DRAFT Supplement to the Environmental Assessment For Restructuring the Program for Observer Procurement and Deployment in the North Pacific

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Abstract: Under the North Pacific Groundfish and Halibut Observer Program, NMFS deploys observers on vessels and in processing facilities to obtain information necessary to conserve and manage the groundfish and halibut fisheries in the Gulf of Alaska, Bering Sea, and Aleutian Islands. This analysis supplements the 2011 Environmental Assessment for Restructuring the Program for Observer Procurement and Deployment in the North Pacific. NMFS prepared this supplement in response to a Court Order to consider whether the restructured Observer Program would yield reliable, high quality data given likely variations in costs and revenues. This supplement analyzes new information since the 2011 Environmental Assessment. NMFS has collected and analyzed observer data, costs, and fee revenue from two complete years under the new program, 2013 and 2014.

Note: print in color for the best results.

List of Acronyms and Abbreviations

ABC	acceptable biological catch
ADP	Annual Deployment Plan
AFA	American Fisheries Act
AFSC	Alaska Fisheries Science Center
BS	Bering Sea
BSAI	Bering Sea and Aleutian Islands
CAS	Catch Accounting System
CDQ	Western Alaska Community Development Quota
CEQ	Council on Environmental Quality
CFEC	Commercial Fishery Entry Commission
CFR	Code of Federal Regulations
Council or NPFMC	North Pacific Fishery Management Council
CP	catcher/processor
CRP	Cooperative Research Plan
CV	Coefficient of Variation
EA	Environmental Assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	Environmental Impact Statement
EM	electronic monitoring
ER	electronic reporting
ESA	Endangered Species Act
FMA	Fisheries Monitoring and Analysis
FMP	fishery management plan
FONSI	Finding of No Significant Impact
FR	*Federal Register*
ft	foot or feet
GOA	Gulf of Alaska
HAL	Hook and line
IFQ	individual fishing quota
IRFA	Initial Regulatory Flexibility Analysis
LOA	length overall
m	Meter or meters
MAD	Mean absolute deviation
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MS	mothership
mt	metric ton
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanic and Atmospheric Administration
NPT	Non-pelagic trawl
Observer Program	North Pacific Groundfish and Halibut Observer Program
OIG	Office of Inspector General
PPS	probability proportional to size
PSC	prohibited species catch
PSEIS	Programmatic Supplemental Environmental Impact Statement
PTR	Pelagic trawl
RIR	Regulatory Impact Review
SAFE	Stock Assessment and Fishery Evaluation
SEA	supplemental environmental assessment
TAC	total allowable catch
U.S.	United States
USFWS	United States Fish and Wildlife Service
VMS	vessel monitoring system

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Executive Summary

In 2013, National Marine Fisheries Service (NMFS) restructured the North Pacific Groundfish and Halibut Observer Program (Observer Program) to implement a rigorous scientific method for deploying observers onto more vessels in the Federal fisheries and a fee system to pay for observers deployed on those vessels with partial observer coverage (observer is on board for some fishing trips). The restructured Observer Program places all vessels and processors in the groundfish and halibut fisheries off Alaska into one of two categories: (1) the full coverage category, where observers are on board for every fishing trip and the vessels and processors obtain those observers by contracting directly with observer providers, and (2) the partial coverage category, where NMFS has the flexibility to deploy observers based on methods described in an annual deployment plan (ADP). Funds for deploying observers in the partial coverage category are provided through a system of fees based on the ex-vessel value of retained groundfish and halibut landings from vessels in the partial coverage category. The restructured Observer Program also increased the number of vessels with full observer coverage to include nearly all catcher/processors, all motherships, and any catcher vessels participating in a catch share program with a transferrable prohibited species catch (PSC) limit.

The North Pacific Fishery Management Council (Council) and NMFS developed the restructured Observer Program to address longstanding concerns about statistical bias of observer-collected data and cost inequality among fishery participants with the prior Observer Program's deployment and funding structure. The Observer Program was restructured with Amendment 86 to the Fishery Management Plan for Groundfish of the Bering Sea/Aleutian Islands Management Area (BSAI FMP), Amendment 76 to the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP) (collectively, Amendments 86/76), and the implementing final rule (77 FR 70062, November 21, 2012).

In partnership with the Council, NMFS prepared the *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* (2011 EA/RIR/IRFA, NPFMC and NOAA 2011) and a Finding of No Significant Impact (FONSI; NMFS 2012a). The EA/RIR/IFA was prepared as the central decision-making document for the Council to recommend Amendments 86/76, for the Secretary of Commerce to approve Amendments 86/76, and for NMFS to implement Amendments 86/76 through Federal regulations.

Concurrent with the development of the final rule, NMFS considered Council input when it developed the 2013 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska (2013 ADP, NMFS 2013a). On January 1, 2013, NMFS began deploying observers on vessels under the new program and assessing fees. NMFS has subsequently issued two additional ADPs (2014 and 2015), and a full Annual Report evaluating observer deployment and coverage under the 2013 ADP (NMFS 2014a). NMFS issued the second Annual Report evaluating observer deployment and coverage under the 2014 ADP in May 2015 (2015a).

The Boat Company filed a lawsuit against NMFS challenging the restructured Observer Program in the District Court of Alaska. In August 2014, the United States District Court for the District of Alaska issued a decision in the case of *The Boat Company v. Pritzker*, No. 3:12-cv-250-HRH. The court upheld the final rule, finding that the new program instituted significant improvements that should be allowed to stand. The court, however, found that NMFS violated the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), the National Environmental Policy Act (NEPA) and the

Administrative Procedure Act by failing to consider whether data collected by observers would be reliable in the face of significant observer cost increases.

The Court Order contained very specific direction for analysis in the SEA. The Court Order centered on the theme that NMFS did not consider whether the restructured Observer Program would yield reliable, high quality data given likely variations in costs and revenues. The Court found that the 2011 EA/RIR/IRFA was inadequate because it failed to address the risk to data quality that may result from increased observer costs and decreased observer coverage. This SEA directly responds to this Court Order in Chapters 3, 4, and 5. In Chapter 6, this SEA uses the new information and analysis from chapters 3, 4, and 5 to build on the impacts analysis completed in the 2011 EA/RIR/IRFA.

This SEA provides new information since the 2011 EA/RIR/IRFA was finalized. NMFS has collected and analyzed observer data from two complete years under the restructured Observer Program, 2013 and 2014. NMFS also has cost and fee revenue data from 2013 and 2014.

Restructured Observer Program

This SEA analyzes the restructured Observer Program relative to the previous Observer Program with the new information available since 2011. Chapter 2 compares the relevant primary features of the restructured Observer Program as implemented by the final rule and subsequent ADPs, relative to the previous program. These are summarized below.

Full Coverage Category
The restructured Observer Program increased the number of participants in the full coverage category but did not make structural changes to the deployment or funding of observers in the full coverage category. Full coverage means that one or more observers are deployed on all fishing trips or available at processing plants to sample every fish delivery. Under the restructured Observer Program, NMFS bases observer coverage categories on data needs for specific management programs rather than requirements based on vessel length or processing volume. NMFS removed the length and volume-based requirements that applied to the previous Observer Program, and now assigns vessels and processors to either the partial or full coverage category based on NMFS's data needs. The result of this change was to require full coverage on 1) most catcher/processors participating in the groundfish or halibut fisheries, 2) all motherships, 3) participants in programs where catch is allocated to specific entities with quotas and PSC limits, and 4) inshore processors when receiving or processing Bering Sea pollock.

Partial Coverage Category
The partial coverage category is for shoreside processors and vessels that are required to carry or provide an observer for less than 100% of their operations. The restructured Observer Program greatly increased the number of vessels that are subject to observer coverage in the partial coverage category. This included vessels in the halibut fishery and groundfish vessels less than 60 ft length overall (LOA) that had never carried an observer under the previous Observer Program. Expanding observer coverage to previously unobserved vessels improves NMFS's ability to estimate total catch in all Federal fisheries in the North Pacific.

Coverage Rates
In the previous Observer Program, vessels between 60 ft and 125 ft LOA were required to carry an observer on 30% of fishing days by calendar quarter for each target fishery and NMFS had no observer data from vessels less than 60 ft LOA participating in Federal fisheries. This resulted in spatial and temporal coverage issues since vessels not required to carry an observer fished in nearshore areas where some species commonly occur (e.g., Gasper and Kruse 2013, Mecklenburg et al 2012). In addition, the previous observer coverage regulations created a clustering of observer coverage as vessels met their

coverage requirements during the quarterly period. See Chapter 3 for a comprehensive assessment of observer coverage.

Under the restructured Observer Program, coverage rates are estimated for each fishing year through the ADP process. The ADP provides flexibility that allows sampling rates to be adjusted and improved such that scientific and management objectives can be met. The ADP also provides an annual evaluation of the risks associated with different allocations of deployment rates. A critical component to the program is to provide a transparent and scientific process to adjust sampling. The Annual Report provides a set of performance metrics that provide a framework from which NMFS can evaluate whether sampling goal were met and identify improvement. This process has resulted in data from the first two years of the restructured Observer Program that represent more fisheries, provide information from more areas, and better represent fishing effort than under the previous program.

Sampling Method

The restructured Observer Program complies with the Magnuson-Stevens Act requirement that NMFS station observers on all or a statistically reliable sample of fishing vessels and processors necessary for conservation, management, and scientific understanding of the fisheries covered by the fisheries research plan (16 U.S.C. 1862(b)(1)(A)). The previous Observer Program did not deploy observers using well-established random sampling methods because fishermen could choose when to take observers to fulfill their observer coverage requirement. The ad-hoc deployment method prevented representative sampling across all fishing trips, resulting in sampling effort that did not correspond with fishing effort and that resulted in consistent problems with under or over coverage in fisheries in the 30% observer coverage category.

To estimate total catch and fulfill our responsibilities for sustainable fisheries, NMFS relies on the use of statistics and sampling. For example, NMFS conducts scientific surveys that only encounter a small fraction of the total biomass, but through the use of statistical sampling and modeling procedures NMFS estimates the total abundance of a species. NMFS uses statistics to guide the decisions about what information the observer collects on the vessel or at the processing plant. NMFS uses statistics in the expansions of observer data to total catch estimates for the fisheries. And, with the Observer Program restructuring action, NMFS now use statistics to determine which vessels and which trips are required to have observer coverage.

A major accomplishment of the restructured Observer Program was the implementation of a scientific sampling plan for deploying observers. A general description of sampling involves the collection of information from a subset of individuals within a population to estimate characteristics of a whole population. In the case of fishery information, bias is introduced when the sample (i.e., observed trips) does not represent fishing activity to which it is expanded (i.e., population of all fishing trips). The restructured Observer Program increases coverage by sampling vessels previously unobserved, and that coverage is generating better data that allows NMFS to produce more reliable estimates of catch and bycatch. See Section 3.2 for a comprehensive discussion of sampling under the restructured Observer Program.

Analysis and evaluation of the data collected by observers is an on-going process. This process was specifically designed to reduce bias in fishery dependent data by using a scientific method to deploy observers. The scientific sampling plan results in better spatial and temporal distribution of observer coverage across all fisheries. This greatly improves NMFS's confidence in catch and bycatch estimation and greatly improves the quality of data collected in Federal fisheries. Random deployment will greatly improve NMFS's ability to evaluate the statistical properties of estimators and improve catch estimation procedures in the future.

Annual Analysis and Evaluation
An integral part of the restructured Observer Program is the annual analysis and evaluation of the deployment methods. The restructured Observer Program established an annual process of 1) developing an ADP that describes plans and goals for observer deployment in the partial coverage category in the upcoming year, and 2) preparing an annual report providing information and evaluating performance in the prior year. Relevant information from the ADPs and Annual Reports is summarized in this SEA.

The ADPs analyzes sampling methods and describes deployment of observers on vessels and processing plants under the partial coverage category. The ADP presents information on deployment methods NMFS will use in the partial coverage category in the upcoming year, including assignment of vessels to selection pools, and the allocation of observers among selection pools and processors.

The Annual Reports provides performance measures to assess the effectiveness of randomization of observer deployments. The Annual Report uses performance metrics to evaluate the observer data resulting from the sampling methods defined in the ADPs. This evaluation determines whether target sampling rates were achieved, the degree to which the observed sample represented the target population, and non-response errors. The ADP also provides an analysis of sample-size through an examination of the probability of selecting a sample and having cells (e.g., defined by gear and NMFS Reporting Area) with no observer coverage.

Fees and Funding
The fee system used in the restructured Observer Program follows the Magnuson-Stevens Act requirements in 16 U.S.C. 1862(a)(2) and (b)(2). The fee system replaces the previous pay-as-you-go method in the partial coverage category where vessel owners directly paid for their observer. The fee-based system allows the observer coverage in the partial coverage category to be paid for by industry and provides a consistent source of revenue directly linked to the value of the fishery.

The restructured Observer Program implemented a 1.25% fee based on the ex-vessel value of groundfish and halibut in fisheries subject to the fee. Through the fees, owners and operators compensate the Federal Government for the costs associated with managing fishery resources. In its final motion, the Council committed to annually reviewing the fee percentage after the second year of the program based on information in the Annual Report.

For 2013, the first year of implementation, NMFS used Federal start-up funds to transition from the existing industry-funded/direct contract model to one where NMFS contracts with observer providers to deploy observers in partial coverage category. NMFS also used Federal funds to pay for observer coverage in 2014 and 2015.

Observer Coverage Assessment

In the 2011 EA/RIR/IRFA, NMFS did not consider whether the restructured Observer Program would yield reliable data with the increase in the actual cost per observer day relative to the anticipated cost per day. The higher actual cost per observer day resulted in lower than anticipated observer coverage rates. The analysis in Chapter 3 assesses changes to the quality of the data derived from the restructured Observer Program versus the previous program and the potential impact on the quality of estimates due to changes in coverage rates. Results from the analysis in Chapter 3 show that the data collected under the restructured Observer Program is more reliable than data under the previous program, even though the cost per observer day were higher than anticipated in the 2011 analysis.

An important goal of observer restructuring is to collect representative at-sea and shoreside data from fisheries for which full coverage is not required by Federal regulation. Reviews of the previous program highlighted concerns about non-representative sampling (MRAG 2000). Regulations implemented under the restructured Observer Program are responsive to this criticism by creating an annual process to evaluate and adjust deployment using scientific methods (e.g., stratified random sampling). The Observer Program had not deployed observers using random selection prior to restructuring. The lack of prior experience made forecasting per day costs difficult and the realized costs under the new program were much higher than anticipated. Thus, given the disparity in the forecasted costs and the realized costs, it is important for us to evaluate the data quality resulting from the new program (2013-2014) relative to the previous program, and to estimate realistic future revenue in terms of days afforded and coverage rates.

Since observer data collected in the partial coverage category is extrapolated in the Catch Accounting System (CAS) to create estimates of catch for groundfish fishing operations, it is important that NMFS collects observer data from a representative sample of fishing operations. These catch estimates are then used by NMFS to close fisheries, prevent exceeding annual catch limits, prevent overfishing, and monitor bycatch. The main sampling issues addressed under the restructured Observer Program are to collect at-sea information on previously unobserved portions of the fishing fleet (halibut individual fishing quota (IFQ) vessels and vessels between 60 ft and 40 ft LOA), and to address the potential bias caused by the self-selection of observed trips for vessels formerly under 30% coverage requirements.

Section 3.2 describes the increase in the number of trips that are now subject to observer coverage that previously were not, the increased spatial distribution of catch subject to observer coverage, and the increase in catch data provided from the IFQ halibut program. The new program improved the sampling frame so that the opportunity to sample vessels increased by 51-55%. The expanded sampling frame created by the restructured Observer Program also resulted in better spatial distribution of sampling relative to the fishery footprint (Section 3.2.1). Previous analysis suggested there was poor coverage in nearshore areas, particularly southeastern Alaska and other nearshore areas in the Central and Western Gulf of Alaska (Gasper and Kruse 2013). The spatial distribution of observer coverage under the restructured Observer Program includes areas not previously covered, particularly nearshore areas. Further, observer coverage now tracks fishing effort throughout the course of year, greatly reducing parts of the year being over or under represented in the observer data (Section 3.3.1). Under the previous program, particularly the trawl fisheries, a clustering of coverage near the end of the quarter as vessel operators took observers to meet coverage requirements was thought to occur (NMFS 2009). Some fisheries would also see spikes in coverage due to vessels voluntarily taking observers, while leaving other fisheries with lower coverage since quarterly coverage requirements were met. Data collected under the restructured Observer Program also showed higher species diversity and because of more data being available in the IFQ fishery, discard was estimated on more trips then under the previous program.

Section 3.4 assesses the risk of gaps in observer data for catch estimation under a range of different observer coverage levels. The analysis examines where gaps in data may occur in catch estimation at two levels: the reporting area (e.g., Area 610, 620, or 630 in the GOA); and the FMP area level (e.g., BSAI or GOA). If reporting area level observer data are not available, then estimation of discarded catch still occurs at the FMP area level; however, if FMP area level observer data are not available then estimates cannot be made.

Overall, the Chapter 3 analysis describes several broad trends associated with the deployment across both small and large vessels: 1) even at the higher than anticipated costs, the observer data collected under the restructured program is more reliable than the previous program; 2) as deployment rates increased, the probability of not having FMP-level and reporting-area data on discarded catch in a fishery declined; and 3) even at observer deployment rates <15% there was generally sufficient observer coverage to provide estimates of discards at an FMP-level for vessels in both the small vessel and large vessel categories. For example, at coverage rates of 10%, potential estimation gaps (i.e., no estimates under the FMP) under the current CAS configuration are likely to develop for only 5% to 6% of all trips in the small vessel stratum.

Many of these estimation gaps were related to vessels not being in the sample frame (i.e., there is no coverage for vessels under 40 ft LOA), resulting in gaps that persisted even at high coverage levels. The sampling frame issue can only be addressed through improvements in deployment (e.g., data collection on vessels less than or equal to 40 ft LOA). However, estimation gaps can be addressed by better utilizing observer data in CAS. NMFS is currently evaluating estimation procedures in CAS to improve estimation, including evaluating situations where estimation gaps develop and improving estimation methods to eliminate gaps.

Observer Fee Revenues and Coverage

The court order requires NMFS to consider two important program elements as they relate to funding and data quality: 1) did unanticipated contract costs prevent the collection of reliable information, and 2) does observer information cease to be reliable under a reasonable range of deployment rates? Chapter 3 discusses data quality as it relates to coverage levels under the 2013 and 2014 ADPs, and provides information on estimation gaps at different deployment rates. The deployment rates associated with estimation gaps are to be viewed in context with the range of reasonably foreseeable deployment rates provided in Chapter 4. Chapter 4 discusses the anticipated fee revenues, costs, and coverage amounts presented in the 2011 EA/RIR/IRFA under the restructured Observer Program and how those compare with the actual fee revenues, costs, and coverage in 2013, 2014, and anticipated for 2015.

Observer coverage rates are affected by the number of observer days purchased with existing fee revenues, effort in the two partial coverage strata (large and small vessel), and the allocation of deployment between the two strata. Chapter 4 evaluates a range of realistic possible observer coverage rates in the partial coverage category by evaluating recent information on: 1) catch and ex-vessel prices, which both contribute to the observer fee revenues; 2) observer costs per day; and 3) fishery effort. The range of coverage rates was estimated using fee, effort, and cost data from the first two years of the restructured Observer Program (2013 and 2014), and using fee and effort data from the preceding 4 years (2009-2012) as if the new program had been in place during those years. While Federal funds have contributed to the Observer Program since restructuring, the number of observer days used in this analysis reflects fee revenues alone.

Over the analyzed time-period, the estimated observer fee revenues ranged from $3.4 million to $5.6 million dollars, with an average of $4.5 million dollars. This is similar to the 2011 EA/RIR/RIFA projected fee revenue of $4.2 million. The analysis estimates the cost per observer day at $1,040 for the partial coverage category. The estimated cost per-day of $1,040 provided in Chapter 4 is a reasonable estimate of daily observer costs. These costs are likely to be fairly stable for the foreseeable future (i.e., the new contract is for 5 years starting in 2015).

Chapter 4 identifies a continuum of observer coverage rates over this time period based on known effort and estimated observer days available. Based on the cost per observer day and the revenues available from fees, between 3,243 and 5,345 observer days could have been purchased in the partial coverage category. Over the time period examined, and with equal deployment between strata, coverage rates between 13.7% and 19.4% were predicted. However, NMFS has the ability to allocate deployment between strata through the ADP process and policy choices of the Council influence observer coverage between the large and small vessel strata.

Since Federal funds paid for observer coverage in 2013 and subsidized coverage in 2014 (and thus effectively offset some costs), it is important to put the realized days purchased in context with the estimated number of days that could have been afforded in 2013 and 2014 based on fees. The realized number of days purchased in 2013 was lower than what could have occurred if fees had been available because NMFS used startup funding in 2013. In 2014, there was only a small difference between days purchased based on fees and those purchased using a combination of fees and the NMFS subsidy. Thus, evaluation of data collected in 2013 and 2014 under the new program and the improvements to reliability described in Chapter 3 (Sections 3.2 and 3.3) reflect an accurate "result" of data collection under the increased cost per observer day relative to the anticipated costs in the 2011 EA/RIR/IRFA.

In order to evaluate a reasonable range of rates and the impact of these rates on the quality of estimates, NMFS used historical catch and ex-vessel value data to determine a range of deployment rates. The range of deployment rates can also be evaluated for extreme situations by taking the lowest estimated number of trips afforded (811 in 2015) and dividing it by the highest amount of effort (8,322 trips in 2012), and taking the highest estimated number of trips afforded (1,242 trips in 2012) and dividing it by the lowest effort (6,220 trips in 2013). This provides a range of observer coverage rates of 10% to 20% that could be afforded from fees (not including NMFS contributions) for vessels greater than 40 ft LOA and in the partial coverage category. Chapter 3 also evaluates the impact on estimation due to deployment rates outside of the 10% to 20% range in response to questions by the Court to evaluate the consequences on changes in deployment rates as they correspond to data quality. NMFS generally found even at low deployment rates, estimates can be made for nearly the entire fishery. In addition, the trends in estimation gaps certainly indicate data quality is a continuum and a single threshold is not appropriate, nor desired, for such a complicated and diverse program. The flexibility afforded NMFS and the Council through the ADP process allows the Observer Program to adapt, as new scientific information is available, and also to inform future changes in estimation methods that will result in better use of observer data under existing funding levels.

Risk that fee revenues will not buy adequate observer coverage

Chapter 5 synthesizes the information in Chapters 3 and 4 to assess the risk that fee revenues will not buy adequate observer coverage. The results of this analysis demonstrate that with current revenues NMFS is able to provide catch estimates for nearly the entire groundfish and halibut fishery in the North Pacific. The results suggest changes to estimation methods in the CAS would better utilize observer information and improve NMFS ability to estimate catch as long as the underlying sample collection remains representative. Chapter 3 provides a detailed overview and analysis of improvements of the restructured Observer Program relative to the previous program, reaching the conclusion the new program is more statistically reliable than the previous program at realized coverage rates and increased costs. NMFS can likely make improvements to its estimation methods to better utilize observer information, but this does not mean estimates cannot be reliably made even if coverage levels become low.

