 7 vessels requested to be in the fixed-gear EM pool but were not approved by NMFS. NMFS based the decision to not include these vessels into the fixed-gear EM pool based on the priorities identified in the draft ADP (NMFS 2023) and supported by the Council (Appendix A) including vessel size, fishing effort, minimizing data gaps, and cost efficiency (e.g. the requesting vessels had either no fishing history or fished too few trips to indicate cost-effectiveness).

EM system installation and maintenance 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 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.

Trawl EM Exempted Fishing Permit (EFP)

NMFS has issued an EFP to evaluate the efficacy of EM on pollock catcher vessels using pelagic trawl gear in the Bering Sea and Gulf of Alaska[4]. Industry received funding from the National Fish and Wildlife Foundation (NFWF) to support this project. The specific requirements for vessels in the trawl EM program was determined through the permit approval process. NMFS approved the EFP in January, 2020, allowing pollock catcher vessels using pelagic trawl gear to use EM systems in lieu of at sea

[4] More details on the EFP permit are available at: https://www.fisheries.noaa.gov/alaska/resources-fishing/exempted-fishing-permits-alaska

observers. All trips in this pool are subject to EM with the goal of monitoring for compliance with at-sea maximized retention. In 2024, 108 vessels are expected to participate in the Trawl EM EFP.

The subset of trips that deliver primarily pollock to tenders or shoreside processors will be subject to dockside monitoring to collect genetic samples from salmon bycatch to support work to identify their stock of origin. Selection rates are as follows:

- *GOA Trawl EM* (selection rates = 33% shoreside by observers, 100% at-sea compliance monitoring with EM). If a vessel opts out of this stratum for a trip, it will enter the observer trip-selection pool as a TRW stratum trip.
- *BSAI Trawl EM* (selection rates = 100% shoreside by observers, 100% at-sea compliance monitoring with EM)

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% threshold 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 algorithm that maximizes precision for chosen metrics (such as halibut PSC) for the least cost. The draft 2024 ADP (NMFS 2023) evaluated new allocation approaches, including a Proximity Allocation method where the allocation of available monitoring resources is based on maximizing the proportion of trips near monitored trips while guarding against low sample sizes.

In 2024, the NMFS will implement the Proximity allocation method to deploy observers and EM. This method is precautionary with respect to obtaining data from all types of fishing activity (decreasing data gaps) while protecting against high variance associated with low sample sizes. The Proximity allocation method is designed to spread sampled trips throughout the fisheries to increase the proportion of trips that are sampled or near a sampled neighbor and to be consistent between strata within a specified budget, while also protecting against small sample sizes within a stratum. This allocation method applies to all sampled strata (i.e., does not apply to zero selection stratum) except the trawl EM stratum; the EM strata are allocated sampling effort under the same allocation algorithm as observed strata with the exception of the Trawl EM EFP pool where in 33% of GOA deliveries and 100% of BSAI deliveries are monitored by an observer.

Dockside Monitoring

Observers will continue to collect genetic samples from salmon caught as bycatch in groundfish fisheries to support efforts to identify stock of origin. Dockside monitoring by observers occurs in the pollock fishery to enable complete enumeration of salmon bycatch and to conduct biological sampling. For trips in the BSAI trawl pollock fishery, both for catcher vessels in the trawl EM pool and those not in trawl EM, a census of salmon will be completed during the offload. Offload monitoring for salmon will also take place for vessels in the trawl EM pool that deliver either a tender and shoreside processor in the GOA. Trips will be randomly selected and offloads will be monitored by observers in shoreside processing facilities.

For vessels that do not participate in the Trawl EM EFP and deliver to shoreside processors in the GOA pollock fishery, trips that are randomly selected for at-sea observer coverage will be completely monitored for 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 salmon found within observer at-sea samples of the total catch.

Observer Declare and Deploy System (ODDS)

Owners or operators of vessels making trips in the partial coverage observer pool must log anticipated eligible trips into ODDS prior to sailing. Owners or operators of vessels making trips in the fixed-gear EM selection pool must log anticipated eligible trips into ODDS prior to sailing and must also use ODDS to close each trip following the instructions in their Vessel Monitoring Plan (VMP). For new partial coverage trip selection participants, vessel owners should contact NMFS at odds.help@noaa.gov requesting an ODDS account. NMFS will then create a user account for the new partial coverage trip-selection participant so that they may access the application at http://odds.afsc.noaa.gov/ and log planned eligible fishing trips electronically. For non-EM trips that were not selected for monitoring, those can be changed or closed by using ODDS, for selected trips those actions must be completed by calling the ODDS call center (1-855-747-6377). Both EM selected trips and EM non-selected trips can be changed or closed by using ODDS. Communication between users and NMFS is facilitated through odds.help@noaa.gov.

Starting in 2024, a vessel operator will be required to declare the FMP Area where they expect the majority of their catch to be harvested. NMFS will retain the current business operating procedure of allowing vessels to log up to three trips in advance and programming that waives observer coverage when a third consecutive non-inherited observer trip is selected for a vessel less than 58 feet (LOA). Additionally, NMFS has made some modifications to ODDS screens to help filter out trips in the PCTC program and in full-coverage CDQ fishing.

Selection Rates

Table 3 lists the selection rates that 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 2024. In 2024, NMFS expects to monitor for catch accounting 2,833 trips in full coverage and 1,006 trips in partial coverage.

Table 3. Summary of total trips, selection rates (rounded to a whole number), and the number of trips expected to be observed in each sampling stratum in 2024. The Trawl EM selection rates refer to offloads that are sampled by observers at the shoreside processing plant, in addition there is 100% at-sea compliance monitoring in both the GOA and BSAI.

Component	Pool	Stratum	Total Number of Expected Trips	Selection Rate (%)	Number of Trips Expected to be Monitored
Partial Coverage	**At-sea Observer**	Fixed-gear BSAI	279	44	123
		Fixed-gear GOA	2,001	13	264

		Trawl BSAI	30	72	22
		Trawl GOA	400	21	82
	Fixed-gear EM	Fixed-gear BSAI	58	74	43
		Fixed-gear GOA	959	24	232
	Trawl EM (EFP)	Trawl GOA	722	33 (plus 100% EM coverage at-sea)	241
	Zero	Zero	1,445	0	0
Full Coverage	**Full Coverage**	Full cover observer coverage	1,172	100	1,172
		Trawl EM EFP in BSAI	1,661	100 (plus 100% EM coverage at-sea)	1,661

EM Development Projects

In addition to ongoing implementation of trawl EM, NMFS recommends collaborating with industry partners on the following EM development and cost efficiency projects:

- Testing EM on trawl catcher vessels participating in the CGOA rockfish program, to increase utility of trawl EM systems and decrease EM infrastructure costs supported by the partial coverage observer fee. The project would include testing elements that could eventually be included in an EFP.
- Continued testing of electronic logbook data collection and reporting in fixed and trawl fisheries, testing integration of elog data into NMFS databases, and exploring a potential EFP to exempt participating vessels from regulatory requirements to maintain a physical printed copy of logbooks.
- Evaluation of testing of alternative catch handling protocols for single pot gear in the EM program in order to identify strategies to improve overall program efficiency while still providing necessary data.
- Testing the use of EM to monitor the sorting line for salmon in shoreside processing plants to enable more efficient use of observer time for biological sampling and improve assurance of Chinook PSC accountability at shoreside processing plants, allowing eLandings to be used for Chinook PSC information.

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. Two catcher/processors requested, and NMFS approved their placement in the partial coverage category for the 2024 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, 2023 for the 2024 fishing year. Each year, the list of catcher vessels that have been approved to be in the full coverage category is available on the NMFS website[7].

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 began on January 20, 2020. The final rule implementing this program does not specify the amount of time allowed for vessel crew to sort, and observers to discard, deck-sorted halibut. This flexibility enables NMFS to adjust sorting times in response to new information. In 2024, NMFS will continue to allow all vessels operating under these regulations 35 minutes to deck-sort and discard halibut. This uniform time allowance maintains the protocol from previous years and is consistent with the fact that there is no data to support vessel-specific deviations from the current time limit.

Voluntary Increase in Observer Coverage on Freezer Longline Vessels

In order to increase the number of non-trawl lead level 2 (LL2) endorsed observers, the Freezer Longline Coalition (FLC) and Alaskan Observers (AOI) are intending to deploy two observers on select catcher/processor longliners. This unique approach combines the two monitoring options in 50 CFR 679.51(a)(2)(vi)(E) and § 679.100(b) by taking increased observer coverage and using a flow scale.

Combining the monitoring options provides increased opportunities for observers to gain a non-trawl LL2 endorsement, supports the collection of high quality data by increasing sampling on these select vessels and sharing the sampling workload, and uses a flow scale to determine the weight of all retained Pacific cod. Additionally, deploying two observers to a challenging sampling platform has the potential to increase observer retention by improving the inexperienced observer's experience through mentorship and minimizing burn-out for the experienced observer.

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:

---

[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

[7] List of BSAI trawl catcher vessels in full coverage available at https://www.fisheries.noaa.gov/resource/document/bsai-trawl-catcher-vessels-cvs-full-coverage

- Information about the Observer Program and Frequently Asked Questions Observer deployment are available at https://www.fisheries.noaa.gov/alaska/fisheries-observers/north-pacific-observer-vessel-plant-operator-faq
- Frequently asked Questions about 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 http://odds.afsc.noaa.gov/ and click the "ODDS login" button.

Observer Program staff are 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 and Alaska Regional Office (AFSC and AKR). 2022. North Pacific Observer Program 2021 Annual Report. AFSC Processed Rep. 2022-06. Alaska Fish. Sci. Cent., NOAA, Natl. Mar. Fish. Serv., 7600 Sand Point Way NE, Seattle WA 98115. https://www.fisheries.noaa.gov/resource/document/north-pacific-observer-program-2021-annual-report

Cahalan, J. and C. Faunce. 2020. Development and implementation of a fully randomized sampling design for a fishery monitoring program. U.S. Fishery Bulletin 118:87-99.DOI 10.7755/FB.118.1.8

Faunce, C., M. Moon, P. Packer, G. Campbell, M. Park, G. Lockhart, and N. Butterworth. 2021. The Observer Declare and Deploy System of the Alaska Fisheries Science Center. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-426, 86 p. https://doi.org/10.25923/wngg-9t31

NMFS (National Marine Fisheries Service). 2022. 2023 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 at https://media.fisheries.noaa.gov/2022-12/2023-annual-deployment-plan-akro.pdf

NMFS (National Marine Fisheries Service). 2023. Draft 2024 Annual Deployment Plan for Observers and Electronic Monitoring in the Partial Coverage Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Available at: https://media.fisheries.noaa.gov/2023-11/Draft-2024-ADP.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 https://www.fisheries.noaa.gov/resource/document/ea-rir-irfa-proposed-amendment-86-fmp-groundfish-bsai-and-amendment-76-fmp.

List of Preparers and Contributors

ADP Analysis Team:

Jennifer Cahalan, Pacific States Marine Fisheries Commission (PSMFC)

Craig Faunce, Alaska Fisheries Science Center (AFSC)
Phil Ganz, Alaska Regional Office (AKRO)
Geoff Mayhew, AFSC

Additional preparers:

Jennifer Ferdinand, AFSC
Jason Jannot, AFSC
Jennifer Mondragon, AKRO

Other contributors:

Glenn Cambell, AFSC
Josh Keaton, AKRO
Joel Kraski, AKRO
Cathy Tide, AKRO
Mike Vechter, AFSC

Appendix A. Council motion related to the ADP

C-2 Observer 2024 Annual Deployment Plan
Council Motion
October 6, 2023

<u>2024 ADP</u>
The Council supports the following for the 2024 draft Observer Annual Deployment Plan (ADP) for partial coverage fisheries. Observer coverage rates resulting from the selected design and the final budget are expected in the final ADP in December 2023. Fisheries with 100% and 200% coverage requirements in regulation are not covered under the ADP. For the 2024 ADP:

- Use combined fixed gear-FMP stratification scheme:
  - Gear: Hook-and-line/pot gear (combined); trawl gear
  - Monitoring method: Observer; fixed gear electronic monitoring (EM); pelagic trawl gear EM
  - FMP: BSAI; GOA
- Use proximity allocation scheme with the exception of the pelagic trawl EM EFP.
- 100% EM on pelagic trawl vessels participating in the EFP, plus 33% observer shoreside sampling rate for partial coverage EM EFP trips.
- Remove fixed-gear vessels which have not fished nor used their EM systems for 3 or more years from the EM stratum. Place such vessels under 50 feet into the zero-selection pool and larger vessels into the observer-selection pool.