The analysis also demonstrated that reliability does become a problem when samples cannot be collected from certain portions of the fleet (i.e., small vessels); however, there are practical limitations to where observers can sample (i.e., logistics and safety) and the current ADP sampling strata reflect those limitations. NMFS can continue to work on these limitations through the ADP process and efforts to put electronic monitoring on vessels, but in the meantime NMFS can also change estimation methods in the CAS to insure catch is accounted for on small vessels (e.g., BSAI small vessels). The analysis also evaluated the impact on estimates at a range of coverage levels (Section 3.4). The important caveat with this analysis is that the restructuring action was specific to the collection of representative data and not issues with estimation methods. However, there is obviously a connection between the amount of coverage and the impact on estimation as currently configured in the CAS. The impacts on estimation are different for the small vessel stratum and large vessels stratum (noting these strata could be changed under future ADPs), and NMFS is investigating methods to better utilize observer information for estimation.

Chapter 5 explains that there are a multitude of potential risks to missing data that occur along a continuum of coverage rates and fishing effort. For example, at coverage rates of 10%, potential estimation gaps (i.e., no estimates under the FMP) are likely to develop for 5% to 6% of all trips in the small vessel stratum. Many of these estimation gaps were related to vessels not being in the sample frame, resulting in gaps that persisted even at high coverage levels (i.e., 6% of the trips were estimated regardless of coverage level). The sampling frame issue can only be addressed through improvements in deployment (e.g., data collection on vessels less than 40 ft LOA) and adjustments to CAS methods to insure estimation occurs. However, regardless of the sampling frame issues, the current sampling frame and methods defined under the 2013, 2014, and 2015 ADPs are a large improvement compared to the previous program and provide reliable information across reasonably foreseeable deployment rates.

As with the small vessel stratum, Chapter 3 identified potential estimation gaps under the large vessel sampling stratum increased with decreasing deployment rates. There were clearly some estimation gaps that were small and defined by fisheries that only occurred in certain reporting areas during short periods of time. These gaps persisted from the reporting area level priority of estimation to the FMP level priority of estimation. High coverage rates are required to cover these post-strata estimation gaps due to the low number of trips and relatively short time period for which the fishery is conducted. However, to try and fill these target-specific gaps through changes to the sampling strata would not be effective since they are specific to a trip target, which is unknown prior to deployment. NMFS plans to evaluate these gaps through ongoing assessment of the design of post-strata and the statistical properties of the estimators used in the CAS. Some gaps may also be identified and changed in future ADPs (e.g., specific gear types with low probabilities of coverage). In this way, many of these coverage gaps can be addressed and situations where they cannot be addressed through changes to CAS methods can be exposed. In these situations, the ability to leverage the ADP process under the restructure Observer Program will be a powerful tool to improve data collection and also improves the quality of the estimates based on these data.

Even at lower coverage levels, the impacts on data quality are not expected to be significant; especially given improvements under the restructured Observer Program relative to the previous program, and current efforts to evaluate CAS methods. The improvements described in Chapter 3 have resulted in better information for the management and conservation of the North Pacific fisheries resources. However, this is not to say concerns about estimation at low levels of observer coverage do not exist. Deployment rates below 25% increase the number of trips where estimates are not made due to lack of observer information. However, in evaluating environmental impacts, there is an important difference between data collection versus estimation methods; CAS estimation methods can be changed to insure estimates are made and total catch accounted. This is accomplished by changing the methods used to aggregate the observer information used for bycatch rates. The tradeoff is that estimates may not be gear and reporting area specific, or close in time (e.g., averaging across 3 months versus 5-weeks). If mangers desire estimates to be predominantly specific to a gear and reporting area, then deployment rates of at least 20% in the large vessel stratum and even higher coverage rates (>30%) for the small vessel stratum will be required (Figure B-2 the 2014 ADP [NMFS 2013b]). The consequence of aggregating information across reporting areas is a potential loss of precision and an increased risk for bias in some situations. Based on past evaluations (e.g., Cahalan et al. 2015 and Cahalan et al. In Press), the impact on estimation from crossing reporting areas will vary for each species estimated (across hundreds of species) and hence will not be uniformly “bad” or “good.” This evaluation is part of the ongoing work to investigate and improve CAS estimates.

Probable Environmental Impacts

In the 2011 EA/RIR/IRFA, the Council and NMFS expected additional benefits from improved observer data from the restructured Observer Program, compared to the previous Observer Program. Chapter 6 uses the new information and analysis from Chapters 3, 4, and 5 to build on the environmental impact analysis completed in the 2011 EA/RIR/IRFA.

Chapter 6 evaluates the three types of benefits identified in the 2011 EA/RIR/IRFA from improved observer deployment methods under the restructured Observer Program—

- Reducing sources of bias.
- Reducing data gaps: lack of data in 30% observer coverage sectors and sectors without observer coverage requirements.
- Targeting observer coverage to address data needs.

As describer in Chapter 6, the restructured Observer Program achieves these benefits predicted in the 2011 EA/RIR/IRFA at the realized coverage rates and with the deployment methods implemented in 2013, 2014, and 2015. Additionally, due to the implementation of a statistically reliable sampling design, NMFS expects to realize these benefits at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

Chapter 6 also analyzes potential physical and biological impacts of the restructured Observer Program identified in the 2011 EA/RIR/IRFA compared to NMFS's analysis of the implemented restructured Observer Program in Chapters 3, 4, and 5. Chapter 6 analyzes impacts on—

- target and incidental catch,
- prohibited species catch,
- marine mammals,
- seabirds,
- ecosystem, and
- habitat.

The impacts analysis in this SEA reaches the same conclusions as the 2011 EA/RIR/IRFA. Given that the restructured Observer Program does not increase in fishing activity or change measures currently in place to protect the physical and biological environment, no significant adverse impacts to target species, other species, prohibited species, marine mammals, seabirds, habitat, or ecosystem relations are anticipated. Improved observer data and monitoring under the restructured Observer Program generates better information to make in-season management and policy decisions, facilitating the attainment of optimum yield, and enhancing the sustained health of the resource, fishing sectors, and dependent communities. Additionally, due to the implementation of a statistically reliable sampling design, NMFS expects to realize these benefits at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

Despite the per-day costs being higher than anticipated, inclusion of small vessels and halibut IFQ vessels under the restructure Observer Program improved the representativeness of data compared to the previous program (see Section 3.1); improvement occurred even at very low deployment rates in the small vessel frame (given the rate prior to restructuring was 0%). These improvements resulted in more nearshore data and better representation of the small vessels and halibut fisheries in 2013 and 2014 (see Section 3.2.1). This improved data in turn allowed estimation to occur when it previously had not under the previous program. These new estimates provided important new information to stock assessment authors and inseason managers on sensitive species such as skates, sharks, and rockfish. This new information raised management concerns for rockfish in the BSAI and skates in the GOA due to catch exceeding acceptable biological catch limits because inseason mangers did not previously have information from which to manage these species.

Implementation of the random sampling methods for the large vessel stratum improved the representativeness of effort for vessels that had had observer coverage under the previous program. This was apparent by observer coverage better tracking actual fishing effort through the year rather than deviating from effort as fishery participants chose when to carry an observer. There were also spatial improvements in the trawl fishery as noted by coverage in the western GOA. Coverage in 2013 and 2014 also resulted in most PSC estimates being made specific to a target and reporting area, which is a result of deployment better representing fishing effort.

The cumulative effects analysis in Section 5.3 considers the amendments to the regulations governing the Observer Program that may be implemented in the next few years. Some of these amendments would make relatively minor changes in the circumstances under which vessels are placed in the partial versus full observer coverage categories. Other proposals would make more significant or large scale changes to the restructured Observer Program. For purposes of this SEA, the most important aspects of these possible future regulatory actions are 1) the impacts on observer fee collections, 2) the total number of trips in the partial coverage category, 3) information relative to the cost or efficiency of deploying observers in the partial coverage category, and 4) impacts on data quality. The impact of an action on the amount of the observer fee is important because it determines the amount of money available to deploy observers in the partial coverage category. The impact of an action on the total number of trips in the partial coverage category is important because it affects the sampling or deployment rate that can be achieved for a given amount of observer fees or budget. Circumstances that affect travel costs or non-fishing days may affect the average cost of deploying observers in the partial coverage category.

The proposed revisions to the Observer Program described in this SEA are—

- Observer coverage requirements for small vessels in the Western Alaska Community Development Quota (CDQ) Program fisheries,
- Observer coverage requirements for small catcher/processors,
- Voluntary full coverage for trawl catcher vessels in the BSAI Pacific cod fishery,
- Observer coverage requirements for trawl catcher vessels harvesting groundfish in the GOA,
- Observer coverage requirements for vessels delivering to tenders, and
- Electronic monitoring.

1 Introduction

The North Pacific Groundfish and Halibut Observer Program (Observer Program) provides the framework for observers to obtain information necessary to conserve and manage the groundfish and halibut fisheries in the Gulf of Alaska (GOA) and the Bering Sea and Aleutian Islands (BSAI) management areas. The Observer Program was created with the implementation of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) in the mid-1970s and has evolved from primarily observing foreign fleets to observing domestic fleets. Data collected by well-trained, independent observers are a cornerstone of management of the Federal fisheries off Alaska. These data are needed by the North Pacific Fishery Management Council (Council) and NMFS to comply with the Magnuson-Stevens Act, the Marine Mammal Protection Act, the Endangered Species Act, and other applicable Federal laws and treaties.

In 2013, NMFS restructured the Observer Program to implement a rigorous scientific method for deploying observers onto more vessels in the Federal fisheries and a fee system to pay for observers deployed on those vessels with partial observer coverage (observer is on board for some fishing trips). The Observer Program places all vessels and processors in the groundfish and halibut fisheries off Alaska into one of two categories: (1) the full coverage category, where observers are on board for every fishing trip and the vessels and processors obtain those observers by contracting directly with observer providers, and (2) the partial coverage category, where NMFS has the flexibility to deploy observers when and where they are needed based on methods described in an annual deployment plan (ADP). Funds for deploying observers in the partial coverage category are provided through a system of fees based on the ex-vessel value of retained groundfish and halibut landings from vessels that are not in the full coverage category. The restructured Observer Program also increased the number of vessels with full observer coverage to include nearly all catcher/processors, all motherships, and any catcher vessels participating in a catch share program with a transferrable prohibited species catch (PSC) limit.

Observers collect biological samples and fishery-dependent information used to estimate total catch and interactions with protected species. Managers use data collected by observers to manage groundfish and PSC with established limits and to document and reduce fishery interactions with protected species. Scientists use observer data to assess fish stocks, to provide scientific information for fisheries and ecosystem research and fishing fleet behavior, to assess marine mammal and seabird interactions with fishing gear, and to assess fishing interactions with habitat. Although NMFS is working with the Council and industry to develop methods to collect some of these data electronically, currently much of this information can only be collected independently by human observers.

At-sea observer data plays a key role in the NMFS catch accounting system (CAS), and allows the agency to gain an objective perspective and independent measurement of the amount and numbers of all species that are caught in the commercial groundfish and halibut fisheries in the GOA and BSAI. In assessing total catch and bycatch of all species, NMFS must consider commercially important species such as groundfish, salmon, crab, and halibut, as well protected species such as marine mammals and seabirds, and discards of other groundfish and ecosystem species such as sponges, coral, and sharks. Observer data provides a direct estimate of species composition and weight, as well as a means to calculate catch and bycatch rates for unobserved fishing vessels. Until 2013, NMFS did not have data to generate a reliable estimate of bycatch on many vessels participating in the groundfish fisheries, as well as the halibut fishery. The restructured Observer Program deploys observers on vessels and in fisheries that NMFS previously did not have reliable data on catch and discards. This has increased NMFS's inseason management ability to assess the catch from a more comprehensive cross-section of federally managed fisheries in the GOA and BSAI.

The Council and NMFS developed the restructured Observer Program to addresses longstanding concerns about statistical bias of observer-collected data and cost inequality among fishery participants with the prior Observer Program's funding and deployment structure. The Observer Program was restructured with Amendment 86 to the Fishery Management Plan for Groundfish of the Bering Sea/Aleutian Islands Management Area (BSAI FMP), Amendment 76 to the Fishery Management Plan for Groundfish of the Gulf of Alaska (GOA FMP) (collectively, Amendments 86/76), and the implementing final rule (77 FR 70062, November 21, 2012).[1]

In partnership with the Council, NMFS prepared the *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*[2] (2011 EA/RIR/IRFA, NPFMC and NOAA 2011) and a Finding of No Significant Impact (FONSI; NMFS 2012a).[3] The 2011 EA/RIR/IFA was prepared as the central decision-making document for the Council to recommend Amendments 86/76, for the Secretary of Commerce to approve Amendments 86/76, and for NMFS to implement Amendments 86/76 through Federal regulations.

Concurrent with the development of the final rule, NMFS considered Council input when it developed the 2013 Annual Deployment Plan for Observers in the Groundfish and Halibut Fisheries off Alaska (2013 ADP, NMFS 2013a). On January 1, 2013, NMFS began deploying observers on vessels under the new program and assessing fees. NMFS has subsequently issued two additional ADPs (2014 and 2015), and a full Annual Report evaluating observer deployment and coverage under the 2013 ADP (NMFS 2014a). NMFS issued the second Annual Report evaluating observer deployment and coverage under the 2014 ADP in May 2015 (2015a).

In December 2012, The Boat Company filed a lawsuit on the restructured Observer Program in the District Court of Alaska. Among other issues, The Boat Company argued that the coverage provided in the restructured Observer Program does not provide scientifically sound information to inform fisheries management therefore the entire North Pacific Observer Program should be vacated. The Fixed Gear Alliance joined the litigation in February 2013. Among other issues, The Fixed Gear Alliance argued that expanding observer coverage to vessels less than 60 ft length overall (LOA) and halibut vessels was arbitrary and NMFS did not adequately consider program costs, strategies for achieving objectives during times of revenue shortfalls, or alternatives to mitigate the impacts of extending observer coverage to the previously unobserved small boats. In May 2013, Oceana joined the litigation as an *amicus curiae* in support of The Boat Company.

In August 2014, the United States District Court for the District of Alaska issued a decision in the case of *The Boat Company* v. *Pritzker*, No. 3:12-cv-250-HRH.[4] The court upheld the final rule, finding that the new program instituted significant improvements that should be allowed to stand. The court, however, found that NMFS violated the Magnuson-Stevens Act, the National Environmental Policy Act (NEPA) and the Administrative Procedure Act by failing to consider whether data collected by observers would be reliable in the face of significant observer cost increases. The court ordered NMFS to prepare a

[1] The final rule is available on the NMFS Alaska Region Web site at http://alaskafisheries.noaa.gov/frules/77fr70062.pdf.

[2] The EA/RIR/IRFA is available on the NMFS Alaska Region Web site at http://alaskafisheries.noaa.gov/analyses/observer/amd86_amd76_earirirfa0311.pdf.

[3] The FONSI is available on the NMFS Alaska Region Web site at http://alaskafisheries.noaa.gov/analyses/observer/amd86_amd76_fonsi0612.pdf.

[4] The Court Order is available on the NMFS Alaska Region Web site at http://alaskafisheries.noaa.gov/sustainablefisheries/observers/courtorder_boatco080614.pdf.

supplemental environmental assessment (SEA) that analyzes when observer data ceases to be reliable, or of high quality, because the rate of observer coverage is too low. The United States District Court for the District of Alaska also issued a decision denying Fixed Gear Alliance's claims.[5]

According to the Council on Environmental Quality (CEQ) regulations, a supplemental environmental impact statement should be prepared if –

1. the agency makes substantial changes in the proposed action that are relevant to environmental concerns, or
2. significant new circumstances or information exist relevant to environmental concerns and bearing on the proposed action or its impacts (40 CFR 1502.9(c)(1)).

Although the CEQ regulations do not speak to the circumstances in which a supplemental EA should be prepared, NMFS assumes these standards to supplemental EAs. Based on the Court Order, NMFS is preparing this SEA to address new information to determine how the restructured Observer Program is relevant to the environmental concerns and how it bears on the action and the impacts identified in the 2011 EA/RIR/IRFA. NMFS is not proposing any substantial changes to the action analyzed in the 2011 EA/RIR/IRFA and implemented in the final rule.

This SEA serves to briefly provide sufficient evidence and analysis for NMFS to determine whether to prepare an environmental impact statement or a finding of no significant impact and aid NMFS's compliance with NEPA when no environmental impact statement is necessary (40 CFR 1508.9(a)).

The Court Order contained very specific direction for analysis in the SEA. The Court Order centered on a the theme that NMFS did not consider whether the restructured Observer Program would yield reliable, high quality data given likely variations in costs and revenues. The Court found that the 2011 EA/RIR/IRFA was inadequate because it failed to address the risk to data quality that may result from increased observer costs and decreased observer coverage. This SEA directly responds to this Court Order in Chapters 3, 4, and 5.

In Chapter 6 uses the new information and analysis from Chapters 3, 4, and 5 to build on the analysis of the environmental impacts completed in the 2011 EA/RIR/IRFA. The analysis of environmental impacts was Chapter 4 of the 2011 EA/RIR/IRFA prepared for Amendments 86/76. This SEA focuses on only those sections of the 2011 EA/RIR/IRFA that required updating per the Court Order. This SEA provides a new analysis of the impacts of the action (Alternative 3, the restructured Observer Program implemented in 2013) presented in Section 4.3, Probable Environmental Impacts in the 2011 EA/RIR/IRFA. This SEA summarizes the information from the 2011 EA/RIR/RIFA that remains unchanged because there is no proposed change to the action: the purpose and need and the description of the alternatives.

This SEA provides new information since the 2011 EA/RIR/IRFA was finalized. NMFS has collected and analyzed observer data from two complete years under the new program, 2013 and 2014. NMFS also has cost and fee revenue data from 2013 and 2014. The restructured Observer Program established an annual process of 1) developing an ADP that describes plans and goals for observer deployment in the partial coverage category in the upcoming year, and 2) preparing an annual report providing information and evaluating performance in the prior year. Relevant information from these documents is summarized in this SEA and these documents are incorporated by reference.

[5] The Court Order is available on the NMFS Alaska Region Web site at http://alaskafisheries.noaa.gov/sustainablefisheries/observers/courtorder_fixedgear080614.pdf.

1.1 Annual Deployment Plan

The ADP describes how NMFS plans to deploy observers to vessels and processors in the partial coverage category in the upcoming year. NMFS has produced three ADPs; the 2013 ADP, the 2014 ADP, and the 2015 ADP (NMFS 2013a, NMFS 2013b, and NMFS 2014b, respectively).[6] The ADP provides flexibility to improve deployment to meet scientifically based estimation needs while accommodating the realities of a dynamic fiscal environment. NMFS's goal is to achieve a representative sample of fishing events, and to do this without exceeding funds available through the observer fee. This is accomplished by the random deployment of observers in the partial coverage category. NMFS adjusts the ADP each year after a scientific evaluation of data collected under the Observer Program. NMFS evaluates the impact of changes in observer deployment and identifies areas where improvements are needed to collect the data necessary to conserve and manage the groundfish and halibut fisheries.

The most important goal of the ADP is to achieve randomization of observer deployment in the partial coverage category. Sampling that incorporates randomization is desirable at all levels of the sampling design since: 1) sampling theory dictates that randomization at all levels allows for unbiased estimation; and 2) sampling is generally preferential over a census because it is more cost efficient, is less prone to bias than an imperfectly implemented census (one subject to logistical constraints), and can result in greater data quality. Random deployment greatly improves NMFS's ability to evaluate the statistical properties of estimators and improve catch estimation procedures in the future. The sampling methods described in the ADPs were designed to reduce bias in observer data, improve catch estimates, and lay the groundwork for cost-effective improvements to sampling methods implemented in future ADPs.

To summarize the ADP process, each year, NMFS develops a draft ADP that describes how NMFS plans to deploy observers to vessels in the partial observer coverage category in the upcoming year. The draft ADP describes the deployment methods NMFS plans to use to collect observer data on discarded and retained catch, including the information used to estimate catch composition and marine mammal and seabird interactions in the groundfish and halibut fisheries. The draft ADP also describes how NMFS will deploy observers to shoreside processing plants or stationary floating processors in the partial coverage category.

The Council reviews the draft ADP and considers public comment when developing its recommendations about the draft ADP. The Council may recommend adjustments to observer deployment to prioritize data collection based on conservation and management needs. NMFS may adjust the draft ADP after a scientific evaluation of Council recommendations and finalizes the ADP. NMFS releases the final ADP prior to the start of the fishing year.

1.2 Annual Reports

NMFS produces an Annual Report to present a review of the deployment of observers in each year relative to the intended sampling plan and goals of the restructured Observer Program. One goal of the restructured Observer Program was to address longstanding concerns about statistical bias of observer collected data. NMFS has produced two annual reports, the 2013 Annual Report (NMFS 2014a) and the 2014 Annual Report (NMFS 2015a).[7] The Annual Reports analyze observer deployment under the previous year's ADP, including an overview of the fees and budget associated with deployment,

[6] Each ADP is available on the Alaska Region Web site at http://alaskafisheries.noaa.gov/sustainablefisheries/observers/.

[7] Each Annual Report is available on the Alaska Region Web site at http://alaskafisheries.noaa.gov/sustainablefisheries/observers/.

enforcement of the Observer Program regulations, a summary of public outreach events, and a scientific evaluation of observer deployment conducted by the Observer Science Committee.

The Annual Report evaluates observer deployment under the ADP, identifies situations where bias may exist, and provides recommendations for further evaluation and improvements to the deployment process for the next ADP. The 2013 Annual Report used a set of performance metrics to assess the efficiency and effectiveness of observer deployment into the partial coverage strata. These metrics provide a method to evaluate the quality of data being collected under the restructured Observer Program. Specifically, the metrics fall into four broad categories—

- Deployment rate metrics that evaluated whether achieved sample rates were consistent with intended sample rates. In addition, the achieved sampling rate was evaluated against the intended sampling rates in terms of the tracking of costs and adjustments in sampling rates to ensure coverage across the entire year.
- Representativeness of *sample metrics* that evaluated whether the observed sample represents the target population. These metrics evaluate sample frame differences and whether the observed and unobserved trips have similar fishing characteristics. These differences can result in incorrect conclusions being drawn about the population based on the sample, especially if the characteristics of the sampled portion of the population are different from the population whole.
- Non-response errors that arise when selected trips or vessels are not observed. Response errors are introduced when characteristics of observed trips differ from unobserved trips. These errors can be a serious problem if the vessels or trips that are actually observed are different from those that were selected but not observed, or are different from those trips or vessels that were not selected (the “observer effect”).
- Sample size metrics were used to assess whether enough samples were collected to provide adequate spatial and temporal coverage.

1.3 Catch Accounting System

Total catch estimates in the groundfish fisheries off Alaska are generated by the NMFS Alaska Region and are used to manage over 600 separate groundfish quotas and prohibited species catch limits in the Bering Sea/Aleutian Islands and Gulf of Alaska. Total catch means the catch retained and catch discarded. The CAS uses information from multiple data sources to estimate total groundfish catch, including at-sea discards, as well as estimates of prohibited species catch and other non-groundfish bycatch. Observer information, dealer landing reports (“fish tickets”), and at-sea production reports are combined to provide an integrated source for fisheries monitoring and in-season decision making. A detailed description of the current catch estimation methods was published by Cahalan et al. (2014).

An important aspect of the CAS is to provide near real-time delivery of accurate data for Inseason Management decisions. To meet this objective, data from industry is reported through the Electronic Reporting System and is fed into the NMFS database every hour. Data from observers is sent to the Alaska Fisheries Science Center (AFSC) electronically and is transmitted into the CAS every night.

The CAS is NMFS’s standardized methodology to assess the amount and type of catch and bycatch, and relies on both observer data and landings information to generate the catch and bycatch estimates for the groundfish fisheries. At-sea observer data plays a key role in the CAS, and allows the agency to gain an objective perspective and independent measurement of the amount and numbers species that are caught in the commercial groundfish and halibut fisheries in the GOA and BSAI. Observer data provide a direct estimate of species composition and weight, as well as a means to calculate catch and bycatch rates for unobserved fishing vessels.

NMFS is continually improving the estimation methods used in the CAS (Cahalan et al. 2014, Cahalan et al. 2010). NMFS is also continually improving the quality of the data used in the CAS, and the observer restructuring action was one important step in this process. Restructuring the Observer Program greatly improved the data used in the CAS. Under the restructured Observer Program, NMFS has greatly improved information to estimate bycatch in the halibut fishery and on vessels between 40 ft LOA and 60 ft LOA. This will improve NMFS's ability to assess the status of each stock and estimate total catch in compliance with Magnuson-Stevens Act's requirement for annual catch limits (16 U.S.C. 1853(a)(15)).

1.4 Summary of Observer Coverage Rates in Other US Fisheries

To provide context for the analysis of coverage rates, this section provides information on observer coverage rates and funding in other federally managed fisheries around the country. The most recent National Observer Program FY 2012 Annual Report lists observer coverage rates and funding information by region and fishery in Appendix A (NMFS 2013c). The restructured Observer Program has fairly high observer coverage rates compared to other regions due in part to industry funds which support observer coverage in both full and partial coverage fisheries. The only other fisheries that rely on industry funds are the West Coast trawl catch share fisheries, the Atlantic sea scallop fishery and, starting in 2013, portions of the Northeast multispecies groundfish fisheries. Most observer programs use funds appropriated by Congress and are limited to providing the coverage afforded by Federal funds.

The North Pacific is one of the few regions with 100% or greater observer coverage for many fisheries. Nationally, only the West Coast trawl catch share fisheries, the California deep-set pelagic longline fishery, the Hawaii pelagic longline fishery for swordfish, and two specific shark fisheries in the Atlantic have 100% observer coverage. Many programs have coverage levels that are substantially lower than the coverage rates under the restructured Observer Program. Nationally, observer coverage rates range from 1% to 38%, with many programs substantially below 10% coverage. However, this does not mean that the data collected by these programs are unreliable. Even with low rates of observer coverage, these data are critical for making science-based management decisions and regulating fisheries. There will always be utility for some types of observer data regardless of how limited the coverage might be. The types and amount of data collected by observer programs will depend on the sampling objectives of the observer program. For example, sightings data for marine mammals, biological samples from fish species for age and growth analysis, and fishing effort data are all useful tools for science and management, regardless of the quantity of data collected or the coverage rates employed in a particular fishery. Observer coverage and data reliability in the North Pacific is discussed further in Chapter 3.

1.5 Possible Future Changes to the Observer Program

The Council is considering a number of amendments to the regulations governing the Observer Program that may be implemented in the next few years. Some of these amendments would make relatively minor changes in the circumstances under which vessels are placed in the partial versus full observer coverage categories. Other proposals would make more significant or large scale changes to the program. A complete discussion of the possible future changes to the Observer Program is provided in Section 5.3, Cumulative Effects.

For purposes of this SEA, the most important aspects of these possible future regulatory actions are 1) the impacts on observer fee collections, 2) the total number of trips in the partial coverage category, 3) information relative to the cost or efficiency of deploying observers in the partial coverage category, and 4) impacts on data quality. The impact of an action on the amount of the observer fee is important because it determines the amount of money available to deploy observers in the partial coverage category.

The impact of an action on the total number of trips in the partial coverage category is important because it affects the sampling or deployment rate that can be achieved for a given amount of observer fees or budget. Circumstances that affect travel costs or non-fishing days may affect the average cost of deploying observers in the partial coverage category.

The proposed revisions to the Observer Program described in this SEA are—

1. Observer coverage requirements for small vessels in the Western Alaska Community Development Quota (CDQ) Program fisheries,
2. Observer coverage requirements for small catcher/processors,
3. Voluntary full coverage for trawl catcher vessels in the BSAI Pacific cod fishery,
4. Observer coverage requirements for trawl catcher vessels harvesting groundfish from the GOA;
5. Observer coverage requirements for vessels delivering to tenders; and
6. Electronic monitoring.

2 Description of Alternatives

This SEA includes the purpose and need from the 2011 EA/RIR/IRFA (Section 4.1). There has been no change to the purpose and need for the action to restructure the Observer Program. The Council identified the following problem statement as the purpose and need. Further background information and detail on the intent of the action is provided in the 2011 EA/RIR/IRFA, Sections 2.1 and 2.2.

Problem statement for BSAI Amendment 86/GOA Amendment 76:

> *The North Pacific Groundfish Observer Program (Observer Program) is widely recognized as a successful and essential program for management of the North Pacific groundfish fisheries. However, the Observer Program faces a number of longstanding problems that result primarily from its current structure. The existing program design is driven by coverage levels based on vessel size that, for the most part, have been established in regulation since 1990 and do not include observer requirements for either the <60' groundfish sector or the commercial halibut sector. The quality and utility of observer data suffer because coverage levels and deployment patterns cannot be effectively tailored to respond to current and future management needs and circumstances of individual fisheries. In addition, the existing program does not allow fishery managers to control when and where observers are deployed. This results in potential sources of bias that could jeopardize the statistical reliability of catch and bycatch data. The current program is also one in which many smaller vessels face observer costs that are disproportionately high relative to their gross earnings. Furthermore, the complicated and rigid coverage rules have led to observer availability and coverage compliance problems. The current funding mechanism and program structure do not provide the flexibility to solve many of these problems, nor do they allow the program to effectively respond to evolving and dynamic fisheries management objectives.*

2.1 Alternatives

The 2011 EA/RIR/IRFA evaluated five alternatives. The action alternatives differ in the scope of sectors included in restructuring and the type of fee established to pay for observer services. All of the action alternatives include an ex-vessel value based fee on some portion or all of the fleet. The fee would be paid directly to NMFS. The following summarizes the five alternatives from the 2011 EA/RIR/IRFA—

- **Alternative 1: no action**. The previous service delivery model. Individual vessels and processors contracted directly with observer providers to procure observer services to meet coverage levels in Federal regulations.
- **Alternative 2: GOA-based restructuring.** This alternative would restructure the program in the GOA, including shoreside processors; and include all halibut and less than 60 ft LOA vessels participating in groundfish fisheries in the GOA and BSAI. Vessels in the restructured program would pay an ex-vessel value based fee. Retain current service delivery model for vessels greater than or equal to 60 ft LOA and shoreside processors in the BSAI.
- **Alternative 3**: **Coverage-based restructuring (preferred alternative).** This alternative would restructure the Observer Program for all groundfish and halibut vessels and processors with coverage needs of less than 100%. The determination of general coverage needs (less than 100 percent versus greater than or equal to 100%) by sector is thus integral to this analysis. Vessels in the restructured program would pay a 1.25% ex-vessel value fee. Vessels delivering shoreside would pay half of the 1.25% fee; shoreside processors would pay the other half.

Catcher/processors would pay the entire fee if they had been included in the revised program. Vessels and processors with at least 100% coverage would remain under the current service delivery model.

- **Alternative 4: Comprehensive restructuring with hybrid fee system.** This alternative would restructure the Observer Program for all groundfish and halibut vessels and processors. Sectors with coverage needs of less than 100% would pay an ex-vessel value based fee; sectors with coverage needs of greater than or equal to 100% would pay a daily fee.
- **Alternative 5**: **Comprehensive restructuring with a single fee system.** This alternative would assess the same ex-vessel value based fee on all vessels and shoreside processors in the groundfish and halibut fisheries in the GOA and BSAI.

The 2011 EA/RIR/IRFA evaluated two options, as follows—

- **Option 1:** For halibut fishery landings and landings by vessels less than (40 ft, 50 ft, or 60 ft LOA) participating in groundfish fisheries (fisheries and sectors not currently subject to the Observer Program), vessels and shoreside processors would pay one-half the ex-vessel value based fee established under the alternative. For example, the ex-vessel value fee selected under Alternative 3 was 1.25%, thus, if Option 1 were applied, halibut landings and groundfish landings from small vessels would be assessed a 0.625% fee.
- **Option 2** (**preferred option**) would require NMFS to release an observer report by September 1 of each year (the annual deployment plan). The report will contain the proposed stratum and coverage rates for the deployment of observers in the following calendar year, as well as a detailed financial spreadsheet by budget category on the financial aspects of the program. The Council may request its Observer Advisory Committee, Groundfish Plan Teams, and/or the SSC to review and comment on this draft plan. NMFS would consult with the Council each year on the draft plan for the upcoming year, at a meeting of the Council's choosing that provides sufficient time for Council review and input to NMFS.

  NMFS also would prepare an annual report on the Observer Program for presentation to the Council each year, including information on how industry participants have adapted to and been able to accommodate the new program. As part of this annual report, the 1.25% fee would be reviewed by the Council after completion of the second year of observer deployment in the restructured program. The Council could revise the fee assessment percentage in the future through rulemaking after it had an opportunity to evaluate program revenues and costs, observer coverage levels, fishery management objectives, and future sampling and observer deployment plans. This report would be provided to the Council at the same time the annual deployment plan is being provided.

2.2 Comparison of Alternatives analyzed in this SEA

This SEA focuses on the analysis of Alternative 3 relative to Alternative 1 with the new information available since 2011. Note that while the other action alternatives would have implement different fee systems or, for Alternative 2, just restructured the Observer Program in the GOA, NMFS would have still implemented a similar observer deployment methods. The issues with coverage rates that vary according to fee revenues, costs, and effort would have been similar under all of the alternatives.

Key to that analysis is a comparison of the new program to the previous Observer Program. Therefore, this section compares the relevant primary features of Alternative 3, the restructured Observer Program as implemented by the final rule and subsequent ADPs, relative to the previous program, Alternative 1. A complete description of the implemented restructured Observer Program is in the preamble to the proposed rule (77 FR 23326; April 18, 2012[8]). A complete description of Alternative 1 is in the 2011 EA/RIR Section 2.1.

2.2.1 Full Coverage Category

The restructured Observer Program increased the number of participants in the full coverage category but did not make structural changes to the deployment or funding of observers in the full coverage category. Full coverage means that one or more observers are deployed on all fishing trips or available at processing plants to sample every fish delivery.

Since implementation of the domestic Observer Program in 1990, NMFS has required 100% observer coverage for vessels greater than or equal to 125 ft LOA and for shoreside processors or stationary floating processors that process at least 1,000 metric tons (mt) of groundfish during a calendar month. NMFS had increased observer coverage requirements since 1990 for vessels and processors in catch share programs with increased monitoring needs such as the CDQ Program, the American Fisheries Act (AFA), Amendment 80 to the BSAI FMP, and the GOA Rockfish Program.

Under the restructured Observer Program, NMFS bases observer coverage categories on data needs for specific management programs rather than requirements based on vessel length or processing volume. NMFS removed the length and volume-based requirements that applied to the previous Observer Program, and now assigns vessels and processors to either the partial or full coverage category based on NMFS's data needs. The result of this change was to require full coverage on 1) most catcher/processors participating in the groundfish or halibut fisheries, 2) all motherships, 3) participants in programs where catch is allocated to specific entities with quotas and PSC limits, and 4) inshore processors when receiving or processing Bering Sea Pollock (Table 1).

2.2.2 Partial Coverage Category

The partial coverage category is for shoreside processors and vessels that are required to carry or provide an observer for less than 100% of their operations. The restructured Observer Program greatly increased the number of vessels that are subject to observer coverage in the partial coverage category. This included vessels in the halibut fishery and groundfish vessels less than 60 ft length overall (LOA) that had never carried an observer under the previous Observer Program (Table 1). Expanding observer coverage to previously unobserved vessels improves NMFS's ability to estimate total catch in all Federal fisheries in the North Pacific.

2.2.3 Coverage Rates

In the previous Observer Program, vessels between 60 ft and 125 ft LOA were required to carry an observer on 30% of fishing days by calendar quarter for each target fishery and NMFS had no observer data from vessels less than 60 ft LOA participating in Federal fisheries. This resulted in spatial and temporal coverage issues since vessels not required to carry an observer fished in nearshore areas where some species commonly occur (e.g., Gasper and Kruse 2013, Mecklenburg et al 2012). In addition, the previous observer coverage regulations created a clustering of observer coverage as vessels met their coverage requirements during the quarterly period. See Chapter 3 for a comprehensive assessment of observer coverage.

[8] The proposed rule is available on the NMFS Alaska Region Web site at http://alaskafisheries.noaa.gov/prules/77fr23326.pdf.

Under the restructured Observer Program, coverage rates are estimated for each fishing year through the ADP process. The ADP provides flexibility that allows sampling rates to be adjusted and improved such that scientific and management objectives can be met. The ADP also provides an annual evaluation of the risks associated with different allocations of deployment rates. A critical component to the program is to provide a transparent and scientific process to adjust sampling. The Annual Report provides a set of performance metrics that provide a framework from which NMFS can evaluate whether sampling goal were met and identify improvement. This process has resulted in data from the first two years of the restructured Observer Program that represent more fisheries, provide information from more areas, and better represent fishing effort than under the previous program.

2.2.4 Sampling Method

The restructured Observer Program complies with the Magnuson-Stevens Act requirement that NMFS station observers on all or a statistically reliable sample of fishing vessels and processors necessary for conservation, management, and scientific understanding of the fisheries covered by the fisheries research plan (16 U.S.C. 1862(b)(1)(A)). The previous Observer Program did not deploy observers using well-established random sampling methods because fishermen could choose when to take observers to fulfill their observer coverage requirement. The ad-hoc deployment method prevented representative sampling across all fishing trips, resulting in sampling effort that did not correspond with fishing effort and that resulted in consistent problems with under-or-over coverage in fisheries in the 30% observer coverage category.

A major accomplishment of the restructured Observer Program was the implementation of a scientific sampling plan for deploying observers. A general description of sampling involves the collection of information from a subset of individuals within a population to estimate characteristics of a whole population. In the case of fishery information, bias is introduced when the sample (i.e., observed trips) does not represent fishing activity to which it is expanded (i.e., population of all fishing trips). The restructured Observer Program increases coverage by sampling vessels previously unobserved, and that coverage is generating better data that allows NMFS to produce more reliable estimates of catch and bycatch. See Section 3.2 for a comprehensive discussion of sampling under the restructured Observer Program.

Analysis and evaluation of the data collected by observers is an on-going process. This process was specifically designed to reduce bias in fishery dependent data by using a scientific method to deploy observers. The scientific sampling plan results in better spatial and temporal distribution of observer coverage across all fisheries. This greatly improves NMFS's confidence in catch and bycatch estimation and greatly improves the quality of data collected in Federal fisheries. Random deployment will greatly improve NMFS's ability to evaluate the statistical properties of estimators and improve catch estimation procedures in the future.

2.2.5 Annual Analysis and Evaluation

An integral part of the restructured Observer Program is the annual analysis and evaluation of the deployment methods. The ADP analyzes sampling methods and describes deployment of observers on vessels and processing plants under the partial observer coverage category described in 50 CFR 679.51. The ADP presents information on deployment methods NMFS will use in the partial coverage category in the upcoming year, including assignment of vessels to selection pools, and the allocation of observers among selection pools and processors.

The Annual Report provides performance measures to assess the effectiveness of observer deployments relative to the sampling plan. The Annual Report uses metrics to evaluate the observer data resulting from the sampling methods defined in the ADP. This evaluation determines whether target sampling rates were achieved, measures the non-response errors, and evaluates the degree to which the observed trips represented the entire fishery in terms of when fishing occurred, where fishing occurred, and by comparing trips characteristics (e.g. trip length, species caught, etc.). The Annual Report also provides an overview of sample-size adequacy through an examination of the probability of selecting a sample and having cells (e.g., defined by gear and NMFS Reporting Area) with no observer coverage.

NMFS has specifically designed the annual deployment process to address the issue that fees will generate variable revenues from year to year. That revenue will be variable and how NMFS will use statistics to determine deployment in a way that improves deployments at all funding levels are two of the primary benefits of the restructured program. The 2013, 2014, and 2015 ADPs were designed to improve the reliability of observer data and the data from the first 2 years of the program has supported these conclusions.

For the purpose of observer deployment, the ADPs segregate participants in the partial coverage category into pools, also called strata. NMFS then uses estimates of anticipated fishing effort and available sea-day budgets as the primary inputs into simulation models to generate anticipated selection rates and coverage days for each pool. The 2015 partial coverage deployment pools are defined as follows:

- No selection: The "no selection" pool comprises of catcher vessels less than 40 ft LOA, or vessels fishing with jig gear, which includes handline, jig, troll, and dinglebar troll gear, or vessels that are conditionally released due to life raft capacity. In addition, vessels selected by NMFS to participate in the electronic monitoring cooperative research will be in the no selection pool while participating in the research.
- Small vessel trip-selection: This pool comprises of catcher vessels that are fishing hook-and-line or pot gear and are greater than or equal to 40 ft, but less than 57.5 ft in LOA. The vessels in this pool were in the "vessel-selection" pool in the 2013 and 2014 ADPs.
- Large vessel trip-selection: This pool comprises three classes of vessels: 1) all catcher vessels fishing trawl gear, 2) catcher vessels fishing hook-and-line or pot gear that are also greater than or equal to 57.5 ft LOA, and 3) catcher/processor vessels exempted from full coverage requirements (50 CFR 679.51(a)(2)(iv)). This pool was termed the "trip-selection" pool in the 2013 and 2014 ADPs.

Each year the ADP describes the anticipated coverage rates in each stratum and the subsequent Annual Report describes the realized coverage rates. For example, the anticipated coverage rates in the 2015 ADP were 12% for the small vessel trip-selection pool and 24% for the large vessel trip-selection pool; and the Annual Report that will be available in June 2016 will present the realized coverage rates.

2.2.6 Fees

The fee system in the restructured Observer Program follows the Magnuson-Stevens Act requirements in 16 U.S.C. 1862(a)(2) and (b)(2). The fee system replaces the previous pay-as-you-go method in the partial coverage category where vessel owners directly paid for their observer. The fee-based system allows the observer coverage in the partial coverage category to be paid for by industry and provides a consistent source of revenue directly linked to the value of the fishery.

The restructured Observer Program implemented a 1.25% fee based on the ex-vessel value of groundfish and halibut in fisheries subject to the fee. The Council determined that the same fee percentage should apply to all sectors as they all benefit from resulting observer data that is essential for conservation and management of the fisheries in which they participate. The 1.25% fee seeks to balance the need for revenue to support the Observer Program while minimizing impacts on the industry sectors included in the restructured Observer Program. Through the fees, owners and operators compensate the Federal Government for the costs associated with managing fishery resources.

The ex-vessel value of the catch is based on a standard measure of the value of the fishery resource harvested or processed by the participants and the fee applies regardless of whether a vessel or processor is selected to carry an observer. The fee is the most equitable method of funding observer coverage because it is based on the value of the resource each operation brings to market. An ex-vessel value fee is commensurate both to each operation's ability to pay and the benefits received from the fishery. The ex-vessel value of the catch is expected to fluctuate, as are the catch quotas.

For 2013, the first year of implementation, NMFS used Federal start-up funds implementation to transition from the existing industry-funded/direct contract model to one where NMFS contracts with observer providers to deploy observers in partial coverage category sectors. NMFS also used Federal funds to pay for observer coverage in 2014 and 2015.

In its final motion, the Council committed to reviewing the fee percentage after the second year of the program based on information in the Annual Report. The Council explained that it may recommend revising the fee assessment percentage in the future through rulemaking after it had an opportunity to evaluate program revenues and costs, observer coverage levels, fishery management objectives, and future sampling and observer deployment plans.

Table 1 Comparison of observer coverage levels under Alternative 1 and Alternative 3 (increases in coverage in bold)

Industry Segment	*Alternative 1 Previous Observer Program*	*Alternative 3 Restructured Observer Program*
AFA Catcher/Processors (CPs)	200% coverage	Full coverage - 200% coverage
CDQ CPs	200% coverage	Full coverage - 200% coverage
AFA motherships	200% coverage	Full coverage - 200% coverage
AFA inshore processors	1 observer for each 12-hour period (i.e., 2 observers if plant operates more than 12 hours/day)	Full coverage - 1 observer for each 12-hour period (i.e., 2 observers if plant operates more than 12 hours/day)
Am 80 trawl CP vessels	200% coverage	Full coverage - 200% coverage
CPs fishing for Atka mackerel in the Aleutian Islands Subarea	200% coverage	Full coverage - 200% coverage
Non-AFA and Non-Am 80 trawl CP vessels ≥125 ft in the BSAI	200% coverage	Full coverage - 200% coverage
Non-AFA and Non-Am 80 trawl CP vessels <125 ft in the BSAI	30% coverage – no scientific deployment plan	**Full coverage - 100% coverage**
Non-AFA and Non-Am 80 trawl CP vessels ≥125 ft in the GOA	100% coverage	Full coverage - 100% coverage
GOA Rockfish Program vessels when operating in that fishery	100% coverage	Full coverage - 100% coverage
Catcher vessels ≥60 ft fishing Non-pollock CDQ	100% coverage	Full coverage - 100% coverage
Pot CPs fishing CDQ	100% coverage	Full coverage - 100% coverage
Non-AFA and Non-Am 80 Trawl CPs <125 ft in the GOA	30% coverage – no scientific deployment plan	**Full coverage - 100% coverage**
Non-AFA and Non-CDQ shoreside processors	If processes <500 mt of groundfish in a calendar month – exempt from coverage. If processes between 500 mt and 1,000 mt of groundfish in a calendar month – coverage for 30% of the days that they receive or process groundfish. If processes 1,000 mt or more of groundfish in a calendar month – coverage for 100% of the days that they receive or process groundfish.	Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
AFA Trawl Catcher vessels ≥125 ft (including CDQ)	Inshore 100% coverage; When delivering unsorted cod ends to CPs or MS – exempt from coverage since observers in the CP or MS sectors will sample the catcher vessel catch.	BS pollock: Full coverage - Inshore 100% coverage; vessels are exempt from coverage when delivering unsorted cod ends to a CP or MS. Non-pollock: Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
AFA Trawl Catcher vessels 60 ft to 125ft (including CDQ)	100% coverage when targeting BS pollock (Am 91); 30% coverage in other fisheries when delivering	BS pollock: Full coverage - Inshore 100% coverage; vessels are exempt from coverage when delivering unsorted cod ends to a CP or

Industry Segment	*Alternative 1 Previous Observer Program*	*Alternative 3 Restructured Observer Program*
	inshore; exempt when delivering unsorted cod ends to MS and CP	MS. Non-pollock: Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
Non-AFA Trawl Catcher vessels 60 ft to 125 ft (Including CDQ)	100% coverage if fishing CDQ pollock 30% coverage for all other activities	Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
Non-AFA Trawl Catcher vessels ≥125 ft	100% coverage	Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
Hook-and-line CPs <125 ft	100% coverage	Full coverage - 100% coverage
Hook-and-line CPs 60 ft to 125 ft	30% coverage - no scientific deployment plan	**Full coverage - 100% coverage**
Hook-and-line Catcher vessels 60 ft to 125 ft	30% coverage - no scientific deployment plan	Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
Hook-and-line Catcher vessels ≥125 ft	100% coverage	Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
Pot CPs ≥60 ft	30% coverage - no scientific deployment plan	**Full coverage - 100% coverage**
Pot Catcher vessels ≥60 ft	30% coverage - no scientific deployment plan	Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
Halibut vessels	no coverage	**Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.**
Jig vessels (all sizes)	no coverage or 30% depending on vessel length	Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.
Groundfish vessels <60 ft	no coverage	**Partial coverage - NMFS determines coverage in ADP to deploy observers using a statistical sampling design.**
Non-AFA Motherships	Processes 1,000 mt or more in round-weight equivalent of groundfish during a calendar month – 100% coverage; Processes from 500 mt to 1,000 mt in round-weight equivalent of groundfish during a calendar month – 30% coverage	**Full coverage - 100% coverage**

Source: 2011 EA/RIR/IRFA and proposed rule (77 FR 23326; April 18, 2012).