The Council requests NMFS re-evaluate the cost estimates for both fixed gear and trawl EM, which directly affect the cost efficiency analysis and the resulting coverage rates.

If the final ADP combines fixed gear types for selection, the Council recommends NMFS make clear to fishermen, NMFS staff, and OLE that there is no prohibition on vessels fishing both FMP areas in one trip, despite needing to choose a predominant area when logging trips into ODDS.

The Council supports additional fixed gear EM vessels added to the EM pool in 2024 (up to 200 total vessels) provided they opt-in prior to November 1, 2023, funding is available, and they meet the criteria in the ADP.

<u>Future work (2025 ADP)</u>
For the 2025 ADP, the Council recommends exploration of a revised hurdle and an analysis of how to effectively deploy days in addition to that hurdle, per the PCFMAC recommendation. The intent is to base the hurdle on the appropriate time and proximity scale to meet biological data collection needs, and then deploy additional monitoring, using at-sea observers, shoreside observers, and/or EM, to be placed where they are most cost effective for catch accounting purposes and for targeting specific types of information deemed necessary to meet legal mandates or assessment purposes. This will require further evaluation of the needed time/space scale for biological samples.

The Council requests NMFS re-evaluate the cost estimates for both fixed gear and trawl EM without including the cost of initially purchasing the EM hardware for both fixed and trawl gear, clearly separating ongoing costs from start-up costs.

Pilot project proposal

The Council encourages submittal of an industry cooperative research grant proposal and encourages NMFS to provide data to support the project: 1) the ports of departure and return for the partial coverage fleet (e.g., how many vessels/trips/catch are associated with smaller remote ports, aggregated as necessary to protect confidentiality); and 2) data on the amount of prior notice vessels are providing when registering trips in ODDS (e.g., is it the 72 hour minimum or are many vessels providing more notice). This project envisions a group of partial coverage fixed gear vessels that continue to be selected for coverage through ODDS but procure observers through a private contract with an observer provider (remove the Federal contract component).

2024 NFWF proposals

The Council will provide written support for the proposals on p. 6 of the September 2023 PCFMAC report submitted for funding from the National Fish and Wildlife Foundation (NFWF) for the 2024 Electronic Monitoring and Reporting Grant Program. Funding for continuation of the pelagic trawl EM EFP is the highest priority, until NMFS completes regulations for the program (anticipated 2025).

Appendix B. Calculation of the Selection Rates for the partial coverage strata of the 2024 ADP

Introduction

The Annual Deployment Plan (ADP) specifies how fishery monitoring assets (observers and Electronic monitoring equipment - EM) are deployed into fishing operations of the North Pacific by the North Pacific Observer Program (Observer Program) of the Alaska Fisheries Science Center, National Marine Fisheries Service (NMFS). The ADP is focused on fishing operations for which sampling rates will be less than 100% (i.e., the partial-coverage fleet). The partial coverage fleet consists of catcher vessels and some catcher processors when not participating in a catch sharing or cooperative style management program. Changes to the composition of the partial coverage fleet have resulted from NMFS policy, Council actions, and regulations.

The sampling design hierarchy used to obtain fishery dependent data has several levels, and the ADP is important since it affects the first, and top-most level of this hierarchy (Cahalan and Faunce 2020). The sampling design for the deployment of fishery monitoring assets (i.e. the deployment design) involves two elements; how the population of partial coverage trips is subdivided (*stratification*), and what proportion of the total observer deployments are to occur within these subdivisions (*allocation*).

The ADP process includes a draft and final version. The draft ADP is focused on presenting alternative deployment designs for consideration for the year ahead, while the final ADP is focused on predicting the most likely coverage rate that available budgets can afford given the selected design from the draft ADP. In this way, the ADP provides an annual process for the NMFS and the North Pacific Fisheries Management Council (Council) to evaluate and recommend improvements to fisheries monitoring in response to changing needs.

Since the inception of the ADP process in 2012 (2013 ADP), trip-selection has been the preferred method to deploy fishery monitoring assets into the partial-coverage fleet.

The 2024 Sampling Design

Following NMFS recommendation and the Councils' support (Appendix A), the selection pools, sampling strata and allocation methods for this 2024 ADP follow recommendations presented in the draft 2024 ADP. Selection rates for the GOA trawl EM EFP stratum is set at 33% of shoreside deliveries based on NMFS policy and Council working group input. Since monitoring costs for fishing activities in the trawl EM EFP are paid by EFP participants and NFWF, this coverage is not included in the $5.819 million monitoring budget.

Selection rates for other partial coverage sampled strata will be based on 1) available budget, 2) predicted 2024 fishing effort estimates (Appendix C), 3) the Proximity Allocation method (see NMFS 2023 and Appendix D). The *Proximity Allocation* method distributes sampling effort to strata to maximize the *proximity allocation index* afforded, which is a function of each stratum's *proximity index* and *variance scaling factor*. The proximity index is based on maximizing the proportion of unmonitored trips that are expected to have a monitored neighbor; hence, as sampling rate increases, the proximity index also increases. The proximity index is a function of the available budget, each stratum's monitoring cost and size (total number of trips or offloads), sample rate, and spatiotemporal distribution of fishing effort. Strata with clustered fishing effort will achieve a specified proximity index at a lower sample rate than strata with more diffuse fishing effort; more samples are allocated towards strata with trips that are more spread out in space and time. The variance scaling factor accounts for the size of each stratum and prioritizes more sampling effort to strata with fewer trips to guard against low sample sizes..

Methods

The methods in this section largely follow those used in the draft 2024 ADP (NMFS 2023). They are visually depicted in Figure B-1.

Data Preparation: Defining the partial coverage fleet

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 10 October, 2023.

As in past ADPs, trip data were altered to reflect fishing effort in the partial coverage fleet for the upcoming year. These alterations included: (1) using ODDS data to more accurately model the duration that observers are assigned to selected fishing trips (NMFS 2019, Appendix C), (2) labeling fishing activity by three 'historical low volume' Catcher-Processors as belonging to the partial coverage category, (3) labeling fishing by American Fisheries Act (AFA) eligible trawl vessels targeting Pacific cod in the Bering Sea Aleutian Islands Fisheries Management Plan Area (BSAI) as belonging to the full coverage fleet if they opted into full coverage for 2024, and (4) removing vessels with no probability of selection from the analysis (i.e., all trips corresponding to the zero selection pool). Vessel lists for the Fixed Gear EM pool and Trawl EM pool were updated following information provided by industry (Trawl EM) and approval processes by the FMA Division through ODDS after Nov. 1[8] respectively (vessels using Hook and Line or Pot Gear with EM). A full description of the selection pools and stratum are provided in Table B-1.

The 2024 sampling design includes the following strata, which are defined by gear, monitoring method (observers or EM or none), and FMP (BSAI or GOA):

1. **FIXED-GEAR GOA**: Observer monitoring of trips using hook-and-line, pot, or both gears on vessels that are greater than or equal to 40 ft LOA and are not in fixed-gear EM predominantly fishing in the GOA.
2. **FIXED-GEAR BSAI**: Observer monitoring of trips using hook-and-line, pot, or both gears on vessels that are greater than or equal to 40 ft LOA and are not in fixed-gear EM predominantly fishing in the BSAI.
3. **TRAWL GOA**: Observer monitoring of trips by vessels using trawl gear predominantly fishing in the GOA, excluding trips where vessels are participating in the Pollock Trawl EM EFP.
4. **TRAWL BSAI**: Observer monitoring of trips by vessels using trawl gear predominantly fishing in the BSAI, excluding trips where vessels are participating in the Pollock Trawl EM EFP.

[8] 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.

5. **FIXED-GEAR EM (EFP) GOA**: EM of trips using hook-and-line, pot, or both gears on vessels that are greater than or equal to 40 ft. LOA and have been approved to carry EM predominantly fishing in the GOA.
6. **FIXED-GEAR EM (EFP) BSAI**: EM of trips using hook-and-line, pot, or both gears on vessels that are greater than or equal to 40 ft. LOA and have been approved to carry EM predominantly fishing in the BSAI.
7. **TRAWL EM (EFP) GOA**: Compliance monitoring of trips by vessels participating in the Pollock Trawl EM EFP in the Gulf of Alaska and shoreside monitoring of a subset of offloads.
8. **ZERO**: No monitoring, including vessels less than 40 ft LOA, for trips fishing exclusively with jig gear, or vessels that have been temporarily removed from the fixed-gear EM vessel pool.

Budget Forecasting

Partial coverage observer deployment is paid for according to a contract between NMFS and its partial coverage observer providers. The current contract for observer coverage will expire in August 2024 and will be recompeted. Observer deployments occurring after the award of the new contract will be paid according to the new contract's provisions, which at the time of the ADP are unknown. For this analysis, budget estimates were based on the current observer coverage contract. Fixed-gear EM deployment is paid according to a contract between NMFS and PSMFC who subcontract to EM providers. The Trawl EM EFP is in its final year of exempted status and will be funded by NMFS and NFWF, not from funds from the partial coverage ex-vessel fee. The GOA portion of Trawl EM is expected to be regulated in 2025 and will operate within the partial coverage monitoring budget at that time.

Due to uncertainty about monitoring costs in the future (i.e., new partial coverage observer contract, regulated GOA pollock trawl EM), the monitoring budget was set such to include funding which is already available on the current observer contract and with EM providers and reviewers and the expected fee revenue from 2022. This is a departure from previous years where monitoring costs were more certain and allowed the analytic team to set a budget that ensures the monitoring program can be sustained over several years.

Accounting for uncertainties

The uncertainties inherent in this analysis include how fishing activity will change from the past to 2024, and how coverage rates need to be set in order to keep the fishery monitoring program fiscally solvent. Accounting for these uncertainties was accomplished through simulation described in more detail in the following sections.

Predicting future fishing effort

Predicting future fishing effort is simplified by assuming the future is most similar to the prior year. However, when this analysis is conducted, only a partial year of 2023 is available. For this analysis, data for 2023 were available through 14 November. Future fishing effort for the upcoming year was predicted by projecting the total 2023 fishing effort and assuming that would equal 2024 fishing effort.

To estimate fishing effort for the calendar year 2023, a linear model was fit to data from 2013 through 2022. Model parameters included year, stratum definitions to be used in 2024, the number of trips that occurred through 14 November, and all interaction terms. The Akaike information criterion (AIC) supported inclusion of 2024 stratum definitions and the interaction terms in the model; the full model fit the data better than lower dimension models. We tested the predictive accuracy of the final model by evaluating predictions for 2018 through 2022 based on the model's fit to previous years of data (i.e., we based 2018 predictions on the model's fit to 2013 - 2017 data, and 2019 predictions on the model's fit to 2013 - 2018 data, *etc.*). We compare these predictions to the amount of effort that was realized in the same year as the prediction (Figure C-1) and the amount of effort that was realized in the year following the prediction year (Figure C-2). The latter comparison replicates the process of predicting the amount of effort to occur in the current year and then applying that estimate to the following year.