3 Observer Coverage Assessment

This chapter provides the necessary background to evaluate the quality of the data collected under the new program, and addresses the direction of the Court to analyze when observer data ceases to be reliable or of high quality because the rate of observer coverage is too low. To lay the framework for this analysis, this chapter provides an overview of the methods NMFS uses to estimate catch; the role of observer coverage to provide otherwise unavailable data on the amount of catch that is discarded at sea; and the potential sources of bias caused by sampling methods or estimation procedures. This chapter makes an important delineation between data collection under the ADP versus catch estimation procedures (Section 3.1).

For the purpose of this analysis, statistical reliability means the degree to which data collected by at-sea observers is representative of the target population and this chapter examines several ways to assess the quality of the data derived from the restructured observer program. This analysis evaluates the data obtained from the new program relative to the previous program and whether the new program's data is reliable. This is of importance and responsive to direction from the Count, since observer costs were higher than anticipated in the restructuring analysis. Section 3.2 describes the number of trips that are now subject to observer coverage that previously were not, the spatial distribution of catch subject to observer coverage, and the impacts of catch data provided from the IFQ halibut program. Section 3.3 evaluates the temporal distribution of observed catch in both the BSAI and GOA under the restructured Observer Program.

This chapter also evaluates where gaps in estimation development given a wide range of deployment rates, which is responsive to the Court's direction to evaluate a range to deployment scenarios to determine when data quality ceases to be reliable. Section 3.4 assesses the risk of gaps in observer data for catch estimation under a range of different observer coverage levels. The analysis examines where gaps in data may occur in catch estimation at two levels: the reporting area (e.g., Area 610, 620, or 630 in the GOA); and the FMP area level (e.g., BSAI or GOA). If reporting area level observer data are not available, then estimation of discarded catch still occurs at the FMP area level; however, if FMP area level observer data are not available then estimates cannot be made.

3.1 Introduction

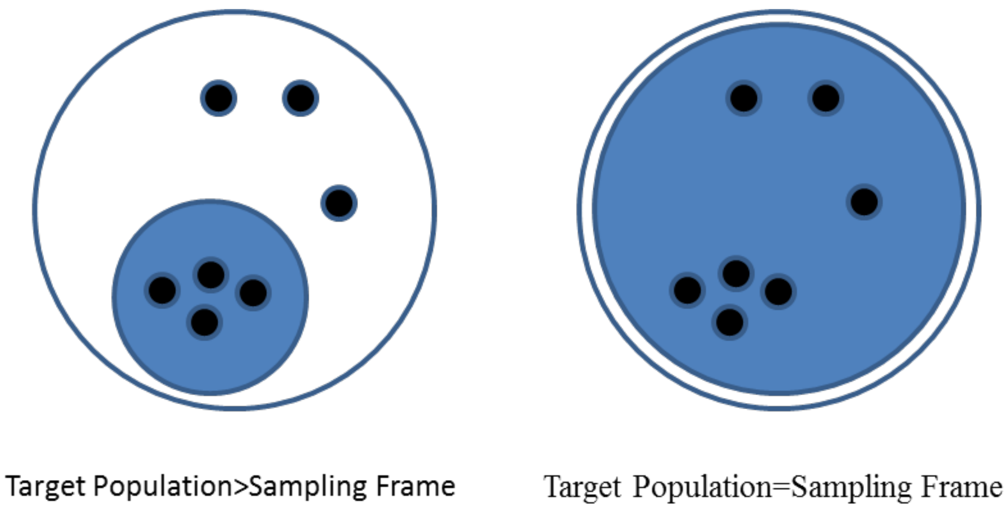
An important goal of observer restructuring was to collect representative at-sea and shoreside data from fisheries for which full coverage was not required by Federal regulation. The main sampling issues addressed under the restructured program were to collect at-sea information on previously unobserved portions of the fishing fleet (halibut longline vessels and vessels between 60 ft and 40 ft LOA), and to address the potential bias caused by the self-selection of observed trips for vessels formerly under 30% coverage requirements.

The restructuring action leveraged section 313 of the Magnuson-Stevens Act (16 U.S.C. 1862) that authorizes the Council to prepare a fisheries research plan that requires observers to be deployed in the North Pacific fisheries. The language is specific to gathering a statistically reliable sample from fishing vessels and U.S. processors. The ADPs (2013, 2014, and 2015) addressed statistical reliability issues in the observer data caused by non-representative sampling under the previous program by randomizing the selection of trips or vessels. Random sampling is a scientifically accepted sampling method to collect representative data from a population.

Observer data are used to make inferences to the fishery and underlying fish populations, through the collection of discard information, biological sample data used in stock assessments, and marine mammal and seabird interactions with fishing gear (e.g., SAFE 2013). This requires a flexible and multi-faceted program with many sampling objectives. The focus of our analysis is the collection of at-sea discard information for groundfish and non-groundfish fish species, while recognizing data needs for other sampling objectives. These other objectives change through time and are difficult to quantify; however, they can be achieved if the underlying sampling methods used to deploy observers are statistically reliable.

Understanding the differences between sampling and estimation is critical in evaluating the impacts of changes in observer coverage levels. The purpose of random sampling is to obtain data that represents the characteristics of a population for which inferences are needed. The group of units for which inferences are needed is called the target population (Figure 1). Within the target population, there are sampling units consisting of trips or vessels subject to observer coverage. The sampling frame refers to this group of trips (or vessels) that have a probability >0 of being sampled. At sea-data collected by observers are used to make inferences about the population of trips that comprise the Federal groundfish and halibut fisheries. Sampling units that are probabilistically selected from the sampling frame are used to make inferences about the target population. Hence, differences in the characteristics of the units within the sampling frame versus units outside the sampling frame and within the target population can be a source of bias in the inferences.

Figure 1 An example of non-representative sampling (on the left) when the target population is greater than the sampling frame; and representative sampling (on the right) when the target population matches the sampling frame. Large blue-filled circles indicate the sampling frame; small black dots indicate sampling units (e.g., trips) that generate sampling information; and the larger outer circle represents the target population.



Inferences to unsampled events (i.e., discard on unobserved trips) in the target population are made using available sampling information, the quality of which depends on how "representative" the sampling frame is of the target population and the estimation processes used in the inference. In situations where the sampling frame matches the target population, statistical inferences can be made directly to the target population. In situations where elements (e.g. trips or vessels) within the target population have no probability of selection (i.e., the sample frame is smaller than the target population; referred to as sample frame issues), then inferences from available sampling information are made to the target population based on assumptions about the underlying distribution of elements outside of the sampling frame. The quality of estimates in both situations depends on the observed fishing activity (selected from the sample frame) having the same distributional characteristics as the target population; however, since elements outside the sample frame are not sampled, inferences are not based on statistical sampling methods.

A primary concern about the accuracy of estimated discard is bias in the observer data. Bias is a measurement of systematic error that describes the difference between the measurement of process and the true value of the process. In estimating total catch, two broad categories of bias reduce the quality of estimates: 1) bias resulting from non-representative sampling, and 2) bias related to the methods used for statistical estimation (Rago et al. 2005). Sampling bias arises from sampling data not representing the target population (e.g., portions of the population not being sampled, vessels fishing differently when an observer is on board). Estimation bias is associated with estimation procedures and is caused by poorly defined post-strata[9] (see Section 3.1.2 for post-strata definitions), violations of estimator assumptions, database and data entry errors, poorly defined target populations, and sampling bias.

Sampling bias will propagate through the estimation process and result in inaccurate estimates. Some methods exist for correcting estimation bias; however, sampling bias generally cannot be corrected. For example, Babcock et al. (2003) suggests methods for correcting bias and while these methods may be useful for adjusting bias associated with an estimator, they do not correct for non-representative sampling (Rago et al. 2005). Other bias adjustments to account for small sample properties on commonly used estimators are also well-known (e.g., Thompson 1992, Cochran 1977). However, despite the ability to make some adjustments for estimation-related biases, estimators are still subject to assumptions that when violated introduce bias and degrade an estimators performance.

In evaluating the reliability of sampling data, sampling bias is often confused with estimation bias and precision. Precision is a measure of the variance around an estimate (i.e., a measure of how repeated values conform to themselves). Precision is not a measure of whether an estimate is close to the true population value. Both the variance and point estimate are subject to sampling bias if the underlying sample is biased relative to the true population and/or estimation bias if the methods used for estimation are miss-specified. Biases due to either non-representative sampling (sampling bias) or inappropriate estimation methods (estimation bias) can result in an estimated value being significantly different from the true value of the discard (as defined by a significance criterion such as a 95% confidence interval).

The presence of estimation bias can depend on the method that that is used to estimate catch, for example a rate or ratio can used to estimate catch. Some estimation techniques (such as the simple mean estimator) are unbiased relative to the sample frame, while other methods tradeoff small amounts of bias for gains in precision. For example, a ratio estimator has a set of assumptions that when met improve the precision of an estimate at the cost of a small increase in bias; however, when the assumptions are violated, bias increases and precision is only relative to the biased estimate, leading to poor performance and unreliable estimates relative to the true population. This illustrates how the choice of an estimator can influence the statistical properties of an estimate regardless of the underlying sample used in estimation. However, as mentioned above, unbiased estimators (such as the simple mean) will still produce a biased estimate if sampling bias exists and the underlying data are collected in an unrepresentative (biased) manner.

The Northeast Region Observer Program uses a 30% Coefficient of Variation (CV) standard to evaluate observer coverage. CVs are simply a measure precision and the variability associated with an estimation method (i.e., for the simple mean estimation, the ratio of the standard deviation of the mean to the mean). Estimates could have a low CV (indicating a high level of precision) and be biased relative to the true population. Use of a different estimator (such as ratio estimator) will result in a different CV for the same input data and may still result in a grossly biased estimate if the underlying data do not represent the target population. For this reason, CVs are not an appropriate performance metric to measure

[9] Sample units collected using random sampling can also be grouped after the sample has been collected. This procedure is called post-stratification. Post-strata boundaries are defined using information that is known after a sample unit has been selected.

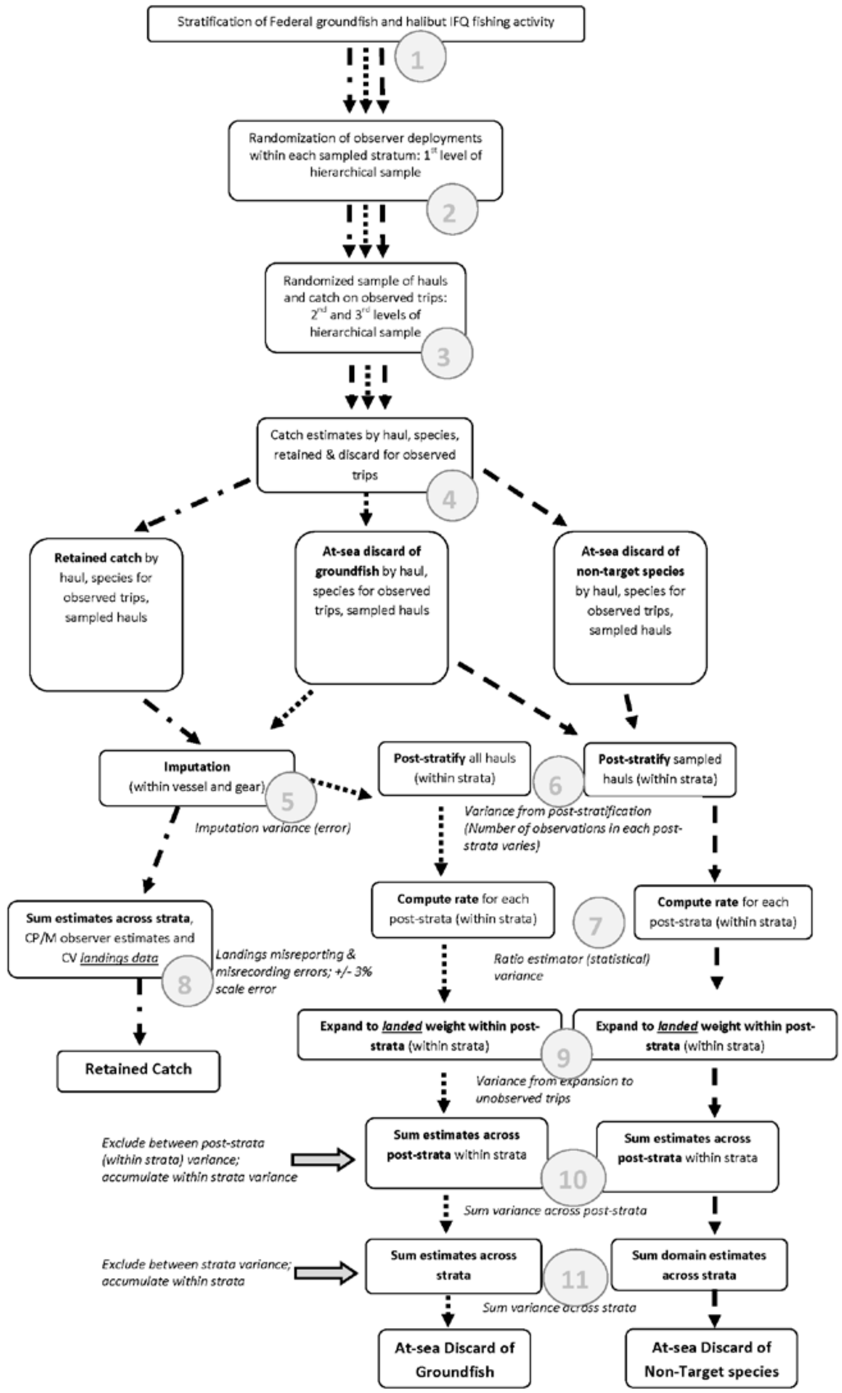
representative sampling (a primary goal of observer restructuring). CVs are useful for measuring the reliability of an estimate, which may be of particular concern for rare species. Since estimates of variance occur throughout the hierarchical estimation process, the largest sources of variance are not necessarily addressed by increasing the number of trips sampled; for example, high variance could be caused by low detectability of rare species that tends to be caught in clusters.

Cahalan et al. (2015) investigated the precision of estimates on full coverage vessels in the Bering Sea using design-based estimators. The fishery programs evaluated in the study were the AFA pollock fishery in the Bering Sea, vessels fishing under Amendment 80, the BSAI voluntary cooperative for Pacific cod, and vessels fishing in the GOA Rockfish Program. This study is the first to provide variance estimates using the hierarchical sampling design (see Section 3.1.1 for a description of the sampling design) of the Observer Program and found the diversity of species influenced the precision of discard estimates. Management programs with diverse fisheries require an observer to spend more time sorting and sampling catch to insure all species are adequately sampled. This increases sample process time and also limits the size and number of samples that can be taken by an observer. The smaller sample size causes higher estimated variance in more diverse fisheries, especially fisheries containing rare species. Overall, the magnitudes of variance for the fisheries in this study were generally within the 20% to 30% goal recommended in the 2004 NMFS report "Evaluating Bycatch: A National Approach to Standardized Bycatch Monitoring Programs" (NMFS 2004a). NMFS is using the information from this study to modify CAS so that a simple mean estimator used in place of the imputation estimator. The study also provided a foundation from which estimation methods used to extrapolate catch from observed to unobserved trips can be better evaluated.

Investigating the methods to expand observer sample data from the individual haul to the trip level will be a necessary step for future analysis of expansion to unobserved trips since associated variance must be carried through the entire sampling hierarchy, thus incorporating sources of variation occurring within and between haul levels (Figure 2). However, because of the complex nature of the estimation of total catch, and the numerous points where variance is introduced into the estimates, final variance estimates are neither the only metric nor necessarily the best metric for evaluating stratification and randomization of sampling of primary sample units (trips, vessels). The use of a fixed CV in the Northeast Region has also illuminated cost tradeoffs; a fixed CV standard implies that a precise value is important regardless of the size of a sampling strata. This results in many more trips being needed on small sampling strata (holding estimation methods constant) to get a precise calculation and is likely not always a cost effective measure of deployment priorities (NEFMC 2012). An analytical focus on variance does not evaluate the overall quality (representativeness, sample size adequacy) of the underlying data collection process. A well-designed sampling program will have a sample large enough to reasonably ensure that the sample data represent the entire target population and hence that the data collected are of high quality.

For the purpose of this analysis, statistical reliability means the degree to which data collected by at-sea observers is representative of the sampling frame and the target population. The statistical reliability of the estimation methods was not part of the restructuring action since evaluation of estimation is focused on the CAS estimation methods, including definitions of post-strata, and estimation methods used throughout the estimation hierarchy, including the influence of haul-level sampling and estimation methods. However, in the context of changing deployment rates, low sample size can create gaps in estimation. Recognizing these potential estimation gaps, we evaluated the probability of gaps in the estimation process under varying observer coverage levels.

Figure 2 Diagram of the CAS process. Circled numbers indicate major computational processes where variance terms are accumulated (from Cahalan et al. 2015).

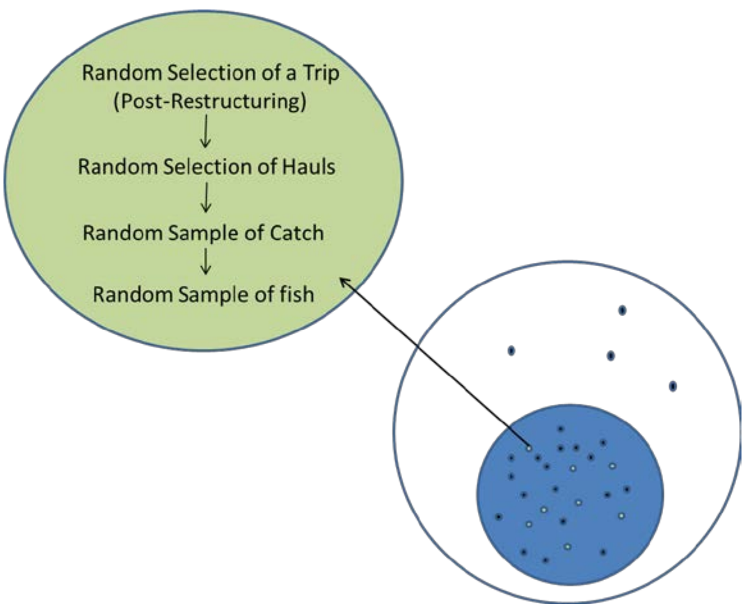


3.1.1 Sampling and estimation hierarchy

The preceding section outlined important differences between estimation and sample collection in terms of bias and precision. A key point is that bias in the underlying sample data is difficult (if not impossible) to correct during estimation, while bias problems due to a poorly performing estimator or poorly designed post-stratification scheme can sometimes be corrected through a change in estimation methods. Bias in the sample or resulting estimates can arise from different processes; the former are addressed through changes in deployment and sampling methods (e.g., randomization) and coverage of the target population, while the latter is addressed through determining appropriate estimators and post-stratification or sample weighting schemes.

The Observer Program uses a nested hierarchical design with randomization at each level within a sampling hierarchy (Figure 3). On an observed trip, this design generally results in a random selection of hauls or sets, from which samples of catch are randomly collected. This type of sampling design provides a well-defined sampling frame from which each unit has some probability of selection (e.g., equal), thus allowing statistical inference from the sample (including subsample) to the haul, the sampled hauls to the trip, and under the new program, the sampled trips to the unsampled trips. Under this hierarchical structure, the statistical properties of the discard estimates are obtained from a representative (unbiased) sampling of trips and events on trips. Under the previous program, the lack of a random sampling of trips prevented rigorous statistical inferences[10] about unsampled trips. This problem was compounded by concerns about the representativeness of the sampled events relative to the sample frame and target population (MRAG 2000).

Figure 3 Example of hierarchical sampling on an observed trip. The blue colored circle represents the sampling frame, the large circle the target population, the black circles are unobserved trips, and the olive colored circles are observed trips



At-sea information obtained from the nested design must be inferred to the unsampled trips in the target population. Because hauls are randomly selected to be sampled within a fishing trip, the haul level estimates are unbiased relative to the trips from which they were sampled. Similarly, estimates of catch and bycatch will be unbiased relative to fishing operations in Alaska if trips are randomly selected from those fishing operations.

[10] Statistical inference from sample data infers solely back to the sampling frame. Inferences to the target population are not statistical, but rather subject matter based and depends on how “representative” the sampling frame is of the target population (Skalski 2003). If the sampling frame is equivalent to the target population, then statistical inference is made to the entire target population; otherwise, inferences are made to the target population based on models and assumptions about the portion of the population outside of the sampling frame.

Prior to restructuring, there was no randomized design to sample trips, leading to potential biases in data collection due to vessels being able to self-select observed trips. To estimate discard, the CAS relied on ancillary information for estimation. Examples of ancillary information include the criteria used for post-stratification and the amount of retained groundfish used in the denominator for the calculated ratio estimators, both of which can introduce biases in estimates under certain conditions (e.g., small sample sizes, violation of assumptions).

3.1.2 Overview of post strata and catch estimation

The restructuring action established two categories of sampling coverage: full and partial coverage. Vessels that are required to carry at least one observer on all trips are in the full coverage stratum. In the partial coverage category, the 2013, 2014, 2015 ADPs created two sampling strata based on vessel characteristics known prior to deployment (NMFS 2013a). The ADPs also created a stratum that is outside of the sampling frame (the no coverage stratum).

In stratified random sampling, a population of units (e.g., trips) within the sampling frame is divided into non-overlapping subpopulations (sampling strata) where every unit must be in a single stratum. When a random sample is taken from each sampling strata, the procedure is called stratified random sampling. The statistical purpose of stratified sampling is to *a prior* subdivide a population in strata that are individually less variable then the overall population; essentially grouping similar elements of the population together to be sampled using the same methods. Stratification is used to sample certain segments of the population using different sampling rates or random selection methods (e.g., different sampling units). Stratified random sampling requires knowing stratum boundaries prior to sampling (i.e., at the sampling design stage).

Units within the strata are randomly selected, with the possibility of random selection probabilities being adjusted to be proportional with the strata size, thereby giving larger units a greater probability of selection then smaller units. This approach is referred to as probability proportional to size (PPS) sampling and in some situations may provide a more precise estimate. In practice however, PPS does not always increase in precision despite the intuitive appeal of adjusting the probability of deployment to reflect the relative size of the sample unit, either in terms of effort (trip length, vessel size) or impact to the marine resource (magnitude of catch, or catch histories for example). Studies that compared catch estimates generated from PPS methods to those obtained through equal probability sampling methods, such as those used in Alaska, show that equal probability sampling was preferable given the relatively marginal estimation benefits (if any) and greater logistical complexities that arise from implementing PPS (Allen et al. 2001; NMFS 2013a).

Sample units collected using stratified random sampling can also be grouped after the sample has been collected. This procedure is called post-stratification. Post-strata boundaries are defined using information that is known after a sample unit has been selected. An advantage of post-stratification is that definitions can include aspects of the fishery not known prior to sampling or aspects that would be unreliable to deploy into (e.g., reporting area or target). When designed appropriately, post-strata can be internally less-variable then the overall population, and they allow discard to be estimated specifically to certain aspects of the fishery such as target, area, and certain groups of vessels.

For vessels in the partial coverage category, fishery-level estimate of at-sea discards are generally derived from a combination of landings information and estimates of discard from observed hauls. For vessels in the full coverage category, discard amounts are estimated based on trip-specific observer information since all trips are observed. Industry production reports are used for vessels with missing observer data (e.g., deleted data) and for CPs in the partial coverage category.

For trips where an observer is not on board, the catch estimation process (catch accounting system, CAS) produces catch and bycatch estimates by multiplying a discard rate by the amount of groundfish and halibut landed for a trip. The discard rate is derived from observer data and is calculated as the amount of species-specific discarded fish divided by the total retained groundfish and halibut caught on observed hauls (as defined by post-strata; see Cahalan et al. 2015, 2010 for detail). The rate is computed for each post-strata using the estimates of at-sea discard for each haul (i.e., estimated from sampled hauls) [11]. This ratio is applied to the retained groundfish weight within the same post-strata for which the rate was calculated. Retained groundfish and halibut weights are generally obtained from landings and production information contained in eLanding reports (see Cahalan et al. 2015 for a full description).

The CAS uses different processes to estimate discard depending whether the species of interest is a prohibited species (king or Tanner crab, salmon, halibut, or forage fish), a groundfish species, or a non-target species. The differences in post-strata definitions are broadly described here. Cahalan et al. (2015 and 2010) provide a more detailed description of CAS estimation.

The post-strata definitions for groundfish are different from those for the PSC and non-target estimation methods. However, the basic process of deriving a discard ratio and estimating at a spatial and temporal resolution closest to the fishing event before using broadly defined post-strata is consistent across estimation for all species. Data are segregated based on gear, predominant species (“target”), and whether a vessel is ≥57.5 ft LOA and not fishing trawl gear (i.e. small vessel post-strata). However, the PSC and non-target systems use 6 categories of post-stratification for each sampling strata (Table 2), whereas discard estimates for groundfish and halibut discard on individual fishing quota (IFQ) halibut trips uses 2 categories for each sampling strata (Table 3). The sampling strata are defined in the 2015 ADP as either large vessel or small vessel selection (NMFS 2013b).

The different approaches for PSC and groundfish are a legacy from the transition between the old estimation process (the “blend” system) and the current CAS that occurred in 2002 (Battaile et al. 2005). The non-target system also added shortly after the transition estimates discard for species outside of the FMPs for ecosystem considerations, and to speciate individual components in the former “other species” category. The non-target system was adapted in 2007 to estimate seabird bycatch (Fitzgerald et al. 2013**)**. Post-strata definitions were changed in 2013 to match the sampling strata described in the ADPs. This created a new attribute that parsed landings and observer information into each sampling strata (small or large vessel, and trawl or non-trawl gear). This change was needed to keep the estimation process consistent with the new sample design (restructured observer deployment), thereby accommodating the different selection units in 2013 and 2014 (vessel versus trip selection) and the different sampling rates in 2015.

[11] The random selection of hauls on a trip can result in some hauls not being sampled. In these situations, groundfish discard is estimated by imputing species composition from the nearest haul (time and area) to the unsampled haul. On trawl vessels, total haul weight is obtained from the vessel's logbook. On longline trips, the total haul weight is computed as the mean weight per hook for all sets on the trip multiplied by the number of hooks set on the non-sampled set.

Table 2 Post-strata definitions for estimation of prohibited species catch (PSC) and non-target catch in the catch accounting system. All post-strata are contained within the larger sampling strata. Priority 1 and 2 post-strata are trip specific and hence are also specific to a gear type and fishery target.

Priority	Aggregation unit	Time period	Area	Other
1	Trip	CP/MS Week catcher vessels: Trip (gear deployment until offload)	NMFS Reporting Area/Special Management Area	
2	Cooperative	3-weeks	NMFS Reporting Area/Special Management Area	
3	Processing Sector (CP, MS, catcher vessels)	3-weeks	NMFS Reporting Area/Special Management Area	Fishery Target/ Small or Large Vessel/Gear
4	All Landings	3-weeks	NMFS Reporting Area/Special Management Area	Fishery Target/ Small or Large Vessel
5	All Landings	3-month	FMP	Fishery Target/ Small or Large Vessel/Gear
6	All Landings	Year to landing or production date	FMP	Fishery Target/ Small or Large Vessel/Gear

Table 3 Post-strata definitions for groundfish and IFQ halibut discard estimation.

Priority	Fishing entity	Time Period	Area	Other
1	catcher vessels	5-week (centered on week 3)	NMFS Reporting Area	Fishery Target/ Small or Large Vessel/Gear
2	catcher vessels	5-week (centered on week 3)	FMP Area	Fishery Target/ Small or Large Vessel/Gear

Each landing has characteristics that correspond to certain post-strata priority levels. The estimation of discard for each landing occurs at the highest priority level for which observer information is also available. If observer information is unavailable for a given priority level, the CAS drops down priority levels until observer information is available from which to generate a discard estimate for a landing.

The lowest levels are priority 6 for PSC/non-target and priority 2 for groundfish. If observer data are still unavailable at these priority levels, then discard estimates are not made for a landing. Using Table 2 as an example, an estimate is not made when observer data are unavailable within a 5-week period of a landing event for a given fishery target, gear type, and FMP area. This occurs if sample size is inadequate to cover the post-strata. Estimates are also not made for jig gear since it is never observed (no coverage category in the 2013, 2014, and 2015 ADPs) and post-stratification does not allow rates to be created across pooled gear-types.

3.2 Changes in the Sample Frame

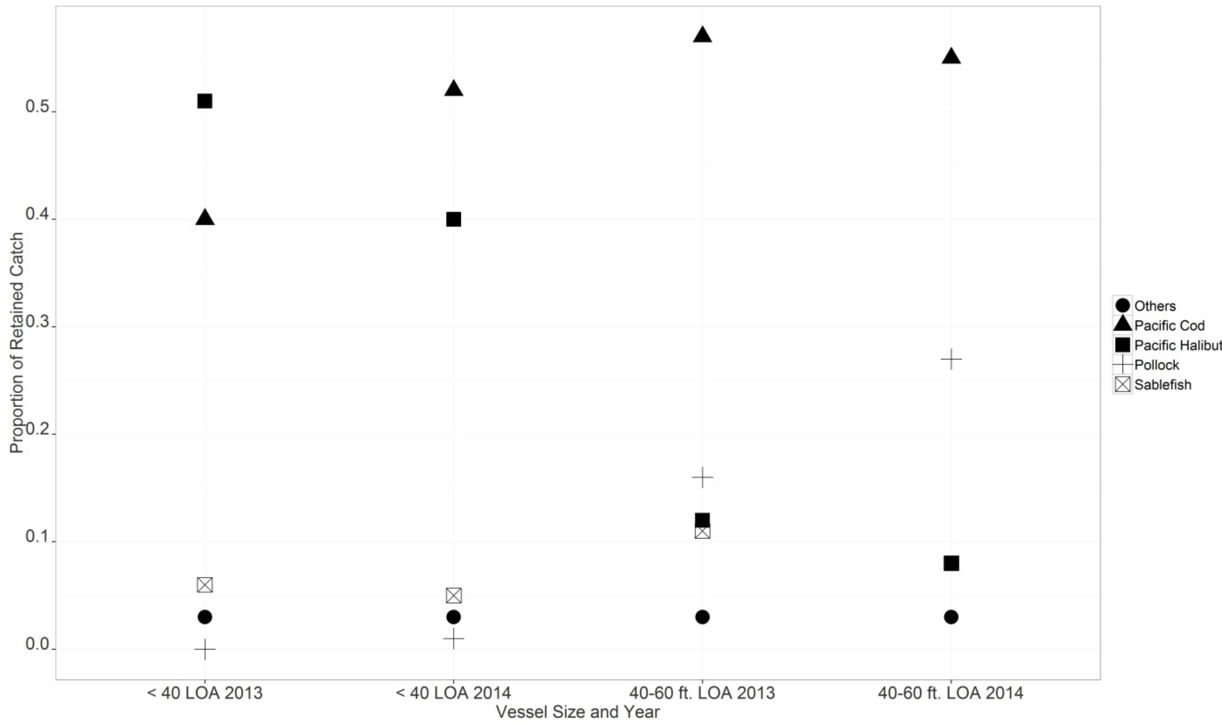
An important improvement under the restructured Observer Program is better alignment of the sampling frame with the target frame. The restructured rule authorized observers to be placed on all halibut vessels and vessels less than 60 ft LOA. This improved sampling frame meant observers had opportunity to sample discards associated with roughly 85,000 to 93,000 metric tons of retained catch (Table 3). The improved sample frame also reduced the number of trips that had no probability of coverage by 41% and 35% for 2013 and 2014, respectively (Table 3). Following the trend in trips, the number of vessels included in the sampling frame increased when compared to the previous program.

There were also differences in catch composition for vessels <40 ft (zero coverage) and the vessels between 40 ft and 60 ft LOA. Nearly all of the retained catch on trips in the zero coverage strata was composed of Pacific cod and halibut (Figure 4). Inclusion of vessels 40 ft to 60 ft LOA shifted the catch composition to Pacific cod, pollock, and halibut (Figure 4); these species accounted for the large differences in retained catch shown in Table 4.

Table 4 **Number of vessels and trips with *no* probability of selection under the restructured program (in accordance with the 2013 and 2014 ADPs) compared with the number of vessels and trips with *no* probability of selection had the previous program regulations been in place in 2013 and 2014. The previous program exempted vessels less than 60 ft LOA and those fishing halibut IFQ from observer coverage.**

Year	Condition	# Vessels	#Trips	Retained Catch (Metric Tons)
2013	Restructured Program	610	3,040	4,338
	Old Program	1,214	7,309	93,383
2014	Restructured Program	485	2,307	4,657
	Old program	1,054	6,593	85,219

Figure 4 Species composition of retained catch for vessels less than 40 ft LOA and vessels 40 ft to 60 ft LOA in 2013 and 2014. The species category labeled "Others" contained small proportions <1% of catch in all size/year categories and is primarily composed of rockfish and skates.



3.2.1 Changes in Spatial distribution

The expanded sampling frame created by the restructured Observer Program was expected to result in a better spatial distribution of sampling relative to the fishery footprint. Previous analysis suggested there was poor coverage in nearshore areas, particularly southeastern Alaska and other nearshore areas in the Central and western Gulf of Alaska (Gasper and Kruse 2013). These are areas where halibut vessels and vessel less than 60 ft LOA are known to operate, and recent landing information shows a clear pattern of fishing activity in nearshore areas for both pre-and -post observer restructuring (Figure 5). The fishery targets in the nearshore areas are primarily Pacific halibut and Pacific cod, with the retention of rockfish, skates, and minor amounts of other species also occurring.

Prior to restructuring, small amounts of at-sea observer coverage occurred on vessels greater than or equal to 60 ft LOA fishing for both halibut and sablefish. Occasionally, the predominant retained species on these trips would be halibut, which provided sporadic and low levels of coverage on mixed halibut and sablefish trips. Most of this coverage occurred along the shelf break and in deep water where sablefish are commonly caught (Figure 6, bottom panel). For example, prior to restructuring, no information was collected in the inside waters of southeastern Alaska, and nearshore waters in southeastern Alaska and along the Kenai Peninsula had limited to no coverage (Figure 6).

Figure 5 **Spatial distribution of catch for all Federal groundfish and halibut fisheries under the restructured program (2013- March 2015; top panel) and under the previous program (2009-2012; bottom panel). Spatial blocks are State of Alaska statistical areas and colors are the total retained catch for each State of Alaska statistical area.**

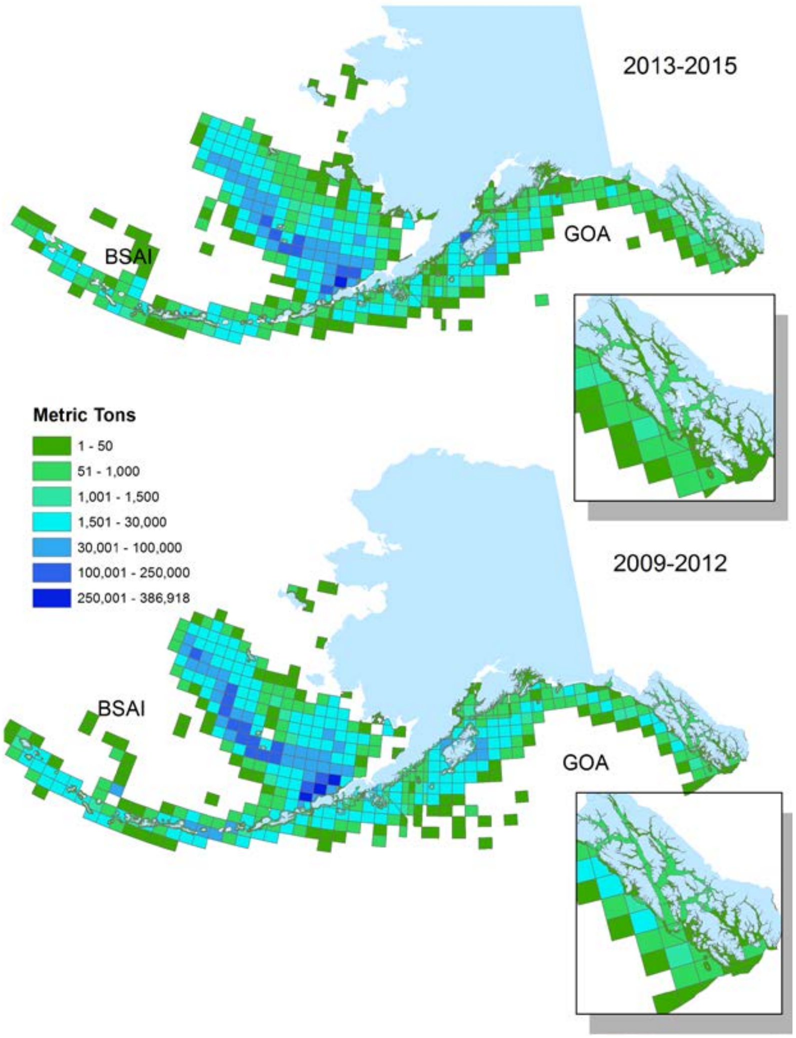


Figure 6 Summary of the number of hauls on observed trips for all vessels fishing in Federal fisheries since restructuring the program (2013-March 2015, top panel) and the previous program (2009-2012) (bottom panel). The total number of hauls (observed+unobserved) on observed trips are summarized to 20 km hexagon cell.

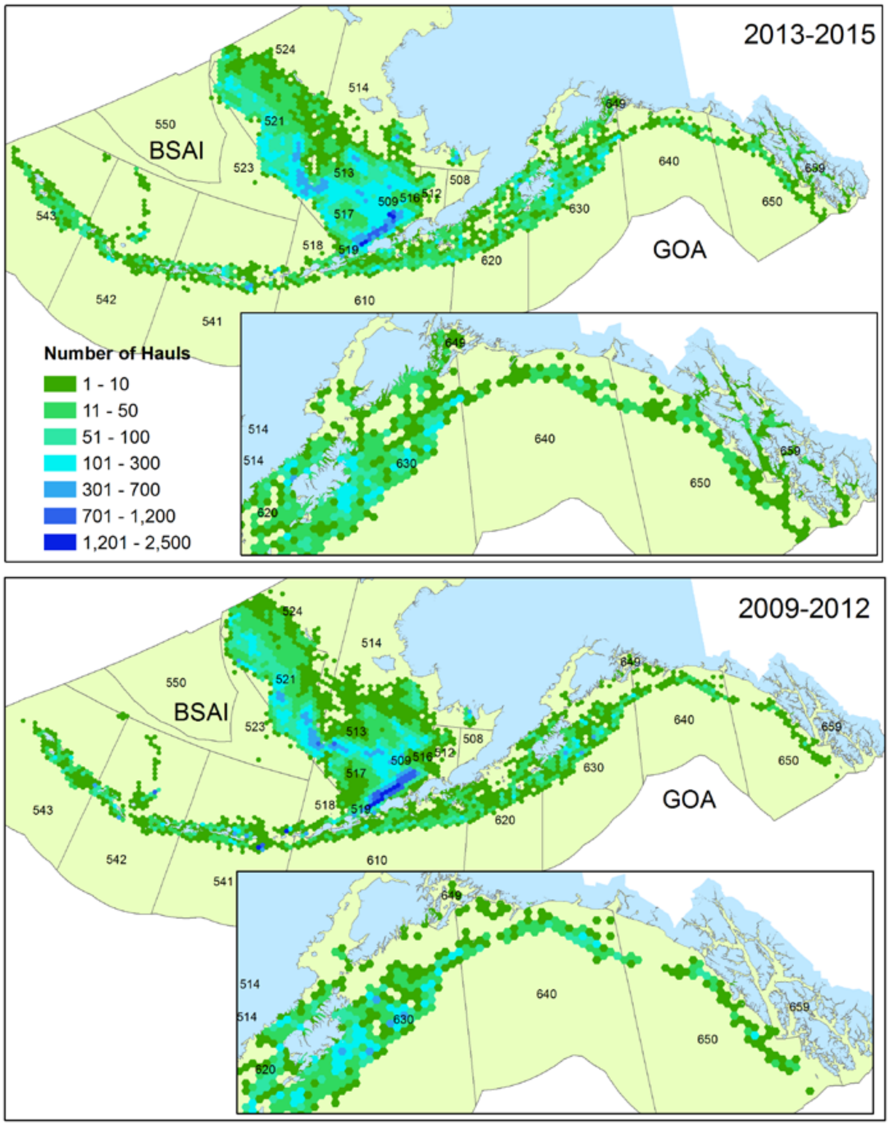
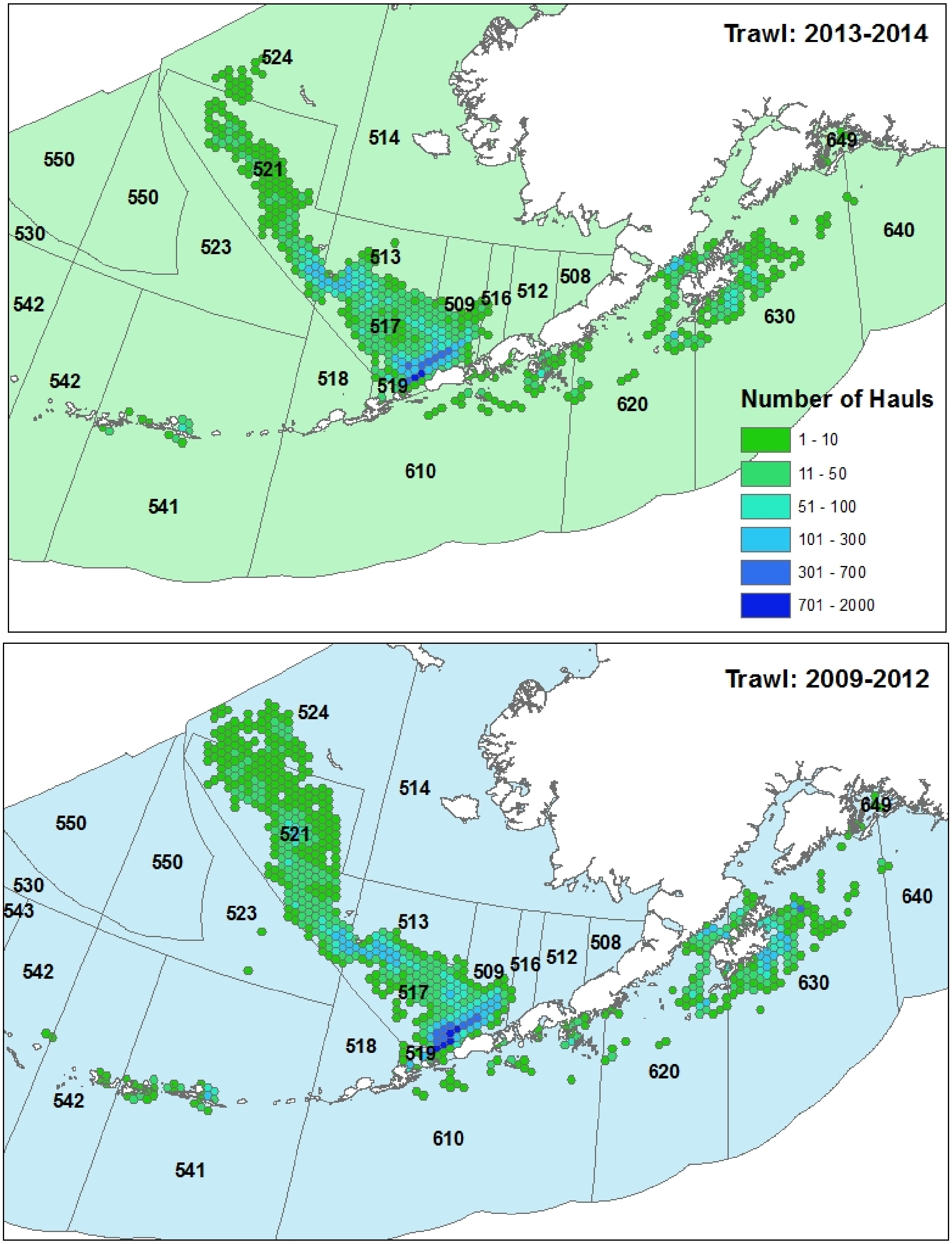


Figure 7 **Summary of the number of hauls on observed trips for all vessels fishing with trawl gear in Federal fisheries during the pre (2009-2012) and post (2013-2014) restructuring periods. The number of hauls (unobserved+observed) on observed trips are summarized to a 20 km hexagon cell.**



The spatial distribution of observer coverage under the new program included areas not previously covered. The largest improvement during the restructured years (2013, 2014, and 2015) occurred in southeastern Alaska (reporting Area 659), which had no coverage in 2009 through 2012 (Figure 6). Other improvements are also apparent, including more nearshore coverage along the Kenai Peninsula, Cook Inlet, Prince William Sound, the outside waters of southeastern Alaska, the nearshore waters of the Alaska Peninsula, reporting areas 513 and 521, and a flattening of coverage spikes in waters near Kodiak Island (seen as dark blue in Figure 6).

In addition, spatial coverage in the trawl fishery showed small changes in the distribution across the GOA. These changes included fewer peaks in coverage around Kodiak and a small increase in the number of areas observed in the western GOA (Figure 7). However, large changes in the footprint of observer coverage are not noted.

Spatial patterns in observer deployment relative to the 2014 and 2013 ADPs are discussed in the 2013 and 2014 Annual Reports (NMFS 2014a, NMFS 2015a). These evaluations showed where the spatial distribution of realized coverage (i.e., actual coverage) at the Federal reporting area level was statistically different from expected under the deployment rate. In both 2013 and 2014, some departures from expected coverage levels in partial coverage were noted in the vessel selection sampling stratum; however, these patterns are inconclusive since some departures are expected by random chance and the analysis in 2013 evaluated trips rather than vessels, resulting in difficulty interpreting results.

Despite the inconclusiveness of the spatial information, considerable data quality concerns resulted from a poorly defined sampling frame coupled with high numbers of vessels conditionally released from observer coverage due to space limitations or safety concerns. The Council and NMFS were concerned about the data quality issues and the burden vessel selection was having on the fishing fleet. The 2015 ADP moved all vessels formerly in vessel selection to trip selection, which is anticipated to improve the sampling frame for small vessels (NMFS 2014b). Concerns still exist about the potential biases resulting from conditional releases of small vessels from coverage (NMFS 2014a). The 2016 Annual Report will evaluate the impact on data quality due to this change in deployment methods.