<u>Uncertainty in characteristics of fishing effort</u>
The Proximity Allocation Method relies on the expected spatio-temporal distribution of fishing trips. Simulated fishing populations for 2024 were then generated by selecting trips within each sampling stratum without replacement from the most recent 1 year of fishing effort (1 October 2022 to 30 September 2023) until the number of selected trips equals the predicted number for each stratum in 2024.

If more trips are predicted for a stratum in 2024 than occurred in the most recent 1 year, then all trips from the most recent year are selected once and additional trips are selected without replacement until the simulated population is the correct size (correct number of trips in each stratum). This process was repeated 1,000 times to create 1,000 versions of the 2024 fishing effort (*2024 simulated populations*), each with its own unique distribution of fishing effort in time and space and trip duration.

This method of simulating 2024 populations of trips is a change from previous years. Hence, different methods of generating simulated populations were evaluated including sampling with replacement from the most recent calendar year (see Appendix D), sampling without replacement from the most recent 1, 2 and 3 years of data. For each simulated population, the proximity indices under a 15% sample rate was calculated and compared across methods (Figure D-3). The proximity indices were best preserved by sampling without replacement from the previous 1 year of fishing activity.

<u>Uncertainty due to Pollock trawl EFP</u>
The Pollock Trawl EM EFP includes a provision where a vessel fishing in the Gulf of Alaska (GOA) may opt out of the EFP (and thus opt into random selection for at-sea observer coverage) on a trip-by-trip basis. For Pollock Trawl EM EFP vessels in partial coverage, simulated future fishing trips were given a 91.19% probability of being under the EFP by random draw based on past participation in the EFP (2022 - 2023) on a trip by trip basis.

Determining selection rates for 2024
The selection rates that can be afforded in the coming year depends on several factors, chiefly the amount of fishing that is expected to occur, the available budget, and estimated monitoring costs. As mentioned previously, 1,000 populations of 2024 fishing effort were simulated where each stratum had the same number of fishing trips across iterations. The Proximity Allocation algorithm (NMFS 2023) was applied to each population assuming a $5.819 million budget, resulting in 1,000 prescribed selection rates for all strata. The average selection rate of each stratum across these 1,000 populations was used as the selection rates for the 2024 fishing year.

<u>Uncertainty in monitoring costs</u>
The costs of monitoring depends on several variables including trip length, contract specification, and type of monitoring (EM, Observer); however in order to adequately assess the probability of remaining within budget, the uncertainty of the total realized costs must be quantified. The monitoring costs were

estimated using the same methods described in the 2024 Draft ADP (NMFS 2023) where the costs of each monitoring method was represented by a model informed by past patterns of costs including fixed and variable costs, and scale of economy. Simulations incorporated uncertainty in several ways to create a distribution of possible realized monitoring costs:

1. Uncertainty in total fishing effort. The uncertainty of the predicted total fishing effort model (Appendix C) is incorporated into a second set of simulations used to evaluate costs. These simulations of fishing effort using the same methods as previously described (sampling from fishing effort from the previous year without replacement), except the total number of trips in each stratum will increase or decrease proportionately with each other in each iteration. If fishing effort is greater or less than in the predictions used by the allocation algorithm (which assumes no variation in total fishing effort), the monitoring rates that are set in the ADP will result in greater or lesser realized costs, respectively.
2. Uncertainty in ODDS Trip selection. The monitoring rates set in ODDS are rarely perfectly realized due to random chance and flexibilities built into ODDS (e.g., canceling selected trips, inheriting selected trips, waivers of coverage). Although these flexibilities cannot be easily simulated, the random nature of ODDS can be simulated. ODDS trip selection was simulated 1,000 times for each simulated fishing population from 1).

By incorporating the uncertainty of total fishing effort and ODDS trip selection into simulations and applying the monitoring rates, the total number of monitored trips in each stratum for each simulation iteration was determined. After totaling the number of monitored trips and/or days by each monitoring method (i.e., at-sea observers and fixed-gear EM), the cost models return a total cost of each monitoring method, the sum of which is the total realized cost of monitoring. The resulting distribution of the total costs from each simulated fishing effort population and each ODDS outcome is then compared to the monitoring budget.

Results and Discussion

Table B-2 shows the available budgets and expected vessel participation for the partial coverage fleet in 2024. The available budgets for partial coverage at-sea observer deployment and Fixed Gear EM were set at $5,819,000. The fixed-gear EM pool consisted of 177 vessels approved by NMFS. Ten vessels requested to be added to the fixed-gear EM pool, 4 vessels opted out of the Program, and NMFS denied EM coverage to 1 vessel for continued failure of compliance with their VMP. NMFS approved 3 requests to be added to the EM pool as the other seven requesting vessels had either no fishing history or fished too few trips to indicate cost-effectiveness. This resulted in a net change of 2 fewer vessels in the fixed-gear EM pool compared to 2023. There will be no vessels participating in Fixed Gear EM Research in 2024. A list of 108 vessels expected to participate in Trawl EM EFP was received on 5 September 2023. Expected vessel participation for the other fishery monitoring strata is provided in Table B-2.

The coverage rates expected to be afforded in 2024 are shown in Table B-3. The final rates differ from those presented in the draft due to changes in expected fishing effort and additionally accounting for the ability of vessels in the GOA Trawl EM EFP to opt out of the EFP and join the observer pool on a trip-by-trip basis.

The expected difference between the available budget and the predicted expended cost is depicted as a risk-profile in Figure B-2. Summary of 1,000,000 outcomes of simulated sampling (1,000 populations, each simulated 1,000 times in ODDS) showing the total cost of the program expected for 2024. Vertical lines depict the available budget (dashed purple line), median expected cost (dashed blue line), and 95% confidence limits (dashed red lines).. The 95% confidence interval ranges between $272,378 under budget (-4.7%) and $249,512 over budget (+4.3%).

References

Cahalan, J. and C. Faunce. 2020. Development and implementation of a fully randomized sampling design for a fishery monitoring program. U.S. Fishery Bulletin 118:87-99.

Faunce, C., M. Moon, P. Packer, G. Campbell, M. Park, G. Lockhart, and N. Butterworth. 2021. The Observer Declare and Deploy System of the Alaska Fisheries Science Center. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-426, 86 p.

Ganz, P., and C. Faunce. 2019. An evaluation of methods used to predict commercial fishing effort in Alaska. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-AFSC-395, 19 p.

NMFS (National Marine Fisheries Service). 2022. 2023 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 at https://media.fisheries.noaa.gov/2022-12/2023-annual-deployment-plan-akro.pdf

NMFS (National Marine Fisheries Service). 2023. Draft 2024 Annual Deployment Plan for Observers and Electronic Monitoring in the Partial Coverage Groundfish and Halibut Fisheries off Alaska. National Oceanic and Atmospheric Administration, 709 West 9th Street. Juneau, Alaska 99802. Available at https://media.fisheries.noaa.gov/2023-11/Draft-2024-ADP.pdf

.

Table B- 1. Description of deployment pools for fisheries monitoring of the partial coverage fleet in 2024. NFWF = National Fish and Wildlife Foundation.

Pool	Applies to	At-Sea				Dockside			
		Monitor	**Purpose**	**Selection Rate**	**Funding Source**	**Monitor**	**Purpose**	**Selection Rate**	**Funding Source**
Fixed Gear EM	Fixed Gear Vessels that volunteer to participate in EM for catch estimation and are approved by NMFS.	EM	Catch estimation	Proximity allocation-based rates	NFWF / industry fees / Federal funds	None	NA	0%	NA
Trawl EM (EFP)	Vessels fishing pelagic trawl gear in the pollock fishery identified in an exempted fishing permit (EFP)	EM	Full retention compliance	100%	NFWF	Observers	Catch & PSC estimation /biological sampling	33%	NFWF
Observer Trip Selection	Fixed-gear vessels >= 40'; and Trawl vessels not participating in the trawl EM EFP	Observers	Catch estimation	Proximity allocation-based rates	Industry fees / Federal funds	None	NA	0%	NA
No Selection	Jig Vessels, vessels < 40'	None	Economic efficiency & logistics (e.g. lack of bunk space)	0%	None	None	NA	0%	None

Table B- 2. Differences in budgets and vessel participation between the Draft 2024 ADP and this analysis. Funding through the observer fee and NMFS funds for monitoring (both observer and EM) is $5.819 million. The number of vessels participating is estimated as the number of unique vessels that fished within each stratum within 365 days prior to the completion of the analyses. Some vessels may fish in multiple strata (e.g., a trawl vessel may fish within the Observer pool and Pollock Trawl EM EFP pools).

	Draft 2024 ADP	Final 2024 ADP
Partial Coverage Monitoring Budget ($)		
Total	5,819,000	5,819,000
Vessels participating (partial coverage)		
At-sea Observer Fixed-gear BSAI	74	63
At-sea Observer Fixed-gear GOA	326	321
At-sea Observer Trawl BSAI	2	3
At-sea Observer Trawl GOA	52	42
EM Fixed-gear BSAI	18	18
EM Fixed-gear GOA	133	128
EM Trawl GOA	47	47
Zero	311	296

Table B- 3. Comparison of the predicted number of trips in a stratum (N_h), predicted number of observed or monitored trips (n_h), observed or monitored days (d_h), and coverage rates (r_h) resulting from the deployment sampling design described in the text for 2024. Values are averages from simulated populations.

Pool	Stratum (h)	N_h	n_h	d_h	r_h (%)
Draft 2024 ADP					
At-sea Observer	Fixed-gear BSAI	361	143	1,054	39.72
	Fixed-gear GOA	2,077	229	1,292	11.04
	Trawl BSAI	21	18	65	85.13
	Trawl GOA	368	110	366	30.02
	Total	**2,827**	**501**	**2,776**	**17.72**
Fixed-gear EM	Fixed-gear BSAI	89	63	440	71.25
	Fixed-gear GOA	986	204	1,057	20.70
	Total	**1,075**	**268**	**1,496**	**24.89**
Trawl EM (EFP)	Trawl GOA	768	256	714	33.33
	Total	**768**	**256**	**714**	**33.33**
Zero	Zero	1,601	0	0	0.00
	Total	**1,601**	**0**	**0**	**0.00**
Final 2024 ADP					
At-sea Observer	Fixed-gear BSAI	279	123	873	43.97
	Fixed-gear GOA	2,001	264	1,510	13.17
	Trawl BSAI	30	22	65	72.28
	Trawl GOA	400	82	283	20.58
	Total	**2,710**	**490**	**2,732**	**18.09**
Fixed-gear EM	Fixed-gear BSAI	58	43	330	74.29
	Fixed-gear GOA	959	232	1,233	24.20
	Total	**1,017**	**275**	**1,562**	**27.05**
Trawl EM (EFP)	Trawl GOA	722	241	731	33.33
	Total	**722**	**241**	**731**	**33.33**
Zero	Zero	1,445	0	0	0.00
	Total	**1,445**	**0**	**0**	**0.00**
Full Coverage	Full	1,172	1,172	11,048	100.00
	Trawl BSAI	1,661	1,661	5,769	100.00
	Total	**2,833**	**2,833**	**16,817**	**100.00**

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

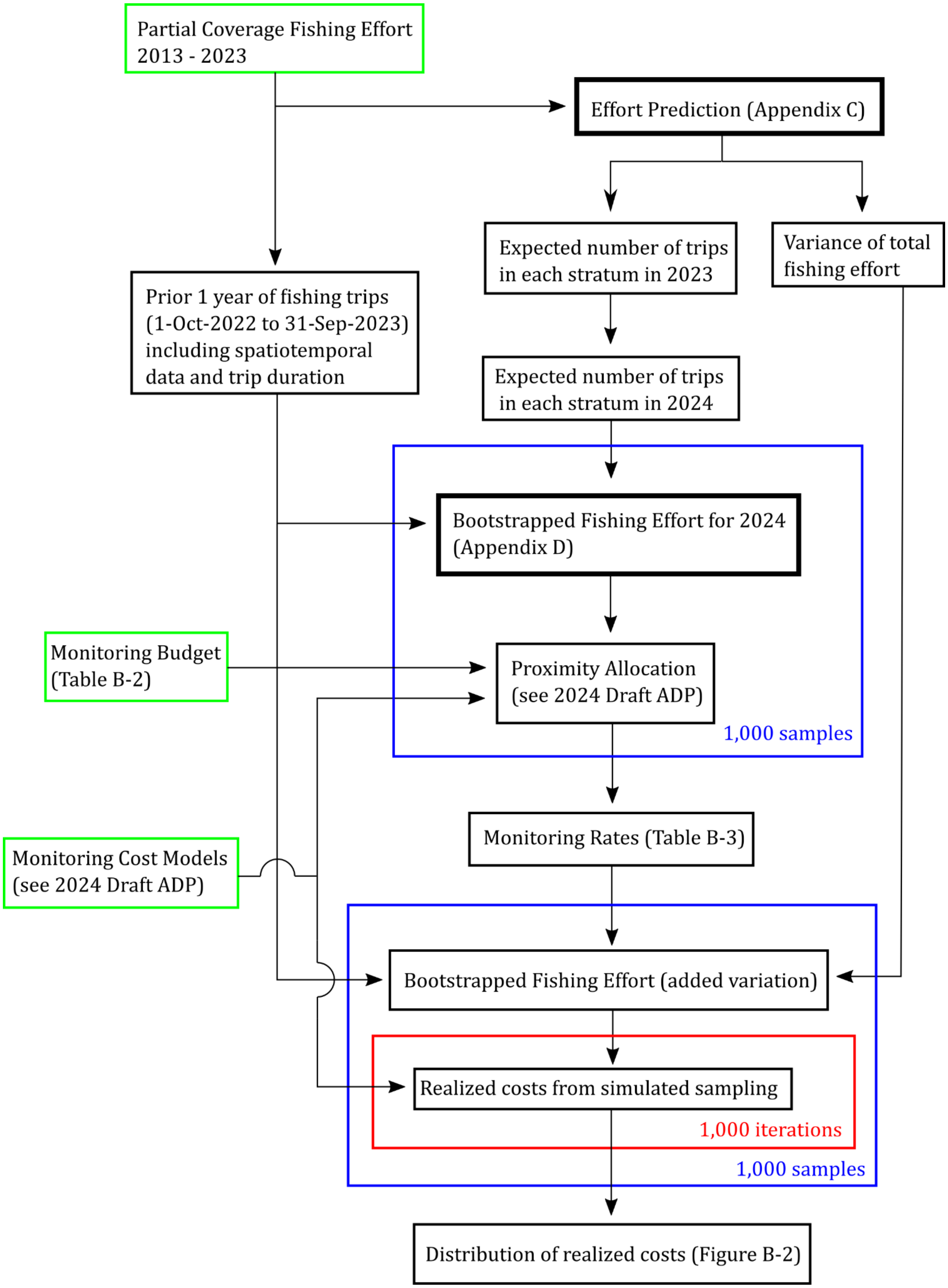
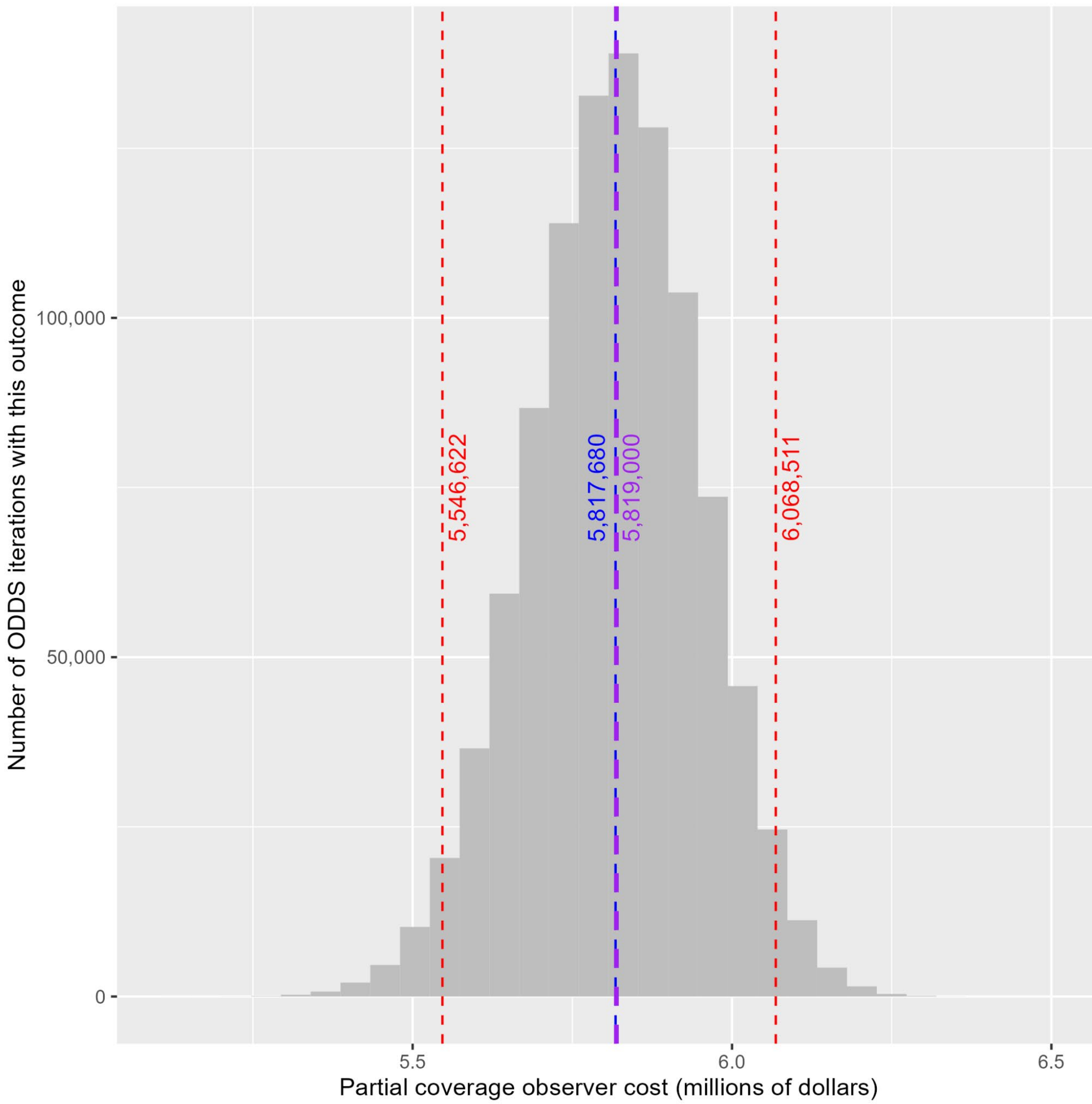


Figure B- 2. Summary of 1,000,000 outcomes of simulated sampling (1,000 populations, each simulated 1,000 times in ODDS) showing the total cost of the program expected for 2024. Vertical lines depict the available budget (dashed purple line), median expected cost (dashed blue line), and 95% confidence limits (dashed red lines).



Appendix C: Methods to Predict 2024 Fishing Effort

Introduction

Setting monitoring rates for the next ADP year requires an estimate of fishing effort (i.e., the number of fishing trips or offloads) in each stratum, the monitoring budget for the upcoming year, and an estimate of the stratum-specific cost per trip. In addition, the *proximity* allocation method utilizes the spatiotemporal distribution of the fishing effort within each stratum to determine how much monitoring effort to allocate to each stratum (Appendix D). The purpose of Appendix C is to describe how we estimated the amount of fishing effort to occur in 2024.

Starting with the final 2019 ADP, we have estimated fishing effort by projecting the number of trips that have occurred so far (i.e., through October/November) in the year prior to the ADP year ("ADPyear - 1") to the end of the year, and then assuming that the same number of trips will occur in the ADP year ("ADPyear"). That is still the case for the 2024 ADP, although the method for projecting ADPyear - 1 effort to the end of the year has changed.

Previously, we projected ADPyear - 1 effort to the end of the year by plotting ADPyear - 1 effort to date (ADP analyses are typically finished in November of ADPyear - 1) by FMP, trip target, and stratum, and then basing the number of fishing trips yet to occur from that year on the proportion of effort that occurred during that portion of the year during the three years prior to ADPyear - 1. For example, if an average of 5% of the BSAI halibut HAL effort occurred during November and December of prior years, we might assume that 5% of that effort would occur in November and December of ADPyear - 1. For some fisheries, where visual inspection of effort plots indicated unusual patterns, we used a subset of prior years to calculate this average proportion. In other cases, we assumed no more fishing for the remainder of the year. For a detailed description of this methodology, see Ganz and Faunce 2019.

For the final 2024 ADP, we changed this process by developing a model of fishing effort, rather than relying on judgments informed by plots. The model-based approach has the advantages of being faster, less subjective, and able to produce prediction intervals around estimates of effort.

Methods

To project ADPyear - 1 (2023) effort to the end of the year, we tested the predictive ability of several linear models that described the relationship between the number of trips to occur and some combination of year, stratum, and the number of trips that had occurred by the date of analysis in ADPyear - 1. With data from 2013 to 2022, we tested whether the predictive ability of the model was increased with the inclusion of each main and all interaction terms. We used the Akaike information criterion (AIC) to select the final model based on fit to the data. We tested the predictive accuracy of the final model by evaluating predictions for 2018 through 2022 based on the model's fit to previous years of data (i.e., we based 2018 predictions on the model's fit to 2013 - 2017 data, and 2019 predictions on the model's fit to 2013 - 2018 data, *etc.*). Using the final model, we summed the predicted number of trips to occur within each stratum in 2023 to predict total effort for that calendar year. We then used the variance-covariance matrix from the model output, adjusted for residual variance, to estimate a prediction interval around total effort.

To predict total effort for 2024, we assumed that total effort for 2024 would be equal to total effort in 2023, with the same prediction interval. Rather than use stratum-specific prediction intervals, we assumed that the proportion of effort in each stratum would be equal to the proportions produced by stratum-specific point estimates for 2023. For example, if 100 trips were estimated to occur in 2023 with 20% of trips being in each of 5 strata, a random draw of 110 trips would have 22 trips in each stratum ($110 \times 20\% = 22$). We tested the appropriateness of these assumptions by comparing predicted total effort for ADPyear - 1 to actual effort for ADPyear

Results

The model we selected to predict total fishing effort for the current year (ADPyear - 1) includes main effects and all interaction terms. Inclusion of 2024 stratum definitions, year, trips-to-date, and interaction terms was supported based on AIC values (Table C-1); the full model fit the data better than lower dimension models. The final model is

$$T_{s,y} = \alpha + \beta_1 t_{s,y} + \beta_2 s + \beta_3 y + \beta_4 t_{s,y} s + \beta_5 t_{s,y} y + \beta_6 s y + \beta_7 t_{s,y} s y$$

where T represents the total number of trips predicted to occur in each stratum (s) for the year (y) and t represents the number of trips that occurred through the day of the year on which the model was run. This model produced approximately unbiased estimates of stratum-specific total current year effort based on inspection of model residuals (Figure C-1, lower panel). Comparisons of ADPyear - 1 predictions to ADPyear - 1 realized effort show minimal differences between predicted and true stratum-specific effort (Figure C-1, upper panel).

The ability of the final model to predict total effort for the following year (i.e., predict ADPyear effort) was generally good with errors rarely exceeding 50%. The model produced approximately unbiased estimates when comparing ADPyear - 1 predictions to ADPyear realized effort (Figure C-2), although residuals were more variable compared to residuals against realized ADPyear - 1 effort (Figure C-1).