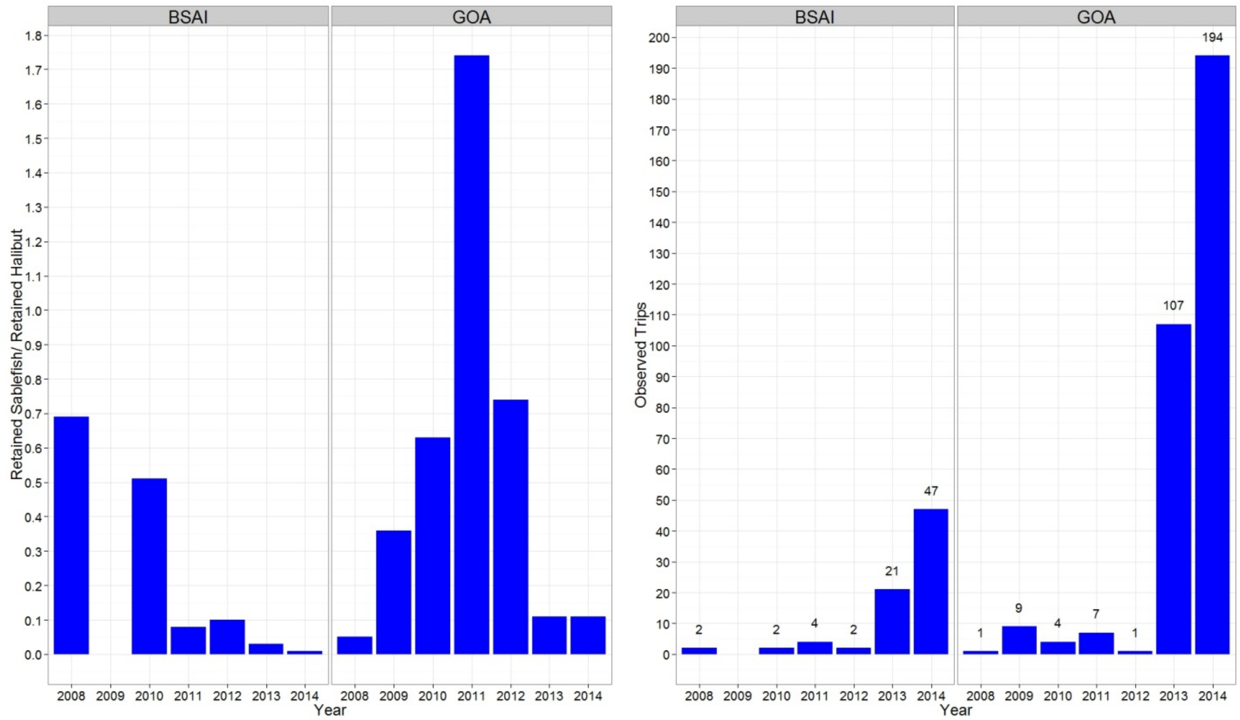
The restructured program has also shown coverage in areas not previously observed. This improvement suggests data collected under the new program has better representation of fishing activities in near shore areas then previously observed under the previous program. Much of this improvement is due to increased coverage in the halibut fishery, which is discussed in the next section.

3.2.2 IFQ Halibut Fishery

Prior to restructuring, observer information from the halibut longline fisheries was sporadic and an evaluation of this sector showed significant amounts of catch could originate from this sector, leading to a serious data gap (Tribuzio et al. 2014, Gasper and Kruse 2013). Coverage on these vessels was largely a result of sablefish and halibut combination trips on vessels greater than or equal to 60 ft LOA. These vessels retained enough halibut relative to other retained species that retained halibut was the predominant species (Figure 8, left two panels). The average proportion of retained sablefish to halibut over all trips within an FMP was generally much higher prior to restructuring, with the GOA showing a much larger difference then the BSAI. The large decline in the sablefish/halibut ratio in post-restructure years suggests observers are getting on more halibut-orientated trips in addition to still observing some trips with a mixture of halibut and sablefish.

Within the IFQ halibut fishery, there was a large increase in observer coverage after restructuring, while fishing effort decreased compared with prior years in (Section 4.1.3). Prior to restructuring, sporadic coverage resulted in few observed trips, the number ranging from zero trips in 2009 in the BSAI, to a high of 9 trips in the GOA (Figure 8, right two panels). After restructuring, deployment into the halibut fleet resulted in a large increase in observer data. Deployment in the BSAI resulted in 21 and 47 trips observed for 2013 and 2014, respectively. The GOA has more overall IFQ halibut and small vessel effort, resulting in 107 and 194 trips observed in 2013 and 2014, respectively.

Figure 8 Left two panels show the proportion of retained sablefish to retained halibut by FMP area for observed halibut vessels delivering shoreside and using hook-and-line gear. The right panel shows the approximate number of observed trips for hook-and-line vessels targeting halibut by FMP.



The increase in the number of halibut trips observed and perhaps better inclusion of trips focused on halibut rather than sablefish, improved the statistical reliability of observer information relative to the halibut IFQ fishery. In the years prior to restructuring, estimates of discard in the halibut fishery either were not made due to a lack of information, or were made based on little information (Figure 8). For example, in 2009, there were no data in the BSAI and thus no estimates of discard were made for halibut vessels (Figure 10). In other years, very few observed trips were used to provide estimates over a large number of unobserved trips and across a broad range of species in both the BSAI and GOA (Figure 9 and Figure 10).

In the GOA, sharks provide an interesting example to illustrate how a few observed trips leveraged many estimates (trips) prior to restructuring. In 2010, 1,100 estimates were made for GOA sharks and 3,000 estimates were made for skates. These estimates were based on information from only four observed trips (i.e., compare Figure 8 and Figure 9). In fact, *all* species-specific estimates for the GOA halibut fishery in 2010 were based on only 4 observed trips. Also note that the graphs are only specific to groundfish and do not include estimates of non-target species, crab, and salmon, all of which were generated from the same four trips. The low count of observed trips prior to restructuring is indicative of the period, resulting in very low sample sizes and unreliable estimates of catch.

Figure 9 The number of trips for which an estimate of discard >0 kg was made in CAS for the GOA: 2008-2014.

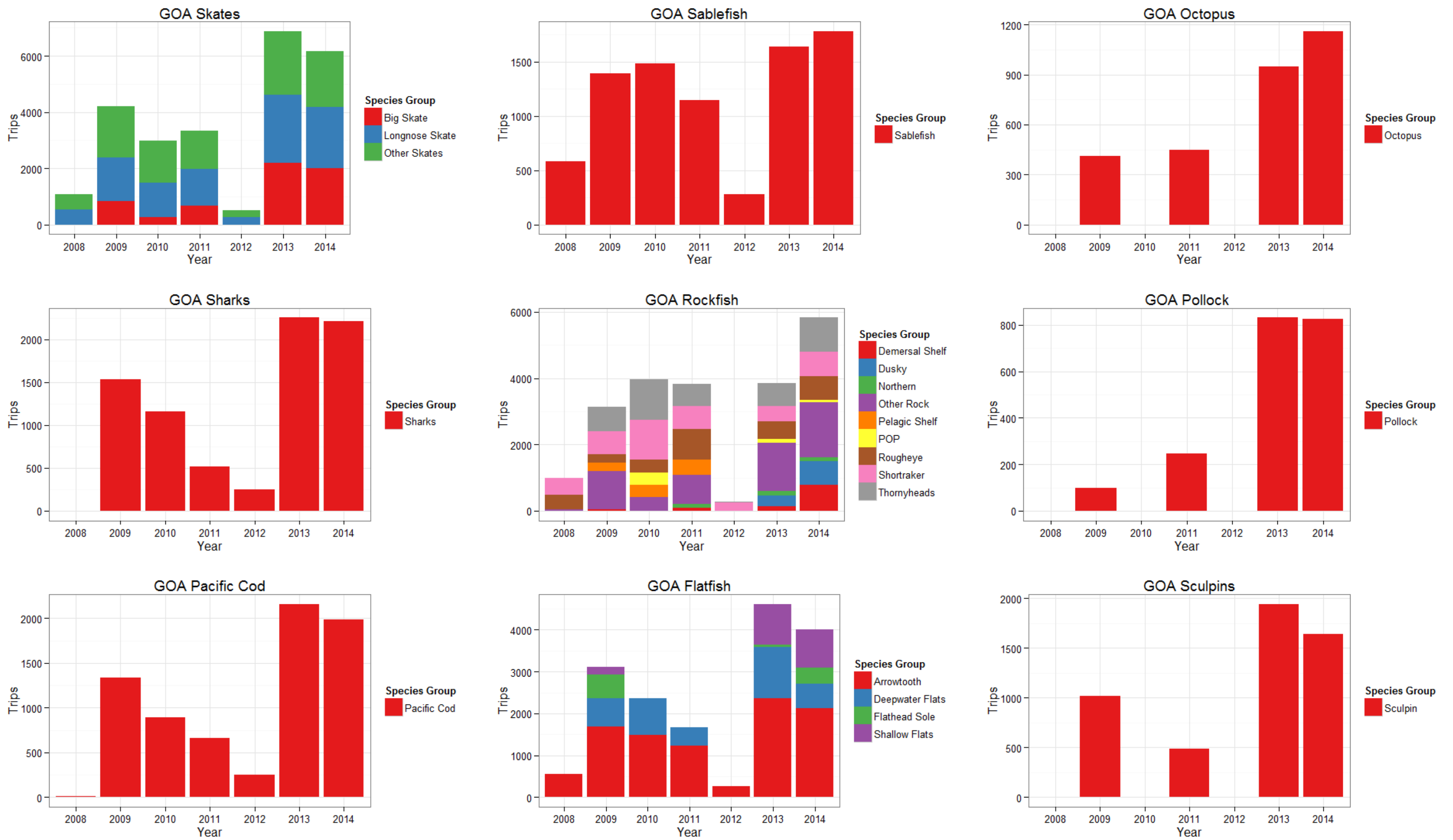
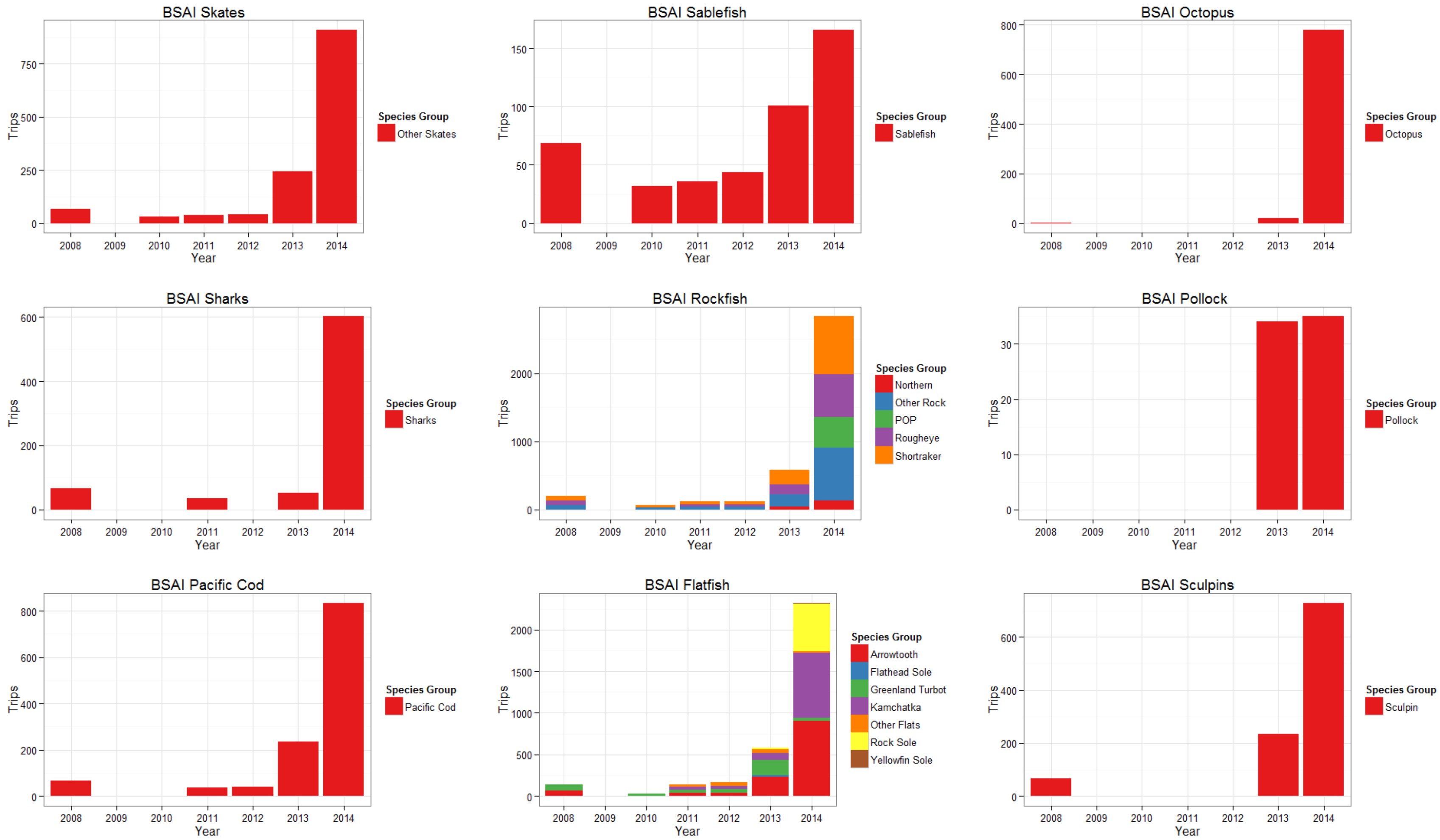


Figure 10 The number of trips for which an estimate of discard >0 kg was made in CAS for the BSAI: 2008-2014.



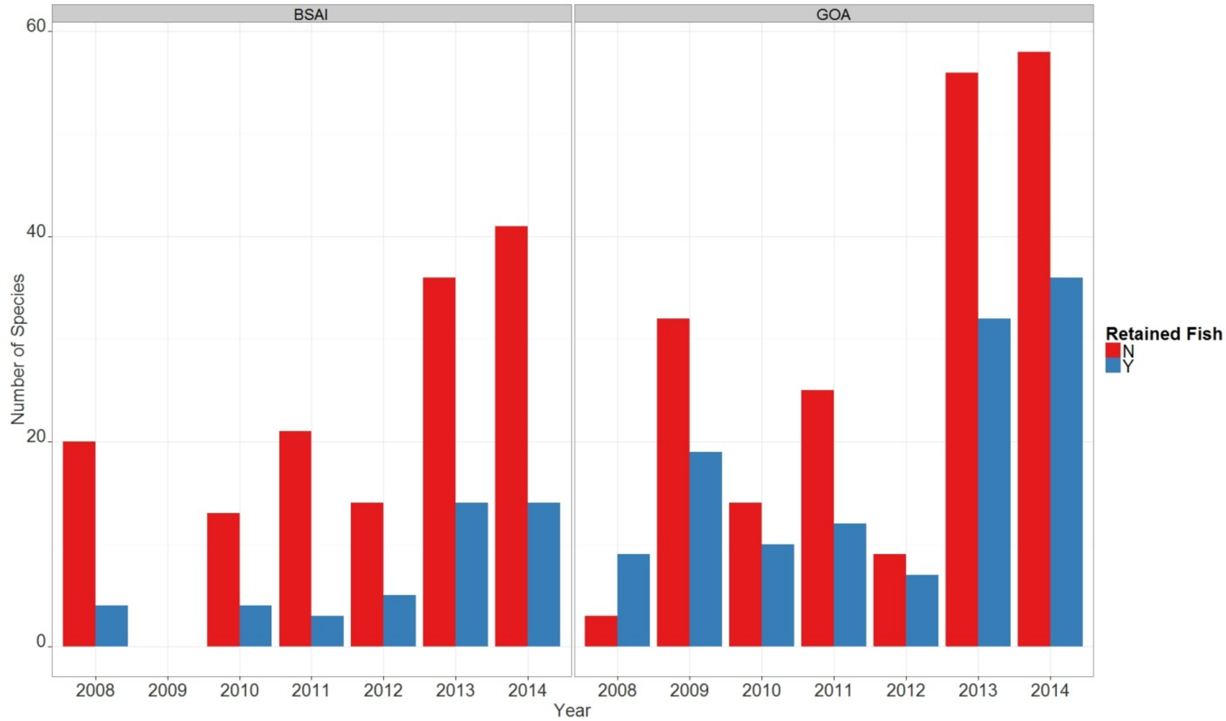
In the Bering Sea, there has also been an increase in the number of observed trips used for estimates before and after restructure, although relative to the GOA, the BSAI has had fewer observed trips. There was also a large difference in the number of trips between 2013 and 2014 for the Bering Sea (Figure 8). There are a few potential causes for this difference. One obvious cause is a lower vessel selection deployment rate in 2013 (11%) versus 2014 (15%). This would reduce the overall number of observed trips and limit the temporal and spatial spread of information available for estimation. The reduced rate also influences the amount of coverage in the Bering Sea versus the Aleutian Islands: 2013 had 5 trips occurring in the Aleutian Islands and 6 in the Bering Sea; whereas, 2014 had 25 and 22 trips observed for each area, respectively. This may have impacts on the composition of species in the observer data and thus impact estimation.

In both the BSAI and the GOA, obtaining representative data from the halibut fishery was expected to capture nearshore fishing activity not previously accounted for. These nearshore areas are important habitat for many species that do not occur in deeper waters where sablefish are commercially caught (Mecklenburg et al. 2002). As previously discussed, the ratio of sablefish to halibut decreased under the restructured program (Figure 8) and spatial coverage improved (Figure 6). Following this trend, the diversity of species should also increase under the new program as more shallow water fishing activity is sampled by at-sea observes in the halibut and Pacific cod fisheries.

The shallow water habitat on the continental shelf (less than 250 m), including the inside waters of southeastern Alaska, is utilized by different species and life stages then species occurring in the deeper shelf-edge waters or deep fjords in southeastern Alaska. For example, juvenile Pacific cod occur mainly between 60 m and 150 m, and the percentage of fish residing in waters less than 100 m tends to increase with length beyond about 90 cm (A'mar and Palsson 2013). AFSC tagging programs have also shown juvenile sablefish to occur in large numbers in the shallow nearshore waters of southeastern Alaska and other nearshore area around the GOA. Other species commonly caught (retained or discarded) also inhabit shallower water: e.g., sculpins, longnose skate (*Raja rhina*), big skate (*Raja binoculata*), rock sole (*Lepidopsetta polyxystra),* certain demersal shelf rockfish species, and other managed species (Mecklenburg et al. 2002). Thus, coverage in these nearshore areas should result in more species sampled by observers and better representation of the species encountered in the fishery.

The new information from nearshore areas coupled with increases in sample size resulted in a large increase in the diversity of discarded species (Figure 11). The annual average count of unique species discarded (using eLandings species codes) under the previous program was 16 in the GOA and 17 in the BSAI (2008 through 2012). The average annual count of unique species discarded under the restructured Observer Program more than doubled under the restructured program (58 in the GOA and 41 in the BSAI, 2013 and 2014). This increase is likely indicative of better representation of fishing activity in nearshore areas and better reflects species diversity. Interestingly, the number of unique species retained also increased. Anecdotal reports from inseason managers suggest this is tied to greater care among fishers to retain certain species as well as improved species identification (J. Keaton, NMFS, personal communication, March 15, 2015).

Figure 11 The number of unique species with an eLandings code sampled by observers. Data are categorized by FMP and whether the species was retained (Y) or discarded (N).



Improvements in sampling under the new Observer Program seem to have resulted in a general increase of total discards during the restructured years. These increases were seen in both the GOA (Figure 12) and the BSAI (Figure 13). Several notable species groups infrequently estimated under the previous program were significant sources of discard during the restructured years. In the GOA these included: big skates, shortraker rockfish, pollock, octopus, and sculpins (Figure 11). The BSAI also saw increases in the amount and types of species estimated. These species included: octopus, pollock, sculpins, sharks, northern rockfish, and shortraker rockfish (Figure 12). The discard amounts in the BSAI were generally small for many of these species, with the exception of skates, Pacific cod, and shortraker rockfish (relative to 250 ton TAC).

Gauging improvements in sampling by assessing the volume of discard is difficult due to confounding factors not associated with sampling. These factors include changes in the abundance of a species, estimation techniques, trip-specific catch characteristics, and the location and timing of observer information. For example, in years prior to restructuring, only a few trips and hauls were available to calculate a discard ratio. These few trips had high discard rates that resulted in discard estimates of the same order of magnitude as those in post-restructuring years (e.g., GOA sharks in 2009). Identifying trends related to the quality of sample data solely based on the total estimated discard is impossible.

However, it is clear that the post-restructure years have generated more estimates of discard. These estimates of discard utilize a larger sample size, encompass a greater diversity of species, cover new spatial areas, and better represent the fishery through time. Taken together, the improvements in the underlying statistical reliability of the data under the restructured program have improved estimates of discards.

Figure 12 Discard estimates for species caught in the GOA halibut longline fishery from 2008 to 2014.