Predicted effort for 2023/2024 is lower than most prior years (Figure C-3), in part because multiple strata had lower amounts of effort through the date of analysis, compared to prior years (Figure C-4). In particular, fixed-gear effort in the BSAI and trawl effort in the GOA were lower in 2023 than in prior years.

Discussion

As stated in the introduction, the method we present here for estimating effort represents an improvement over past methodology by being faster, less subjective, and able to produce prediction intervals around estimates. Although we did not compare the performance of the model against the performance of the previous method of estimating effort, we showed that estimates of effort produced by the model were approximately unbiased for total effort in ADPyear (Figure C-2).

We can build upon this methodology in future years by estimating effort for ADPyear that differs from the estimate of effort for ADPyear - 1. We can accomplish this by using a separate model that does not rely on the number of trips that have been taken through the date of analysis, as the value for that variable will not be available for ADPyear at the time of analysis.

References

Ganz, P., and Faunce, C. 2019. An evaluation of methods used to predict commercial fishing effort in Alaska. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-AFSC-395, 19 p

Table C-1. Model candidates and their resulting AIC and ΔAIC values.

Model	AIC	ΔAIC
$T_y = \alpha + \beta_1 y$	1291	625
$T_{s,y} = \alpha + \beta_1 s + \beta_2 y + \beta_3 sy$	1063	397
$T_{s,y} = \alpha + \beta_1 t_{s,y} + \beta_2 s + \beta_3 y + \beta_4 t_{s,y} s + \beta_5 t_{s,y} y + \beta_6 sy + \beta_7 t_{s,y} sy$	666	0

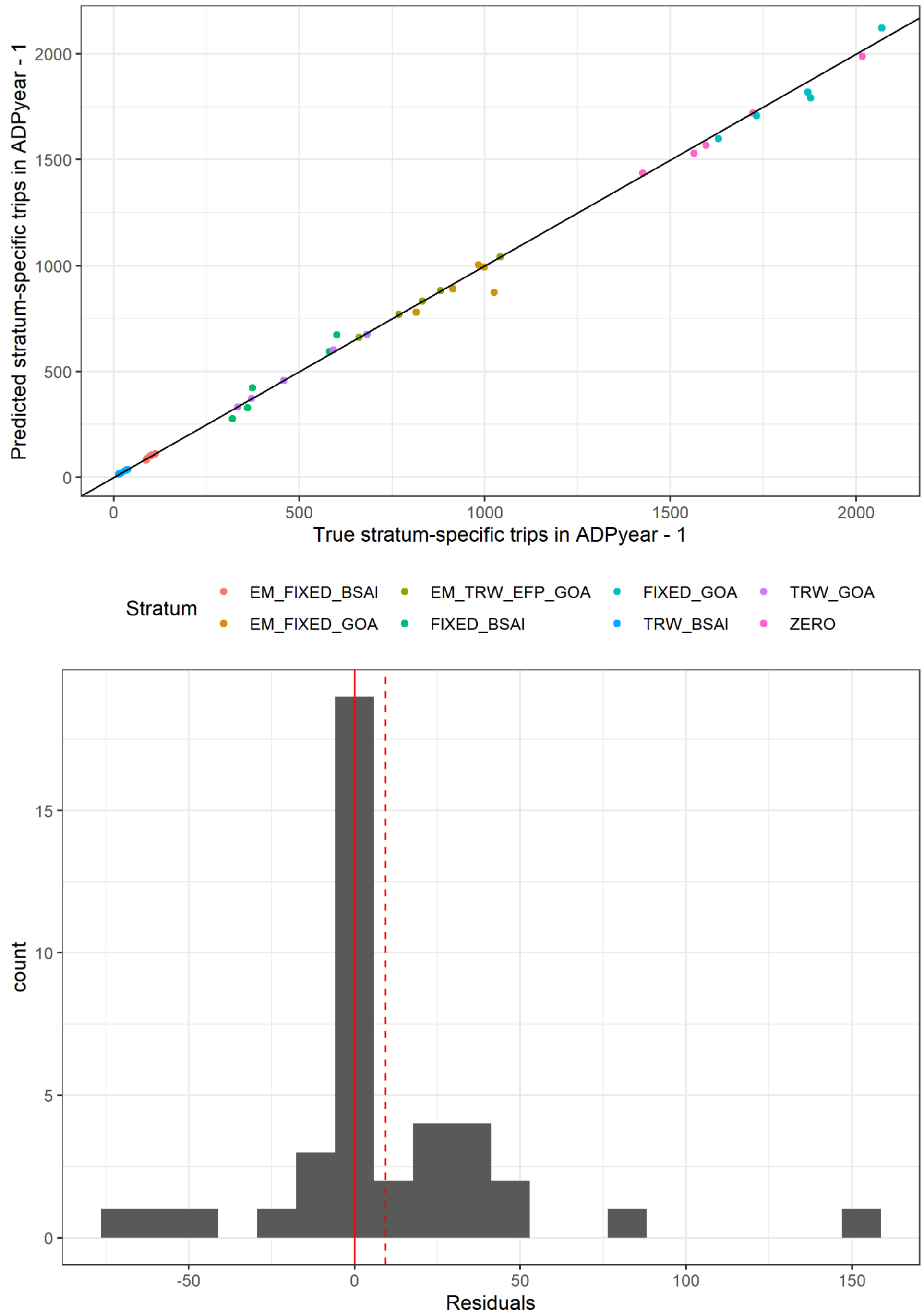


Figure C-1. Comparisons of predicted effort for years 2018 to 2022 with actual effort for years 2018 to 2022 (top panel) and the resulting residuals (bottom panel). Solid lines in both panels represent where residuals are equal to zero. The dashed red line in the bottom panel represents the mean of residuals.

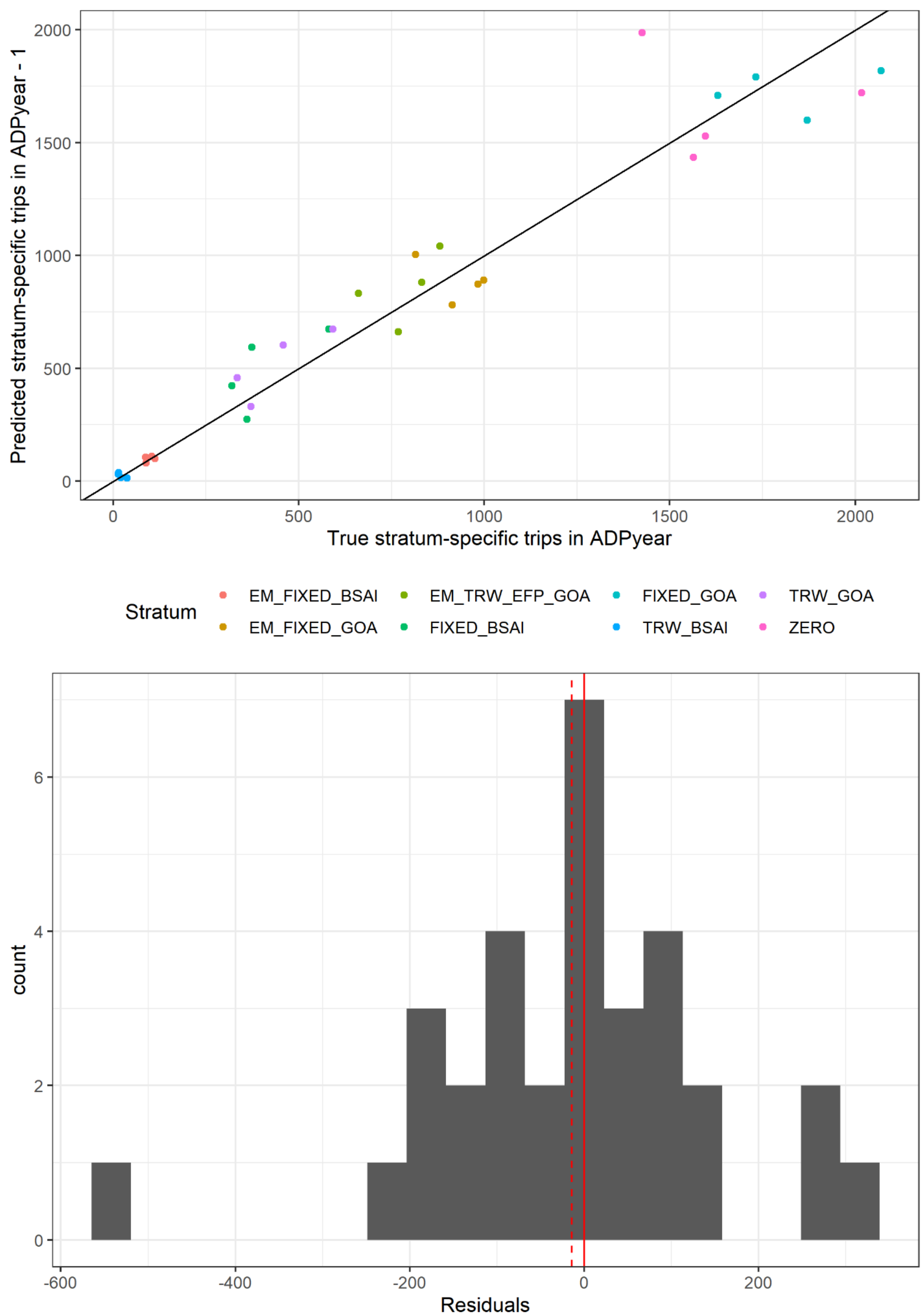


Figure C-2. Comparisons of predicted effort for years 2018 to 2021 with actual effort for years 2019 to 2022 (top panel) and the resulting residuals (bottom panel). Solid lines in both panels represent where residuals are equal to zero. The dashed red line in the bottom panel represents the mean of residuals.

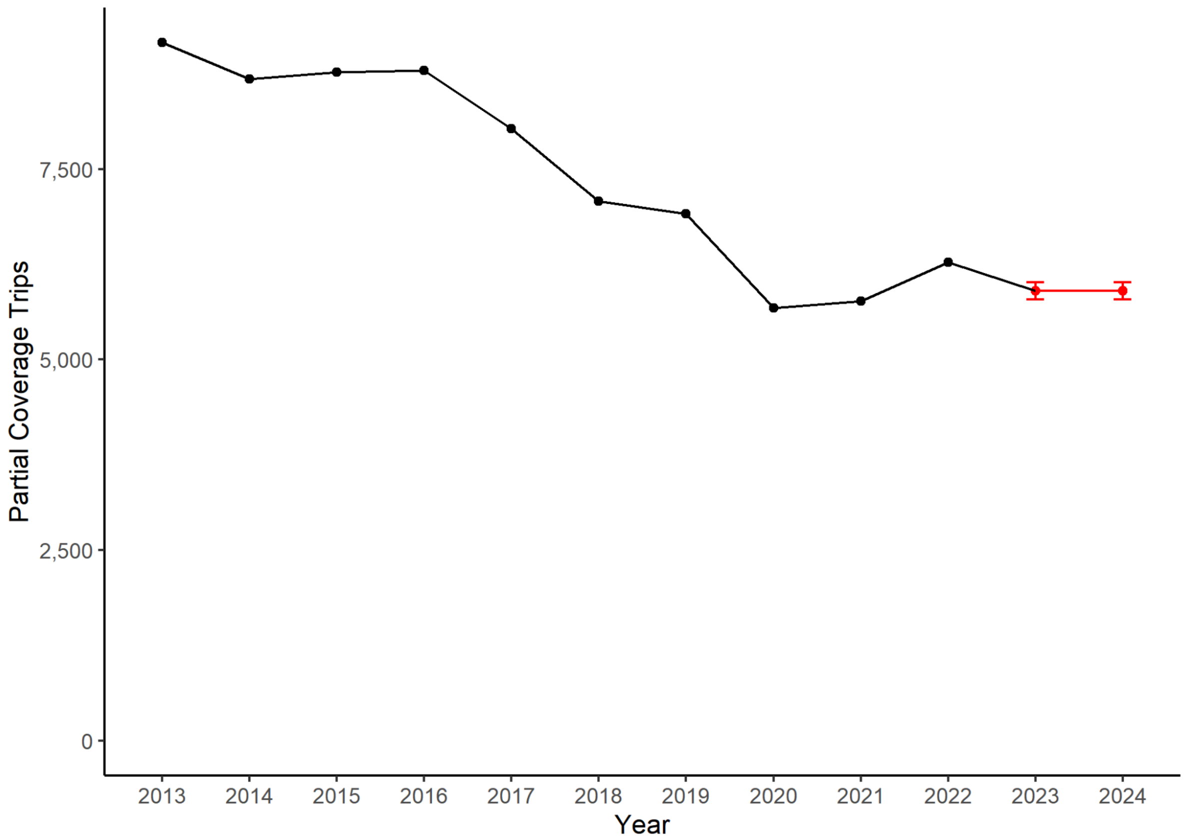


Figure C-3. Partial coverage trips by year. Black points represent realized effort. Red points represent estimates. Red error bars represent the 95% prediction interval.