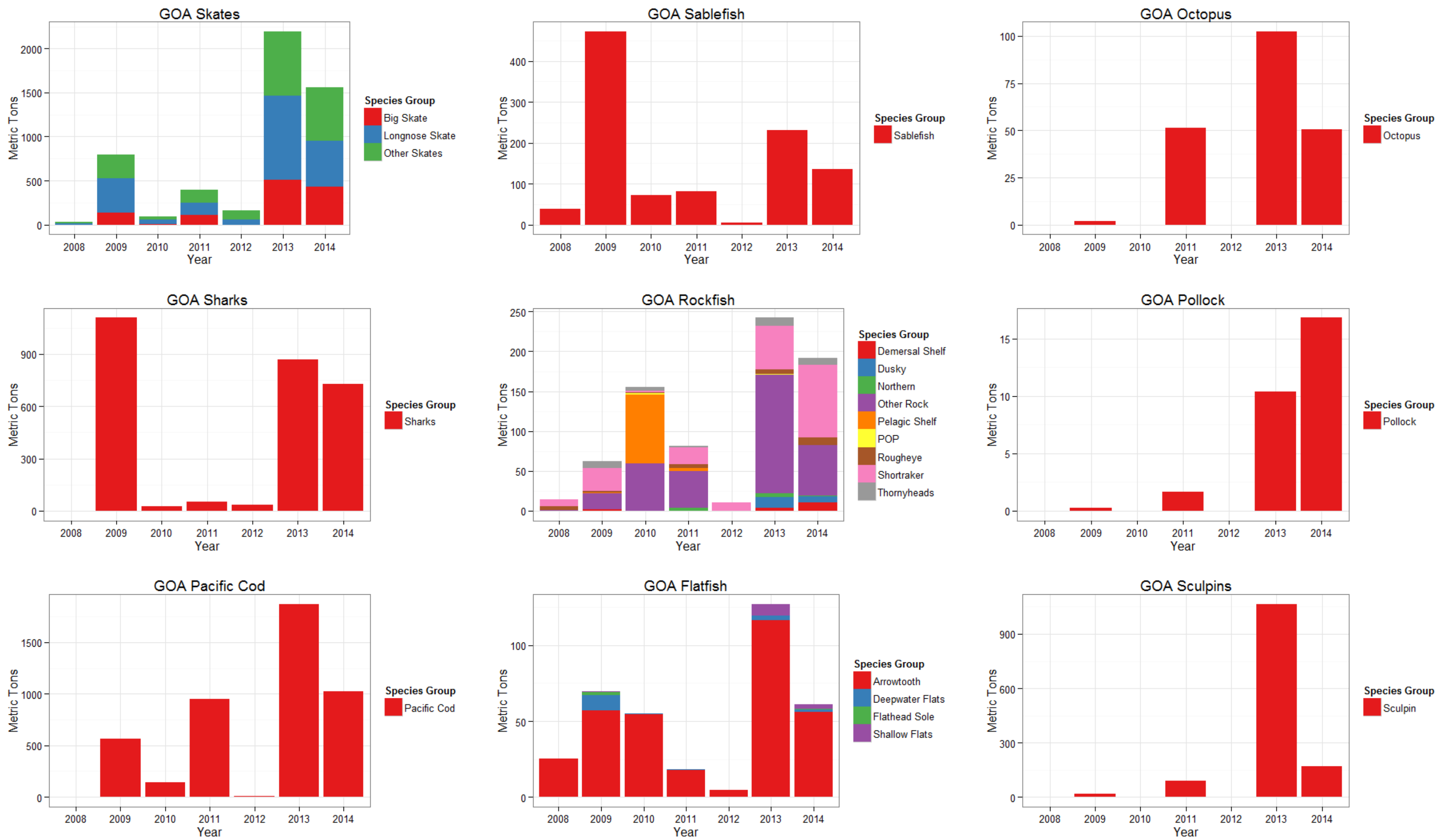
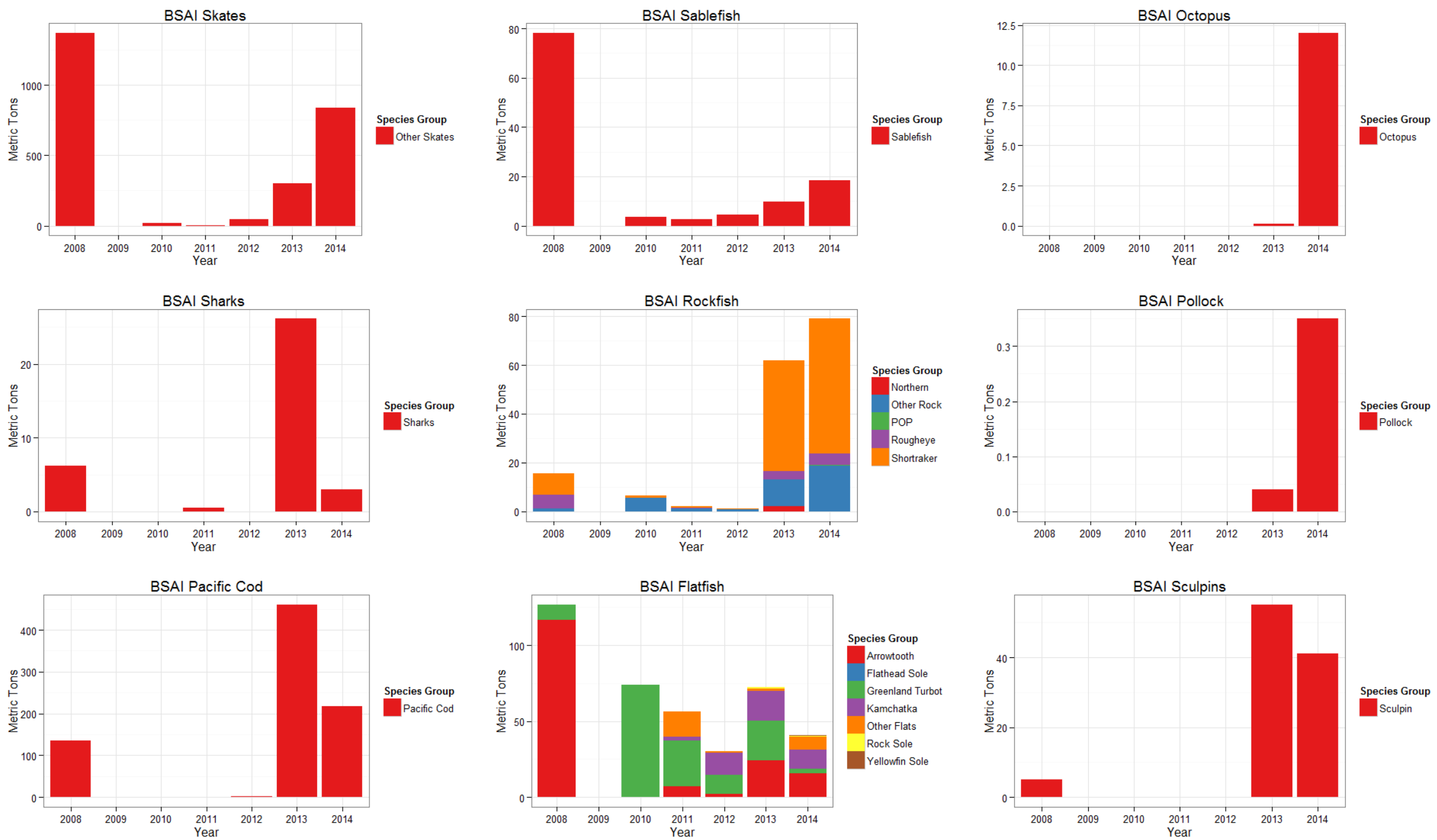


Figure 13 Discard estimates for species caught in the BSAI halibut longline fishery from 2008 to 2014.



3.2.3 Management Implications of Expanded Coverage

On a daily basis, inseason managers project fishery effort and catch amounts to ensure future catch remains within limits. However, starting in 2013, there was no past information available from which to gauge catch rates for small hook-and-line vessels. As the season progressed, it was clear the large improvement in sampling under the new program exposed gaps in the previous year's estimation due to inadequate sampling of the IFQ and small vessel fleet under the previous Observer Program rules. Ultimately the new information resulted in some species exceeding inseason projections and the acceptable biological catch (ABC).

The species that exceeded the ABC included shortraker rockfish in the Bering Sea, rougheye and "other rockfish" in the Aleutian Islands, and big skates in the Central Gulf of Alaska. These species coincide with the increased catch observed in Figure 12 and Figure 13. Inseason managers have since adjusted management methods to better utilize the new information in their catch projections. The new information has also required inseason managers to closely monitor the harvest levels of other species including sharks, other skate species, octopus, and various rockfish species to ensure harvest remains within limits.

The exceedance of the ABC is not a result of the restructured Observer Program, rather the large increase in data quality illuminated previously unknown management issues. The ability to estimate bycatch on small vessels will provide critical information to inseason managers and stock assessors about total removals. Currently, only two years of information is available, so a time series to help predict future behavior and characterize "typical" catch levels is still lacking.

Another area of management concern is the management of halibut and salmon PSC in the Gulf of Alaska. The Council put a priority on covering vessels with PSC limits, resulting in a higher deployment rate for large vessels. To evaluate whether the restructuring changed how data are post-stratified by the CAS during the estimation process, we investigated the distribution of estimates made in the PSC post-strata. In general, post-strata at the priority 3 level (reporting area rate, Table 2) were used for halibut estimation. This demonstrates roughly 80% of the halibut estimates were made using observer information specific to a gear, trip target, 3-week period, and reporting area.

3.3 Quality of trip level information

A primary goal for the Observer Program is to collect representative data associated with fishing events. Two documents govern the methods used for sampling: the Fisheries Monitoring and Analysis (FMA) Division's North Pacific Observer Program Sampling Manual (NMFS 2015d) provides detailed data collection methods that generally follow random selection within a nested hierarchal sample design, specific to an observed trip; and the ADP provides methods for the random selection of trips. Both these documents are evaluated by NMFS on an annual basis and changes are made as needed to improve the statistical reliability of sampling methods and adjust sampling priorities.

Each year sampling protocols for the sampling of hauls or sets on a trip are published by FMA and are in addition to other data quality controls already in place (NMFS 2015d). The sampling manuals provide a Standard Operating Procedure for observers deployed at-sea and are an important accompaniment to training courses for observers required by FMA. Vessels and shoreside plants are difficult environments to work and require special knowledge about vessel operations, safety, and how to appropriately use equipment. Training provides observers with the knowledge necessary to conduct duties in this harsh environment. However, difficult working conditions coupled with a diverse fishing fleet require careful quality control methods to evaluate data collected by observers and also address problems in the field. Quality control occurs on many levels within the Observer Program: inseason advising to observers on data collection, mid-deployment briefing that allows the quality of information to be evaluated and problems in the field to be discussed, automated error checking is built into many of the FMA databases to allow streamlining of data corrections, debriefing of observers after deployment to provide quality control on incoming data correcting, databases that provide quick access to data and facilitate quality control, and trainings coupled with changes to the sampling protocol that responds to quality control issues. Taken together, this creates a robust system to ensure data collection is conducted using statistically reliable sampling methods.

The methods used for the deployment of observers onto vessels are governed by the ADP process and Federal regulations created by the restructuring action. This is a different process than the previously discussed sampling priority process. There have been three ADPs published to date (2013, 2014, and 2015). Readers are directed to these documents for details on deployment. In addition, Federal regulations require vessels to meet coverage and sampling requirements, including logging of trips into the Observer Declare and Deployment System if they are in the partial coverage category, payment of fees, and measures to protect observers from harassment and the opportunity to obtain representative samples of catch on observed trips.

Each year following deployment, the sampling goals of the ADP are evaluated and the reliability of the information collected under the deployment plan is assessed (Faunce et al. 2014). These results are summarized in a larger annual review of the observer deployment plan that occurs each June (NMFS 2014a). To date there have been two annual reports published (2013 and 2014). In brief, both the 2013 and 2014 annual reports of deployment evaluated the reliability of data using metrics designed to assess the representativeness of a sample. These metrics measured the following data qualities (Faunce et al 2014):

- Evaluate the temporal representativeness of observer coverage using plots of effort over time to compare patterns and differences between observed and unobserved trips.
- Evaluate the spatial representativeness of observer coverage using two broad methods; a visual depiction of observer coverage relative to total coverage; and whether the amount of observer coverage was as expected given the distribution of fishing effort.
- Comparisons of trip characteristics between observed and unobserved vessels. A representative sample should not have statistical differences in attributes between observed and unobserved vessels. Attributes such as trip length, total catch, and number of species caught were used for comparison.
- Adequacy of sample size relative to the target population. In this case the target population was trips that have >0 probability of being sampled and was evaluated by determining the probability of having no data in a NMFS reporting area.

A well-known issue with at-sea data collection is the potential for an observer-effect. This occurs when the vessel fishes differently when an observer is on board. Each Annual Report investigates differences between the sampled population, the sample frame, and the target population to investigate potential observer effects. Unfortunately, the potential observer effect on discard composition and volume can only be directly measured by on board observers and thus cannot be measured on unobserved trips (e.g., at-sea discard). Therefore, trip characteristics that can be measured such as trips length, retained species composition, number of areas fished, and trip duration are used to evaluate observer effects. Readers are directed to the Annual Report (NMFS 2014a, NMFS 2015a) for more information on these methods.

The 2013 Annual Report evaluated the first year under the new program for each of the two sampling strata in the partial coverage fleets (NMFS 2014a). In general, the report found sampling in the large vessel stratum to be representative, whereas the vessel selection stratum had numerous issues that were indicative of unrepresentative sampling.

> Trip Selection: No large differences in temporal or spatial patterns were observed for vessels in trip selection. Comparisons of trip attributes (e.g., trip length, retained catch, species diversity) between observed and unobserved trip showed no obvious patterns that would indicate non-representative sampling of trips in the sampling frame (Faunce et al. 2014).
>
> Vessel Selection: The impact of non-response (i.e., a vessel was selected to be observed, but was released or exempted during the selection period) had significant impacts on the spatial distribution of observer coverage, with several reporting areas consistently having coverage levels different from expected for much of the year. The small sample sizes for each selection period made distinguishing differences in trip attributes between observed and unobserved vessels inconclusive. However, very large differences would have been detectable and these were not observed. Perhaps the largest problem was that coverage levels were less than expected during the first 5 selection periods (January through October) resulting from a poorly defined sampling frame and large number of conditional releases. In the last period this resulted in abandoning random sampling in an effort to get enough vessels observed to conform to expected sampling rates.

Results from the 2014 Annual Report (evaluating 2013 deployment) prompted the NMFS and Council to recommend and implement, changes to sampling methods from those used in 2013 and 2014. These changes were made in the 2015 ADP and are anticipated to improve the statistical reliability of observer data in 2015. The largest improvement eliminated using a vessel as the selection unit in the vessel selection stratum, thereby putting all vessels under trip selection. This change will improve the sampling frame definition by eliminating the need to rely on prior year's effort information to define the sampling frame. The change is also anticipated to improve coverage of the target population by reducing the number of vessels (and trips) conditionally released from coverage; this change is believed to reduce the burden on vessels since the selection period is s single trip rather than a 2-month period. The changes implemented in the 2015 ADP will be evaluated in the 2016 Annual Report.

In summary, the ADP and Annual Report process provides ongoing evaluation of the reliability of the information collected through the restructured Observer Program. This iterative process is adaptive to the dynamic nature of fishery data collection by facilitating a process of evaluation, public and Council review, Council recommendations on sampling plan adjustments, and adjustments to deployment by NMFS. Importantly, the ADP enables changes to be implemented to address identified sampling issues. The 2015 ADP provided a risk assessment of data being available for every NMFS/area/gear combination to help guide policy decisions about deployment rates (e.g., Figure B-2 in the 2015 ADP). The 2015 ADP provided a risk assessment of data being available for every NMFS/area/gear combination to help guide policy decisions about deployment rates (e.g., Figure B-2 in the 2015 ADP). The ADP analysis does not provide a "hard line" that indicates a single rate that results in the whole observer data collection program not being able to collect reliable information. A "hard line" would be inappropriate in context with all the data collection priorities that the Observer Program must balance. Instead, the ADP process provides a risk assessment and information to guide policy decisions about where to reduce risk of no coverage rather than a single defining rate where data becomes unreliable (which would only be relative to a specific sampling objective and measure).

3.3.1 Temporal patterns in vessels 60 ft to 125 ft LOA

Under random selection, the cumulative distribution of the number of all observed trips will be proportional to the total amount of fishing effort. Small deviations are expected since randomization will result in slight variability in selection rates; however, large trends in deviation between observer coverage and effort should not occur under random sampling. The change from the previous program to random selection under the restructured program allows for a more robust evaluation of current methods (sampling and estimation).

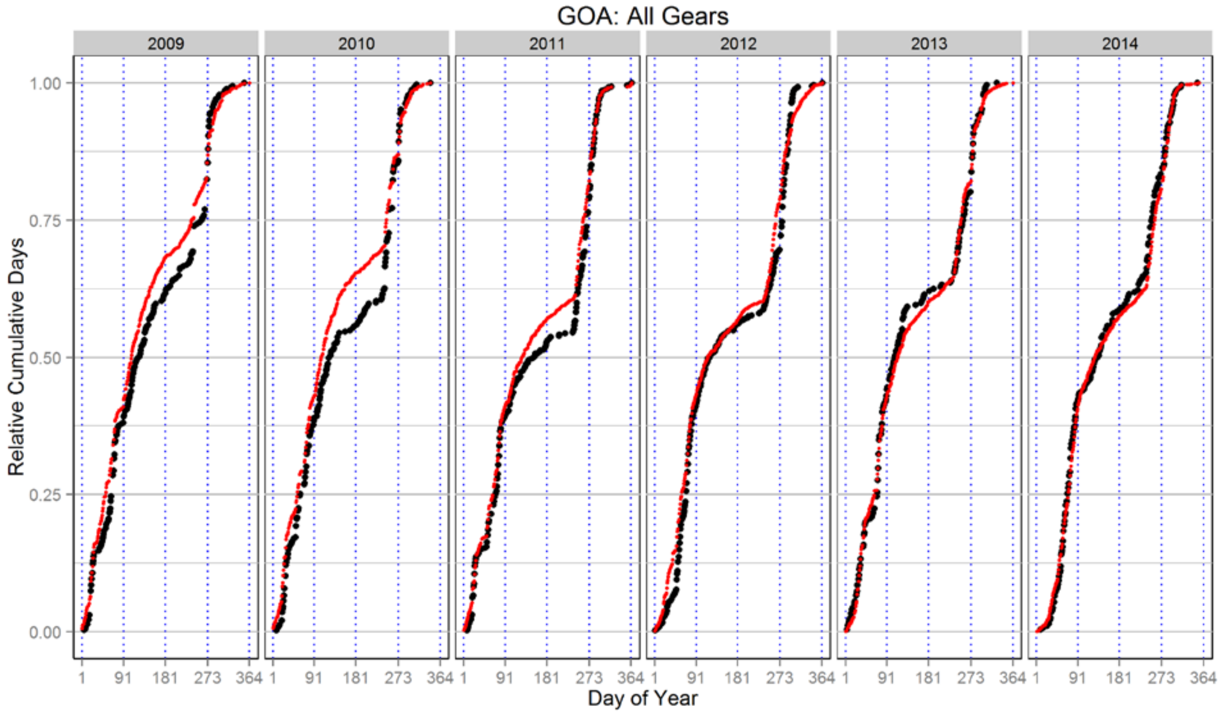
Under the previous program, the deployment of at-sea observers was not random for vessels in the 30% category. This category comprised vessels not subject to management-program specific requirements for full coverage and catcher/processors or catcher vessels greater than or equal to 60 ft (18.3 m) LOA but less than 125 ft (38.1 m) LOA, and who participated for more than 3 fishing days in a directed fishery for groundfish in a calendar quarter. Vessels were required to have an observer on board during at least one fishing trip in a calendar quarter for groundfish categories designated in regulation.

In some fisheries, particularly the trawl fisheries, a clustering of coverage near the end of the quarter as vessel operators took observers to meet coverage requirements was thought to occur (NMFS 2009). Some fisheries would also see spikes in coverage due to vessels voluntarily taking observers, while leaving other fisheries with lower coverage since quarterly coverage requirements were met. The end result was that the amount of observer coverage did not track fishing effort throughout the course of year, resulting in parts of the year being over or under represented in the observer data. In addition, work done by Faunce and Barbeaux (2010) found observer effects related to differences in landings and temporal patterns in observed and unobserved vessels. They concluded that observer data was vulnerable to bias within the 30% coverage fleet.

We investigated changes in the temporal patterns in observer coverage by comparing trends in effort with trends in observer coverage. This evaluation was limited to catcher vessels between 60 ft LOA and 125 ft LOA since no coverage occurred in the previous program for vessels less than 60 ft LOA and vessels less than 125 ft had 100% observer coverage. For years prior to observer restructure, a proxy to identify a fishing trip was created using a combination of the unique date fishing began and the vessel permit number. This likely undercounted trips for vessels taking two trips on the same day; however, this was the best available method to identify trips and these errors are not expected to drastically change results for this vessel group. In addition, only the GOA was evaluated since most of the restructured vessels occur in the GOA and a large portion of the BSAI fleet is under 100% voluntary coverage.

Trends in observer coverage in the restructured program were evaluated by comparing the cumulative count of trips observed by day of the year with the cumulative count of observed trips (Figure 14). The cumulative counts were normalized by all days within the total effort category (red line) or observed category (black line) to create a proportion of days of observed between 0 and 1.

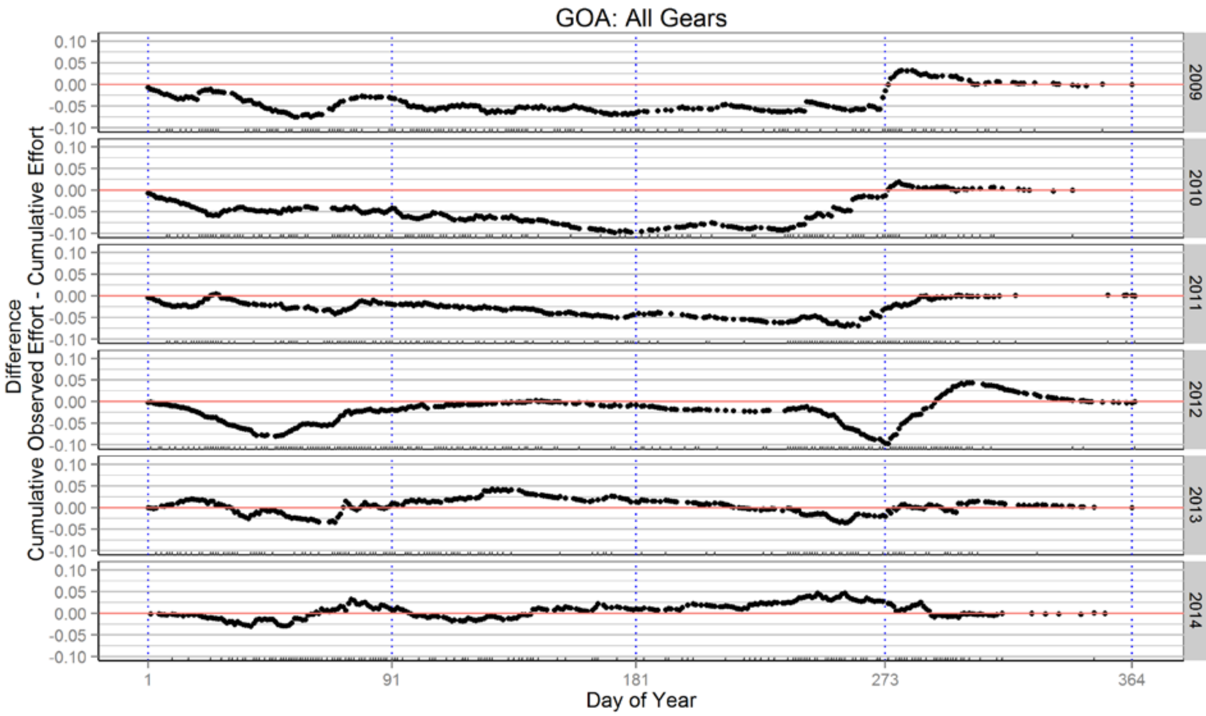
Figure 14 Cumulative proportion of observed trips (black line) and all trips (red line) by day of year and year. Information from catcher vessels 60 ft to 125 ft LOA and operating the GOA are included in the graph. Light blue lines indicate quarter breaks.



To help visualize the differences in observer and total effort through time, the cumulative total effort on each day can be subtracted from the cumulative effort for each observed day. In other words, subtract the red line in Figure 14 from the black line in the same figure. This creates the graphs depicted in Figure 15. A zero value in Figure 15 indicates the cumulative relative amount of observed effort was exactly the same as the cumulative relative amount of total effort (i.e., the black line and red lines overlay). Positive values indicate there was more observer coverage then total effort cumulatively to that point in time, whereas negative values indicate there was less observer coverage then effort.

In viewing the graphs it is also important to realize changes in the cumulative distribution will follow trends. Once too much or too little observer effort is accumulated relative to total effort, the graph will trend away from zero. These trends will persist until enough observer days are accumulated (or not) to force the difference back to zero. In this way, differences between effort and observer coverage can be identified, but these differences are the result of the days accumulated to the date being evaluated and thus there is a lag in response unless a large change occurs on a single day (this results in a steep slope, e.g., quarter 3 in 2009).

Figure 15 **The daily difference between the cumulative proportion of observed trips and total effort as shown in Figure 14. Positive values indicate there was more observer coverage than total effort cumulatively to that point, whereas negative values indicate there was less observer coverage than expected. Information from catcher vessels 60 ft to 125 ft LOA (former 30% coverage fleet) and operating in the GOA are included in the graph. Light blue lines indicate quarter breaks.**



Over all gear types, the restructured program showed a lower mean absolute deviance[12] than in the years under the previous program (Table 5). Figure 15 shows the difference between the cumulative effort and the cumulative observed effort, with the area above the red line indicating more coverage than expected, and the area below the red line being less coverage than expected. Coverage under the previous program was generally lower than expected (relative to total effort) during the first three quarters of the year, and precipitously increased during the last quarter.