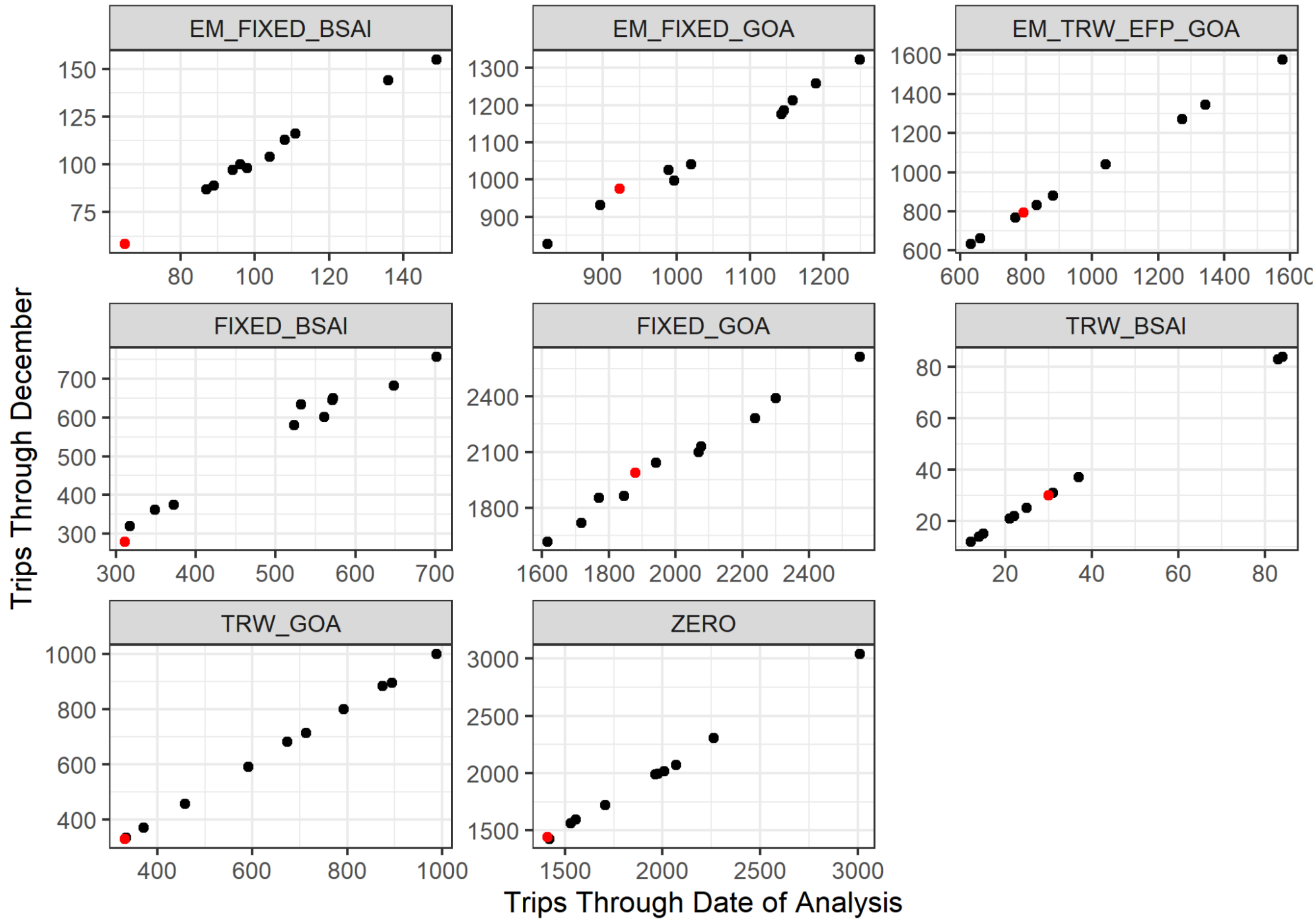


Figure C-4. Trips through December, plotted against trips through the date of analysis, for years since 2013. Each black point represents a year of realized effort prior to 2023. Red points represent the 2023/2024 estimate.

Appendix D: Methods to Simulate Fishing Effort

Introduction

In addition to predicting 2024 total and stratum-specific fishing effort (Appendix C), an estimate of the spatiotemporal distribution of effort within the 200 km by 1 week boxes that are used to estimate neighborhoods and the proximity of monitored trips within strata (see NMFS 2023) is also needed. Modeling this distribution is beyond the scope of this analysis; however, this appendix provides details of an evaluation of the suitability of using recent fishing distributions as a proxy for fishing effort for the following year.

Once the predicted number of fishing trips for each stratum is estimated, the spatiotemporal distribution of those trips must be estimated in order to allocate monitoring effort to different strata. The goal of proximity allocation is to maximize the *proportion of trips* in a stratum neighboring monitored trips where neighborhoods are defined as sets of adjacent spatial hexagonal cells 600 km across and temporal blocks 3-weeks in length (see NMFS 2023 for additional details). The distribution of 2024 fishing effort across this grid of neighborhoods needs to be estimated and used to generate the 1,000 simulated populations used in the allocation process. The average of the allocated rates across the bootstrapped populations will be the prescribed monitoring rates for each stratum in the upcoming year.

Since estimation of the time and location of fishing trips is complex and beyond the scope of this analysis, the suitability of using previous fishing patterns was evaluated. These methods are similar to those used in prior years where sampling with replacement was used to build the bootstrapped fishing effort populations. One concern with using sampling with replacement is that the resulting populations of fishing effort may not have the same spatiotemporal characteristics as the prior fishing years or the forecasted 2024 fishing year. Since sampling with replacement allows for the same trip to be selected (added to the future population) multiple times while other trips may not be selected, the bootstrapped populations may be more 'clumped' than actual fishing patterns. This effect will be more pronounced in strata with fewer trips, leading to under-allocating monitoring resources to small strata and over-allocating to larger strata.

To mitigate these concerns, bootstrapped populations were constructed using sampling both with and without replacement. In addition, drawing trips from the previous fishing year as well as from a range of two or three prior years was also tested. Using the *proximity index* as a measure of each stratum's spatiotemporal distribution, the indices for each of the bootstrapped populations were compared with the 'actual' proximity indices for each year evaluated. Similarly, the final monitoring rates resulting from the allocation process for each bootstrapped population were also compared to those from 'actual' fishing effort.

To compare the performance of the different bootstrapping methods, 100 populations were constructed (bootstrapped) for years 2018-2023 (using earlier years as prior fishing effort back to 2015). Each population was constructed with the same number of trips per stratum as previous years (actual effort; Table D-1). Under each bootstrapping method, the proximity indices of each stratum were calculated assuming a 15% selection rate and these were compared to the proximity values that would have resulted from a 15% selection rate with 'actual' fishing effort. The allocated monitoring rates were determined for all strata assuming a $5.819 million monitoring budget, excluding ZERO stratum as it is unmonitored and EM_TRW-GOA as it is currently under Excluded Fishing Permit (EFP) status and will not be funded via the partial coverage monitoring budget.

The preferred bootstrapping method will be the method with the lowest bias and error relative to actual fishing in both the proximity indices and allocated rates. Note that in this exercise, we are evaluating the methods in terms of their predictive ability (using past to predict the future), and not evaluating how well these methods capture the true spatiotemporal arrangement of the prior fishing.

To control for changes in total fishing effort and to ensure that the proximity indices and monitoring rates generated for each bootstrapped population are comparable to the actual values for each year, bootstrapped populations contained the same number of fishing trips that actually occurred for that year. This way, any differences between bootstrapped and actual values can be attributed to differences in how well each bootstrap method mimics the spatiotemporal arrangement of fishing trips.

Four bootstrapping methods were evaluated:

- *SWR_1*: Sampling *with* replacement using 1 prior year of fishing effort (existing method)
- *SWOR_3*: Sampling *without* replacement using 3 prior years of fishing effort
- *SWOR_2*: Sampling *without* replacement using 2 prior years of fishing effort
- *SWOR_1*: Sampling *without* replacement using 1 prior year of fishing effort (if the number of trips to draw is higher than the number of trips in prior year, draw all trips once and then draw the remaining number of trips required without replacement)

Proximity Indices

During the allocation process, the proximity index is calculated for each stratum for a wide vector of assumed sample rates. However, to be able to make valid comparisons, we calculated the proximity index under a 15% selection rate using the 2024 strata definitions for each population constructed under each bootstrapping method. The proximity index ranges between 0 and 1, where values closer to 1 indicate that the spatio-temporal arrangement of fishing effort in a stratum is more clumped. A bootstrapping method that constructs populations with an average proximity index that is similar to that of the actual population of fishing trips (e.g., proximity index has minimal bias and error) is preferred, and differences relative to the proximity indices of actual fishing indicate whether bootstrapping methods result in populations that are either more clumped or more diffuse.

Each bootstrapping method was used to construct 100 simulation populations. For each population the proximity index was calculated assuming a 15% selection rate (Figure D-1).

Although *SWOR-1* and *SWR-1* performed similarly, *SWOR-1* methods produced populations with proximity indices with less bias and less variability (Figure D-1) relative to the actual (true) values. The smaller variability associated with proximity indices for populations generated by bootstrapping without replacement from the previous 1 year (*SWOR-1*) reflects the similarity between consecutive years in dispersion of fishing effort. In most cases, the bootstrapped populations differ by only a small number of trips and therefore the proximity values are virtually identical. However, both *SWR_1* and *SWOR_1* generated populations had less variability in proximity indices than either *SWOR_2* or *SWOR_3*, indicating that the spatio-temporal differences in fishing patterns accumulate over time.

The difference between the mean proximity index for populations generated with each method minus the actual proximity index (average(Predicted) - Actual) is a measure of the prediction accuracy (stratum-specific bias) for each method of generating populations of fishing effort (Figure D-2). These differences are greater, and more variable between years, for the OB_TRW-BSAI stratum due to the relatively large differences in the number of trips in that stratum between years (e.g., 31, 14, 37, 15, 31, 31 for 2018 through 2023, Table D-1). However, all methods are able to predict proximity within approximately +/- 0.1.

The bias and mean squared error (MSE) of the proximity indices for the predicted populations were calculated. Bias was estimated as the average difference between the mean predicted proximity index and the actual proximity index for each year. The MSE is estimated as the average of the squared differences for each of the 100 simulated populations.

All the simulation methods result in populations that are similar to the actual fishing for the stratum and year in terms of *proximity indices* (Figure D-3).

For the 2018-2023 period, the *SWOR_3* and *SWOR_2* methods both tend to underestimate the *proximity index*, potentially due to larger changes in fishing patterns over longer periods; clusters of fishing effort may not persist in the same time and space over multiple years. Combining fishing effort patterns across multiple years, probably creates a more diffuse prediction of fishing effort compared to the actual pattern seen in any single year. The *SWOR_1* method looks very similar to *SWR_1* but has overall less bias, especially for the EM_FIXED-GOA and EM_FIXED-BSAI strata.

Combining across strata, all bootstrapping methods generated simulated populations with similar variability in proximity indices (Table D-2). On average, *SWOR_1* has the lowest bias, overestimating proximity indices by only 0.0022. *SWOR_2* has the lowest MSE, but is more biased than *SWOR_1*.

Monitoring Rates

To evaluate whether the simulated populations are similar enough to actual fishing patterns, for each simulated population, the proximity allocation method was used to allocate available monitoring resources under a $5.819 million dollar budget. Monitoring rates for each of the simulated populations are presented in Figure D-4 along with the actual rates generated by proximity allocation (actual population of fishing effort) for a given year. In all cases, fishing effort was assigned to strata based on the 2024 strata definitions. Note that the Zero and EM_TRW strata are not included since monitoring effort is not allocated to those strata in the 2024 ADP.

For simulated populations generated under *SWOR_2* and *SWOR_3*, the proximity allocation method tended to over-allocate monitoring resources, resulting in higher monitoring rates than were assigned to strata (“true values”). In addition, since the proximity indices for populations generated using these bootstrapping methods were more variable, sampling rates also tended to vary more, resulting in larger differences from the true monitoring rate. It should be noted that the magnitude of the differences in sample rates were not as large as the differences in proximity indices. Strata with fewer trips tend to have greater variability on the estimated proximity indices, but the allocation algorithm is designed to also guard against low sample sizes for such strata, as opposed to simply maximizing proximity indices.

Monitoring rates generated under all the bootstrapping methods were within +/- 5 percentage points of actual on average (Figure D-5). Notice that all methods tended to over prescribe selection rates in 2021; this is due to increases in trip durations in 2020 and 2021. Overestimation of monitoring rates increased when more years of prior fishing effort were used in the bootstrapping process (*i.e.*, *SWOR_2* and *SWOR_3*).

Using the same estimation methods to calculate the bias and MSE of the estimated rates for the simulated populations for each bootstrapping method, *SWOR_1* populations have the least biased monitoring rates with the lowest MSE (Figure D-6).

Note that overestimation of proximity (Figure D-3) results in an underallocation of sampling (Figure D-6). As previously, *SWOR_1* performs best with consistently lower bias and lower MSE for all strata.

Combining across strata, all bootstrapping methods generated simulated populations with similar variability in proximity indices (Table D-3); however, the *SWOR_1* and *SWR_1* methods had the lowest bias over all strata and *SWOR_1* has the lowest MSE. *SWR_1* has the least bias; however this is due, at least in part, to the large EM_FIXED_BASI underestimation canceling the overestimation seen for the other strata (Figure D-6).

Conclusions

In order to simulate fishing effort distribution for a given number of trips in each stratum, four bootstrapping methods were evaluated: sampling with replacement from fishing effort in the previous year (*SWR_1*), and sampling without replacement from fishing effort in the previous year (*SWOR_1*), previous 2 years (*SWOR_2*), and previous 3 years (*SWOR_3*). Each of these methods were used to generate one-hundred simulated populations as predictions of fishing effort for years 2018-2023 and tested to assess whether the proximity indices estimated for a 15% monitoring rate were similar to the actual proximity index for that year, and whether allocation of monitoring effort under proximity allocation would result in monitoring rates similar to actual rates.

Populations generated using *SWOR_1* were most similar to actual fishing effort in the following year in terms of bias and MSE of both proximity indices and monitoring rates. Hence, ***SWOR_1* bootstrapping methods were used to simulate 2024 populations used to estimate monitoring rates for each stratum and total costs of sampling.**

Table D-1. Counts of trips in strata defined according to 2024 stratum definitions (e.g., monitoring method, gear type, and FMP) for fishing effort from years 2018-2023. Note that the zero selection pool (ZERO) was split by FMP solely for the sake of comparison and consistency with the monitored strata.

Stratum	2018	2019	2020	2021	2022	2023
EM_FIXED-BSAI	98	115	107	87	89	59
EM_FIXED-GOA	1,026	984	797	914	986	783
EM_TRW-GOA	1,041	881	832	661	768	654
OB_FIXED-BSAI	602	579	371	320	361	274
OB_FIXED-GOA	1,875	1,737	1,654	1,878	2,077	1,684
OB_TRW-BSAI	31	14	37	15	21	30
OB_TRW-GOA	683	592	458	334	371	295
ZERO-BSAI	530	739	311	191	134	105
ZERO-GOA	1,165	1,214	1,074	1,337	1,439	1,189
Total Monitored Strata	5,356	4,902	4,256	4,209	4673	3,779
Total	7,051	6,855	5,641	5,737	6,246	5,073

Table D-2. Bias and mean squared error (MSE) of estimated proximity indices under a 15% sample rate from simulated populations generated using four bootstrapping methods for years 2018-2023 and across all strata.

Method	Bias	MSE
SWR_1	0.01002	0.00503
SWOR_3	-0.02812	0.00438
SWOR_2	-0.01905	0.00326
SWOR_1	0.00219	0.00517

Table D-3. Bias and mean squared error (MSE) of monitoring rates based on proximity allocation and a $5.819 million dollar budget for simulated populations generated using four bootstrapping methods for years 2018-2023 and averaged across all strata.

Method	Bias	MSE
SWR_1	-0.00025	0.00078
SWOR_3	0.01821	0.00086
SWOR_2	0.01147	0.00077
SWOR_1	0.00299	0.00065

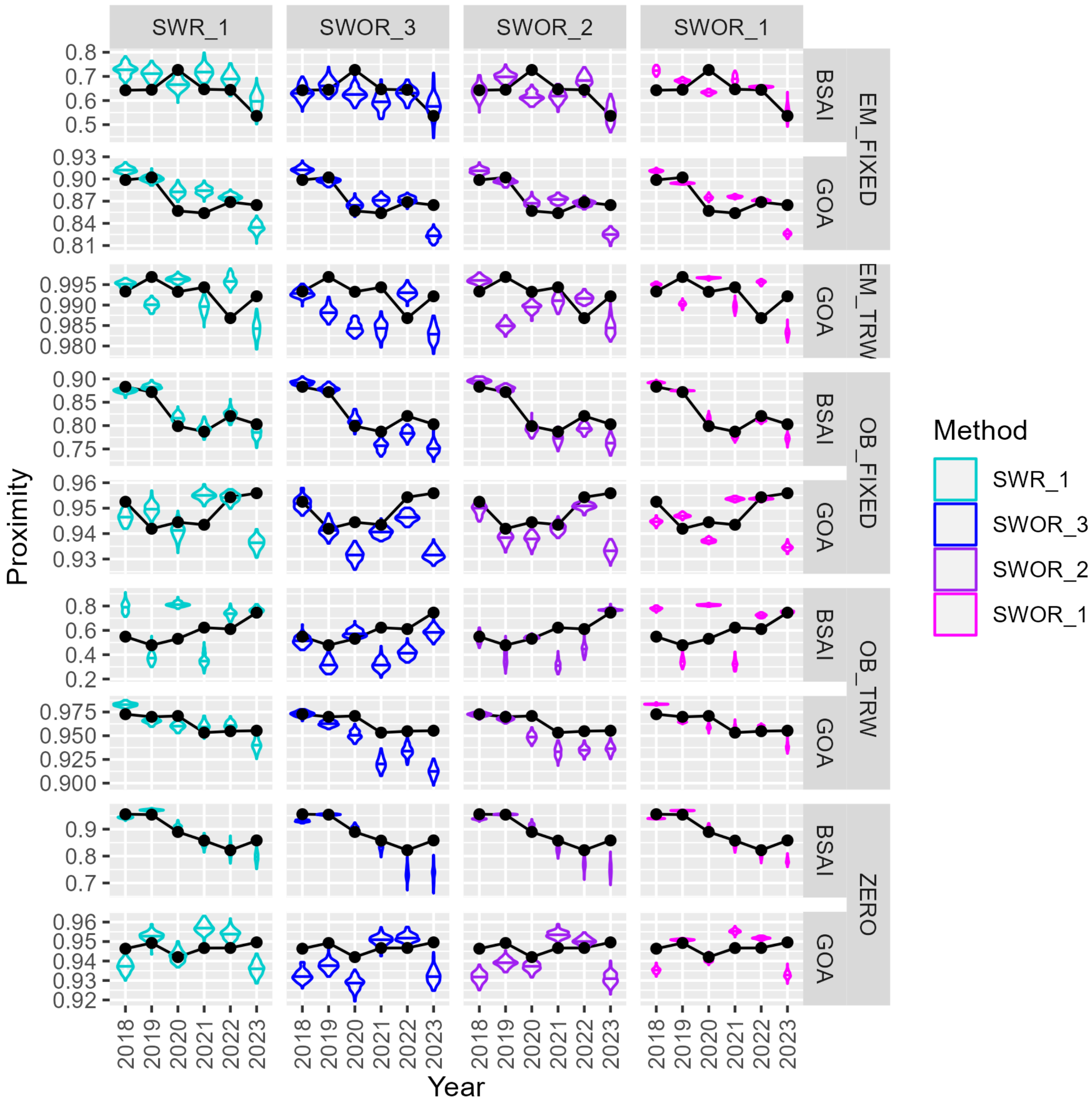


Figure D-1. Proximity indices for each stratum (using 2024 stratum definitions applied to past fishing effort back to 2015) assuming a 15% selection rate from four bootstrapping methods. Black data points indicate actual proximity values, outlined shapes show the distribution of estimates, and the horizontal lines within the distributions are the medians. Note the y-axis scale varies between strata.

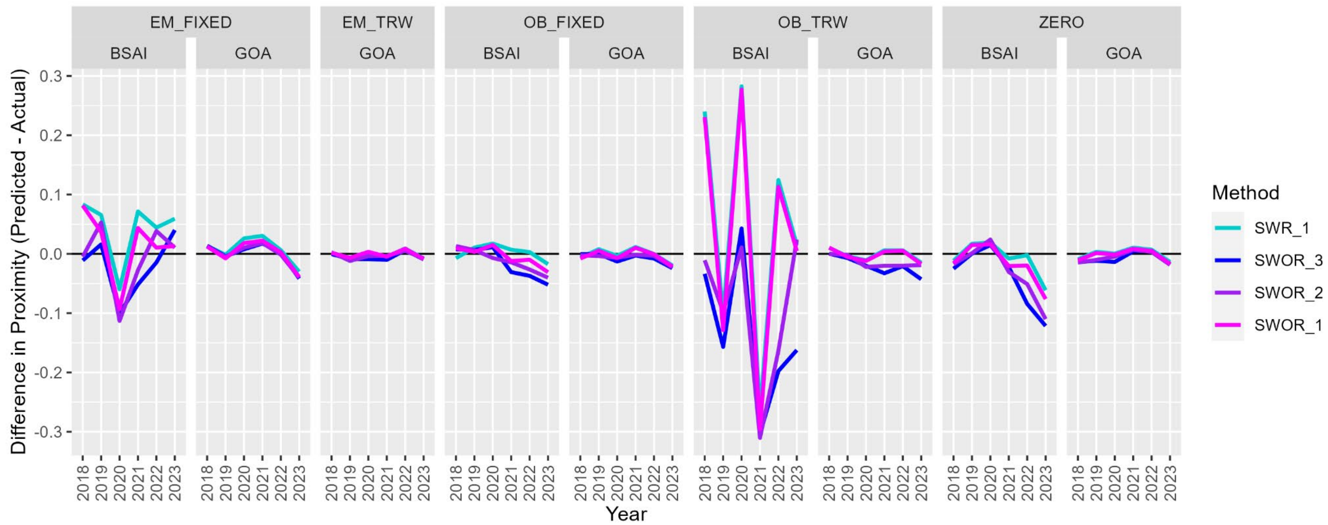


Figure D-2. Average differences in proximity index under 15% sampling between actual fishing effort (populations) and simulated populations generated under each bootstrap method.

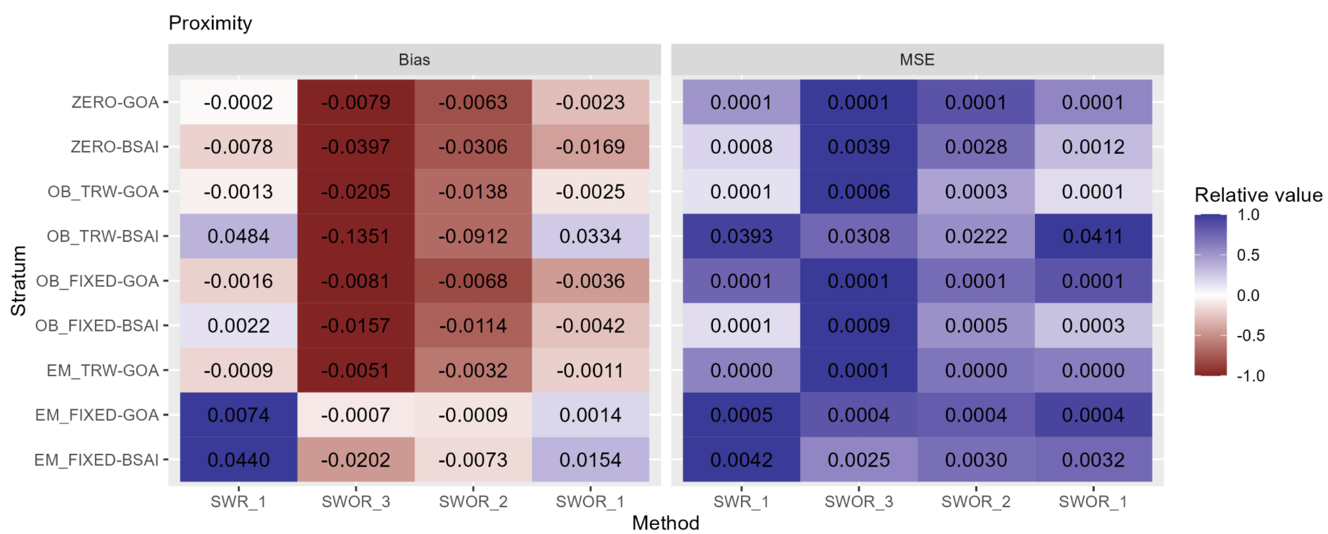


Figure D-3. Stratum-specific bias and MSE proximity index estimates for simulated populations generated under the four bootstrapping methods and sampled at a 15% rate.

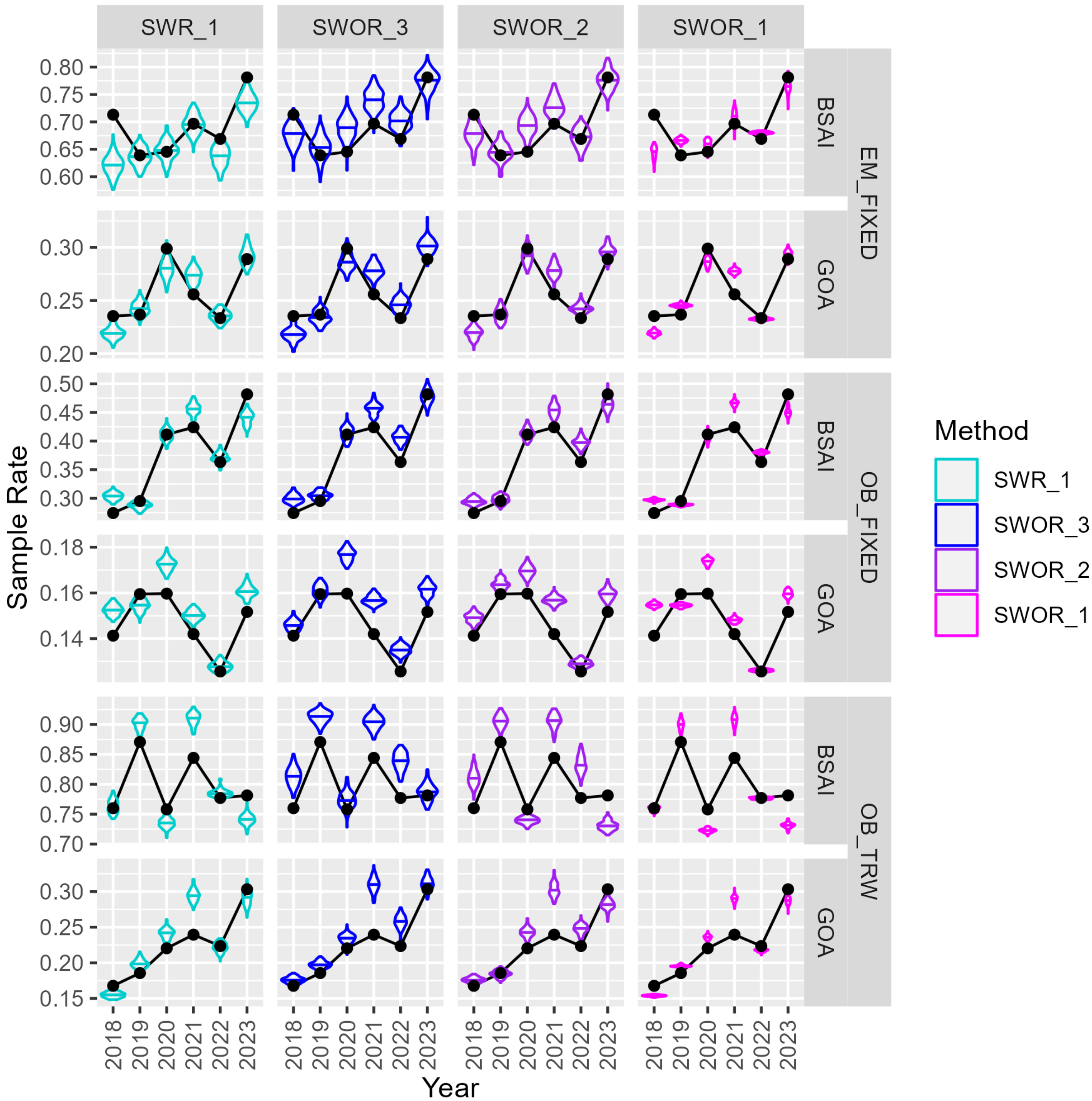


Figure D-4. Monitoring rates for each stratum based on the four proximity allocation methods and the 2024 stratum definitions applied to past fishing effort. Black data points indicate actual monitoring rates, outlined shapes show the distribution of estimates, and the horizontal line within the distributions is the median. Note the y-axis scale varies between strata.

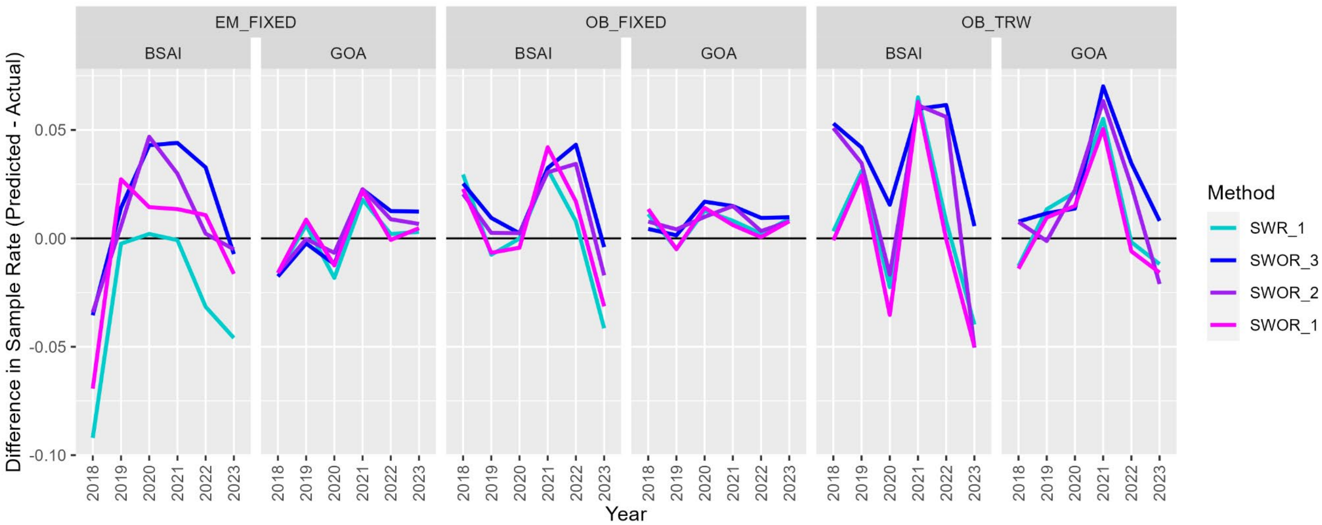


Figure D-5. Average differences in monitoring rates estimated using the proximity allocation method and a $5.819 million dollar budget for actual fishing effort (populations) and simulated populations generated under for each bootstrap method.

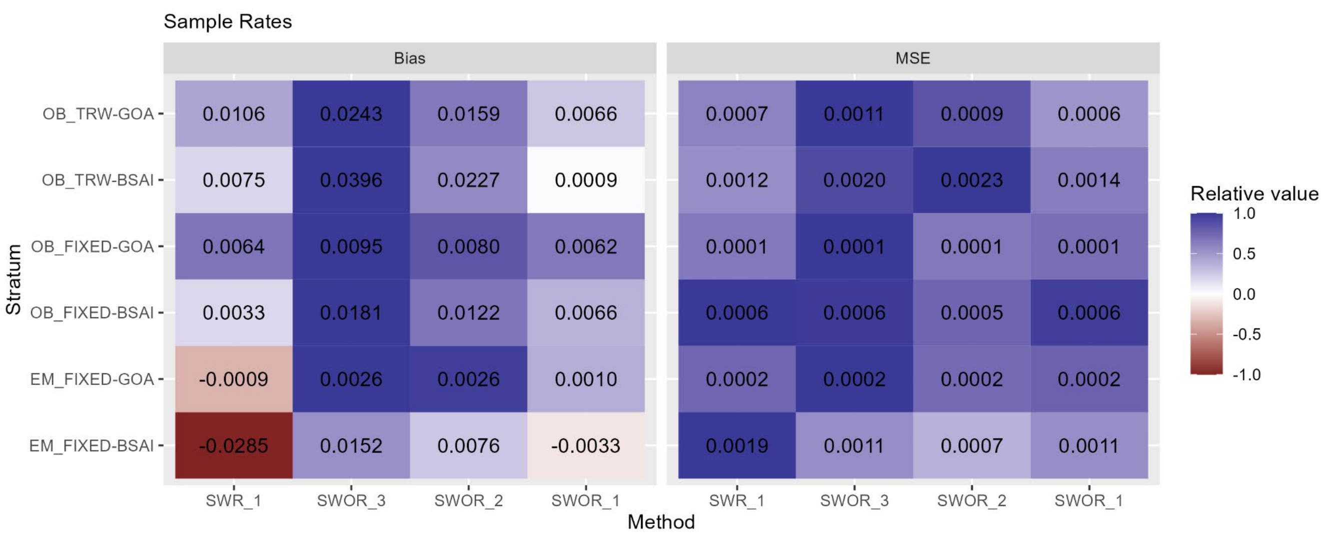


Figure D-6. Stratum-specific bias and MSEmean squared error of monitoring rates estimates for simulated populations generated under the four bootstrapping methods and a $5.819 million dollar budget.