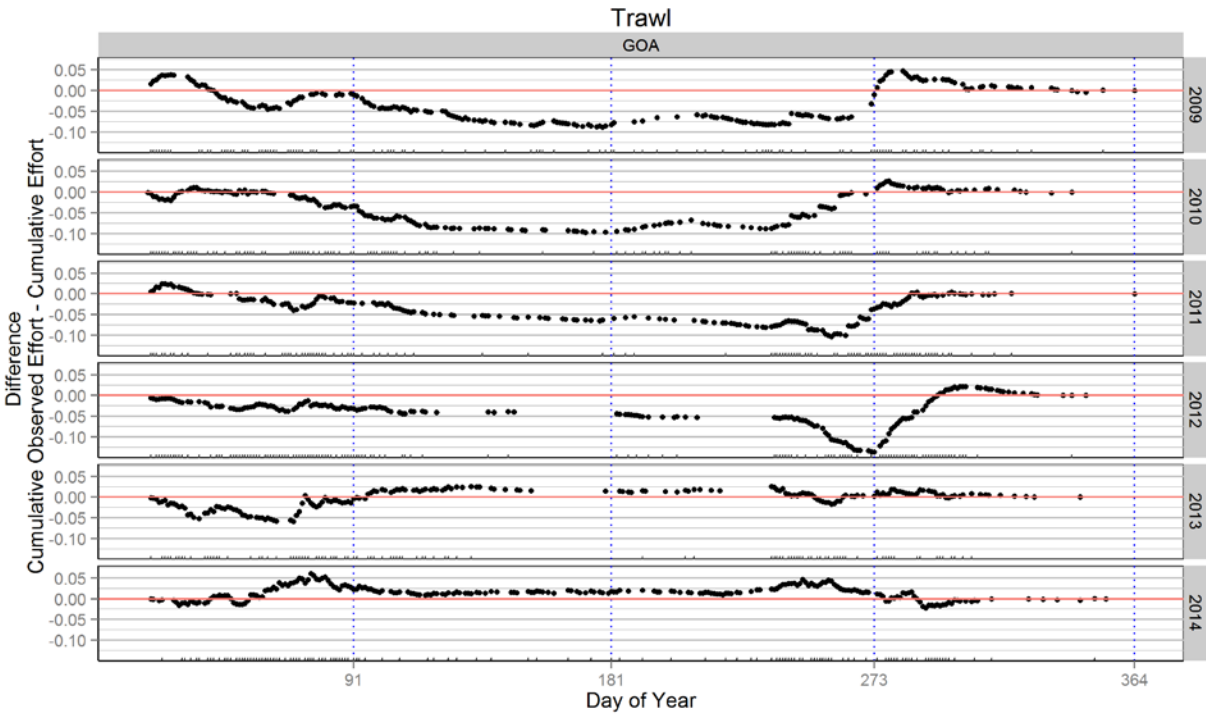
[12] The mean absolute deviance (MAD) within a year was calculated as $MAD_{year} = \frac{1}{n}\sum_{i=1}^{n} | E_i - O_i |$, where n is the number of days with an observed trip, i is the ith observed day, E is the cumulative proportion of total trips on the ith observed day, and O is the cumulative proportion of observed trips on the ith day.

Table 5 **Mean absolute deviation (MAD) of the cumulative difference between total daily trips and total daily trips observed for all gear types in the GOA. 2009 through 2012 are years under the previous program, 2013 and 2014 are years since restructure. See Figure 14 and Figure 15 for graphical comparison of the differences.**

Year	MAD
2009	0.044
2010	0.049
2011	0.029
2012	0.031
2013	0.015
2014	0.016

Temporal patterns in coverage were especially apparent in the trawl fisheries (Figure 16) particularly around the third quarter (day 273). The flexibility under the previous program allowed vessel operators to distribute coverage within a quarter and across different fisheries. Regulations only required that one observed trip had to occur in each fishery for which the vessel participated during a quarter (fisheries were defined in Federal regulation). For example, halibut PSC constrains flatfish and Pacific cod harvest in some years, so participants would choose coverage in clean target fisheries such as pollock to avoid high halibut bycatch rates. In other cases industry formed informal cooperatives to increase observer coverage and allow certain fisheries to remain open. Thus, coverage levels would not be expected to track with effort under the under the previous program. These abrupt increases and drops in observer coverage under the previous program were much less apparent in 2013 and 2014 when the coverage was proportional to the total amount of fishing effort. This change resulted in observer data that better represented temporal patterns in the fishery, which reflected improvements in the reliability of observer information.

Figure 16 **The daily difference between the cumulative proportion of observed trips and total effort for trawl vessels in the GOA. Positive values indicate there was more observer coverage than total effort cumulatively to that point, whereas negative values indicate there was less observer coverage than expected. Information from catcher vessels 60 ft to 125 ft LOA and operating in the GOA are included in the graph. Light blue lines indicate quarter breaks.**



3.4 Estimation gaps under varying observer coverage

The amount of funding obtained from the 1.25% landing fee and any additional funding provided by NMFS annually determines the amount of coverage in the partial deployment category. Section 4.0 of this analysis provides details on hypothetical funding levels 2009 through 2012, and actual funding levels in 2013 and 2014. The number of observer days available fluctuates between years due to changes in revenue that are caused by changes in ex-vessel value of catch and volume, and changes in the cost of an observer day. Deployment rates fluctuate due to variation in trip length (i.e., days observed), the number of days NMFS can afford, and the total amount of trips occurring the fishery. The yearly fluctuation in rates has consequences in NMFS's ability to estimate catch in the groundfish and halibut fisheries.

An important consequence of changing deployment rates is whether the post-strata within the CAS can still be reliability filled with observer information. In order to assess the risk of gaps in estimation and situations where estimates could not be made under varying levels of observer deployment, we simulated sampling in the trip selection stratum using the post-strata definitions currently used in the CAS and evaluated the probability of a post-strata in the CAS having no observer data.

3.4.1 Simulation Method

Simulations were run in R Cran that mimicked the CAS post-stratification definitions (Table 3) and Cahalan et al. (2015) for groundfish discard estimation. All 2014 landings made by vessels in the partial coverage category (excluding two partial coverage CPs) were used in the simulations as the population of trips for which estimates were computed. These are the same data used in the 2014 Annual Report (NMFS 2015a).

The simulation categorized trips (unsampled and sampled) into the same post-strata used to estimate groundfish discard in the CAS. Section 3.1.2 describes the post-strata and estimation process for the groundfish discard system in the CAS. In brief, there are two spatial resolutions at which CAS estimates groundfish discard rates (and halibut discard rates on IFQ trips): reporting area or FMP area. As shown in Table 3, we refer to reporting-area post strata as priority 1 and the FMP area post-strata as priority 2. These priorities reflect the order in which CAS estimates based on available information.

The CAS is programmed to use discard rates derived from observer data that are within the same reporting area post-stratum as the landing (priority 1 in Table 3). If observer data are unavailable at the reporting area level (i.e., no discard rate), then the CAS drops down to priority level 2, and estimates discard rates using an FMP area post-stratum. When discard rates are available, discard estimates are made for each landing record by applying the discard rate to the total landed weight. When discard information is unavailable, no estimates of discard are made, resulting in an estimation gap.

Non-groundfish species and prohibited species are estimated using a more complex system then the groundfish discard subsystem. This system has a wider variety of post-strata definitions (Table 2). Compared with the groundfish discard system, the PSC and non-target systems are less likely to result in situations where no estimates can be made since the lowest priority level over which data are aggregated to form a discard rate is much larger than those used in the groundfish system. Therefore, by using the groundfish discard post-strata to evaluate gaps, the results are applicable to PSC and non-target species, but provide a much more conservative evaluation. An important difference between the systems occurs at the lowest two priority levels. For PSC and non-target species, both the priority 5 and 6 level post-strata definitions use a wider date range (3 month and year to date) and aggregate across processing sectors (catcher vessels and CPs). The priority 2 level used to estimate groundfish discard only aggregates across a 5-week period and for catcher vessels only since production reports are currently used to evaluate discard on vessels with less than 100% coverage (imputation methods are used on full coverage CPs (Cahalan et al. 2014 and Cahalan et al 2015).

Observer deployment rates were analyzed between 5% and 60% for the large vessel and small vessel sampling strata. Deployment rates were derived as the number of trips sampled divided by the total number of trips within a sampling stratum (i.e., large vessel versus small vessel). The deployment rate for both sampling strata were set to be the same per iteration. For example, a 10% deployment would be set for both the large and small vessel sampling strata.

For each deployment rate, the population of all trips within each strata was sampled 1,000 times producing 1,000 sample realizations. These sample data then were categorized into post-strata. This was repeated across 8 different deployment rates, and resulted in a total of 8,000 fishery realizations. Separate simulations were run for priority 1 and priority 2 post strata (Table 3) in the groundfish discard estimation process (i.e., 8,000 iterations for each priority level).

The post-stratified data for each simulation trial was summarized and the probability of a post-strata not being empty was calculated as the proportion of simulation trials (iterations) within a sampling rate and post-strata combination where no trips were observed. In addition, the simulation describes of every post-strata used in 2014, including the total number of trips that occurred in that post-strata, the number of observed trips, and landings specific information related to unobserved and unobserved trips.

Simulations were conducted with the following caveats and constraints:

1. The simulation uses trips as the selection unit. In both 2013 and 2014, the selection unit for vessels less than 57.5 ft LOA was vessels not trips. In 2015, the selection unit for these vessels was changed to trips.

2. All vessels in partial coverage and greater than or equal to 40 ft and not fishing jig gear were included in the sampling strata (i.e., they had a probability of being selected). Note that vessels less than 40 ft and those using jig gear were evaluated in the post-strata to mimic the current estimation methods. The restructuring rule authorized NMFS to place observers on vessels less than 40 ft LOA and on jig vessels; however, considerable public testimony at the Council meetings, and logistical issues of placing human observers on small vessels made lowering the minimum size limit for coverage unlikely in the foreseeable future. In addition, electronic monitoring programs are being developed, which may provide information on the smaller vessels (as well as other size categories) in the future. However, despite the current lack of observer coverage, vessels less than 40 ft LOA and jig gear must still have catch estimated for their trips, so they have a no probability of selection, but were included in the post-strata evaluation.

3. Conditional releases are not evaluated since these could vary widely between years and are unknown.

4. There are a few CPs that were in partial coverage category in 2014; however they were excluded from this analysis. Determining when a trip starts and ends for a CP is difficult given current data structure. Their inclusion may systematically bias the results. In addition, production reports are currently used to estimate discard for these few vessels and the groundfish discard system is specific to catcher vessels only.

5. The analysis was done using a single year (2014) and there could be temporal differences in effort between years within a given post-strata. We considered using 2013 information since it also is structured to identify partial coverage vessels, trips, and sampling strata membership (Faunce et al. 2014); however, 2013 had similar fishery characteristics to 2014 and we concluded that including this year would not significantly change the results. This is not to say large changes in the distribution in total fishing effort may occur in the future. These changes would influence the probability of any observer data in a post-stratum since the amount of observed information is proportional to the total effort in the post-stratum (measured in trips). Temporal differences in effort between years would have a larger impact on individual small post-strata since random sampling is proportional to effort, and the probability of obtaining samples in small strata is low compared to large strata (Thompson 1992). Differences may also arise in post-strata containing trips with no chance of selection (e.g., vessels less than 40 ft LOA and released trips), particularly if the ratio of trips in the sampling frame versus trips not in the sample frame decreases.

6. The post-strata definitions used in the simulation are those currently used in the CAS. These post-strata are currently being evaluated in the context of catch estimation and may be redefined in future years. However, while the specific results from this analysis are based on current post-strata definitions, the general result will be applicable in many post-stratification situations.

3.4.2 Results and Discussion

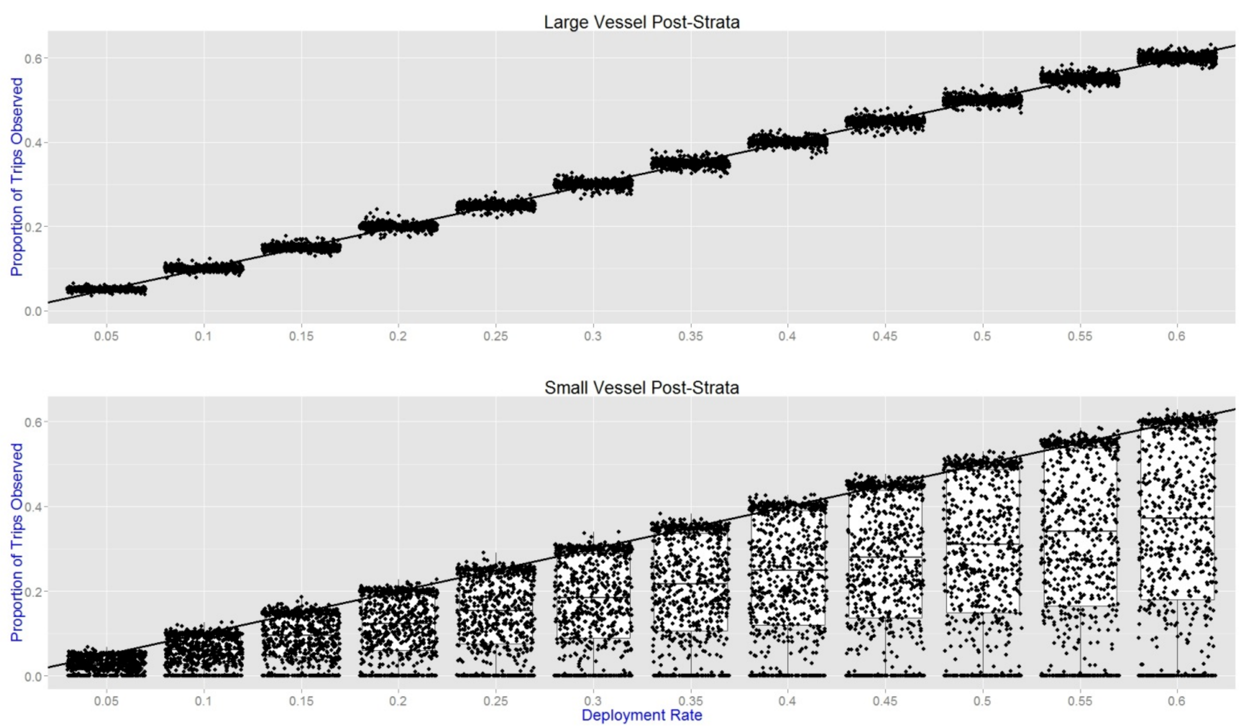
Results from the gap analysis were evaluated at two levels: the reporting area (e.g. Area 610, 620, or 630 in the GOA) level post-strata (priority 1 in Table 3); and the FMP area level post-strata (e.g., BSAI or GOA) (priority 2). If observer information corresponding to a landing at the reporting area level is unavailable, then estimation still occurs at the FMP area level. The lack of observer data at an FMP area level post-strata results in no estimates being made. Hence, this analysis is an effective measure of how sample rate impacts the probability of obtaining data under the current post-stratification scheme and, most importantly, the risk of being unable to estimate at-sea discards (i.e., data is unavailable to estimate at the FMP area level). We also note that post-strata compliment sampling strata in that delineations made in the sampling strata definitions are carried through to the post-strata for groundfish (e.g., large versus small vessel sampling rates). Thus, both the FMP and reporting area post strata categorize information by large or small vessel selection. The post-strata delineations result in a total of 1,701 reporting area level post-strata (priority 1) and 682 FMP area post- strata (priority 2) in 2014.

Discard rates for a NMFS reporting area may differ from the FMP-wide discard rate if the fishery species composition/discard composition varies geographically. In these situations, use of discard estimates at the FMP level to estimate discards at the reporting area level may produce biased estimates and/or also increase variance due to inefficient stratification. The biases associated with the post-strata definitions were not evaluated in the simulation study, but are part of future evaluations of the post-strata currently in the CAS.

3.4.2.1 Reporting Area Post Strata Gap Results

Random selection of trips will result in the proportion of trips selected in all post-strata to approximate the sampling rate under the assumption that every trip has an equal probability of selection. The points in Figure 17 represent the average proportion of observed trips for each post-strata and sampling stratum. Most of the small vessel post-strata had average rates below the 1:1 line. This pattern was driven by trips made by vessels less than 40 ft LOA and jig vessels that have no probability of selection. Since all large vessels were in the sampling frame, the proportion of observed trips was proportional to the sampling rate as shown by the 1:1 line in Figure 17.

Figure 17 Summary of the average proportion of trips observed within each post strata and hypothetical deployment rate. The 1:1 line depicts the deployment rate and corresponding proportion of trips that should be observed. The large vessel stratum include all partial coverage trip on vessels greater than or equal to 57.5 ft LOA and all trawl vessels, and the small vessel post-strata includes all trips on vessels less than 57.5 ft LOA.



The probability of a post-stratum being empty is related to the size of the post-stratum (number of trips fished in the post-stratum) and whether it contains vessels with no probability of coverage. As a rule, larger post-strata with all trips in the sampling frame will have a lower probability of being empty then smaller post strata, or post-strata with trips outside of the sampling frame. Thus, the design of post strata (e.g., size) and the definition of the sampling frame (i.e., who gets coverage) has consequences on the statistical reliability of estimates. Post-strata that are small (but could be entirely in the sample frame) have lower probabilities of having observer data since they represent a small portion of the overall population (i.e., rate event). Post-strata with many trips outside of the sampling frame are either not sampled or require model-based inferences since a segment of trips cannot be sampled.

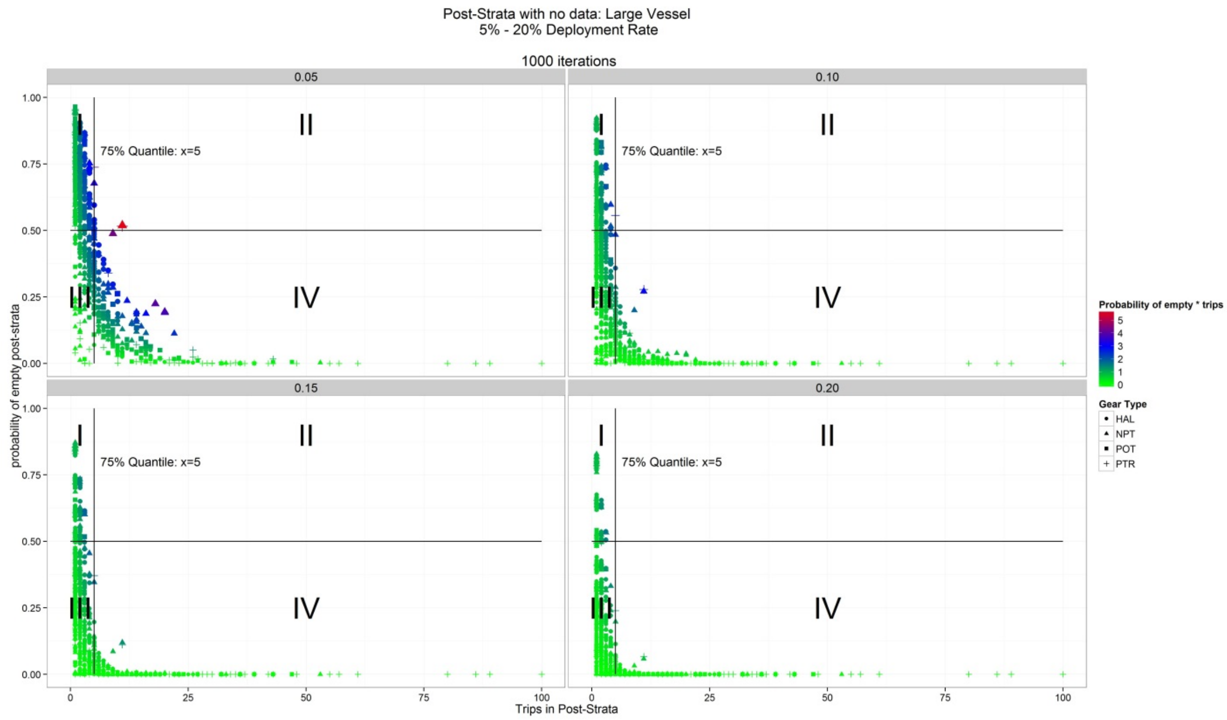
A range of coverage rates were evaluated to determine when estimates were not likely to be made due to changes in deployment rates. To evaluate the impact deployment rates have on estimation gaps, the number of trips in a post-strata for which estimates are made was compared against the probability of each post-strata being empty.[13] Results from the simulation were analyzed separately for the large vessel (Figure 18) and small vessel (Figure 19) sampling strata. Individual panels present the simulated outcomes at the given deployment rate (indicated in the great panel heading) for each sampling strata. The number of trips for a post-strata did not change with differing deployment rates since the same population was used across all deployment rates. Therefore, changing the coverage rate only changes the probability of a post-strata being empty. The dynamics of this pattern result in individual points (i.e., a post-stratum) moving downward (decreasing probability of having no data) as observer rates increase.

The quadrant lines (Figure 18 and Figure 19) divide estimation impacts by whether the post-strata had a greater than or equal to 50% probability of being empty. In addition, points to the left of the vertical line fall within the 75th percentile of all post-strata measured by total number of trips- i.e., the post-strata with the smallest number of trips are to the left of the vertical line. For example, most of the population's post strata with a greater than 50% probability of being empty occur in quadrant I and each post-strata impacted a maximum of 5 trips in 2014; whereas, very large post strata that also have >=50% probability of being empty occur in quadrant II and these post-strata impacted more than 5 trips.

The quadrant definitions are geared towards aiding discussion. The information can also be displayed as surface or series of curves (Appendix A). Each curve represents a probability of a post-strata cell being empty, and the y-axis represents the number of trips that would be impacted by an empty post-strata at a given deployment rate (Appendix A). In general, the probability of post-strata being empty decreases with increasing deployment rates. For small vessel selection, the curve will never result in a zero probability of all post-strata cells being filled because some post-strata are entirely composed of vessels that fall outside of the sampling frame (e.g., jig gear). To evaluate different levels of "risk," the information in Figure 18 and Figure 19 can be compared to a different horizontal line corresponding to a different probability of a post-strata being empty (e.g., the probabilities shown in Appendix A).

[13] Note that this is not the total size of the post-strata; the x-axis reflects the number of trips during the week for which estimation was made. Post-strata span a 5-week period, so the size of the post-strata and probability of it being empty are related to the distribution of trips during a 5-week period. Thus, a value of 1 on the x-axis may take different probabilities of being empty depending on the amount of observer information available over the entire 5-week period. A more formal evaluation of the statistical properties and "adequacy" associated with post-strata methods would need to consider the amount and statistical properties of data defining a post-stratum.

Figure 18 **The size and probability of large vessel post-strata not having any observer data at the reporting-area based on a range of deployment rates. Points represent individual post-strata summaries over 1,000 simulations. Colors represent an index calculated as the size of the post-strata (#trips) multiplied by the probability of the post-strata being empty. The graphs are divided into quadrants based on a 50% probability of a post-strata being empty (horizontal line), and the vertical line represents the 75th percentile of trips in the population (i.e., 75% of all trips are left of the line). Point shapes reflect gear definitions: HAL = hook and line, NPT = non-pelagic trawl, POT = pot gear, and PTR = pelagic trawl.**



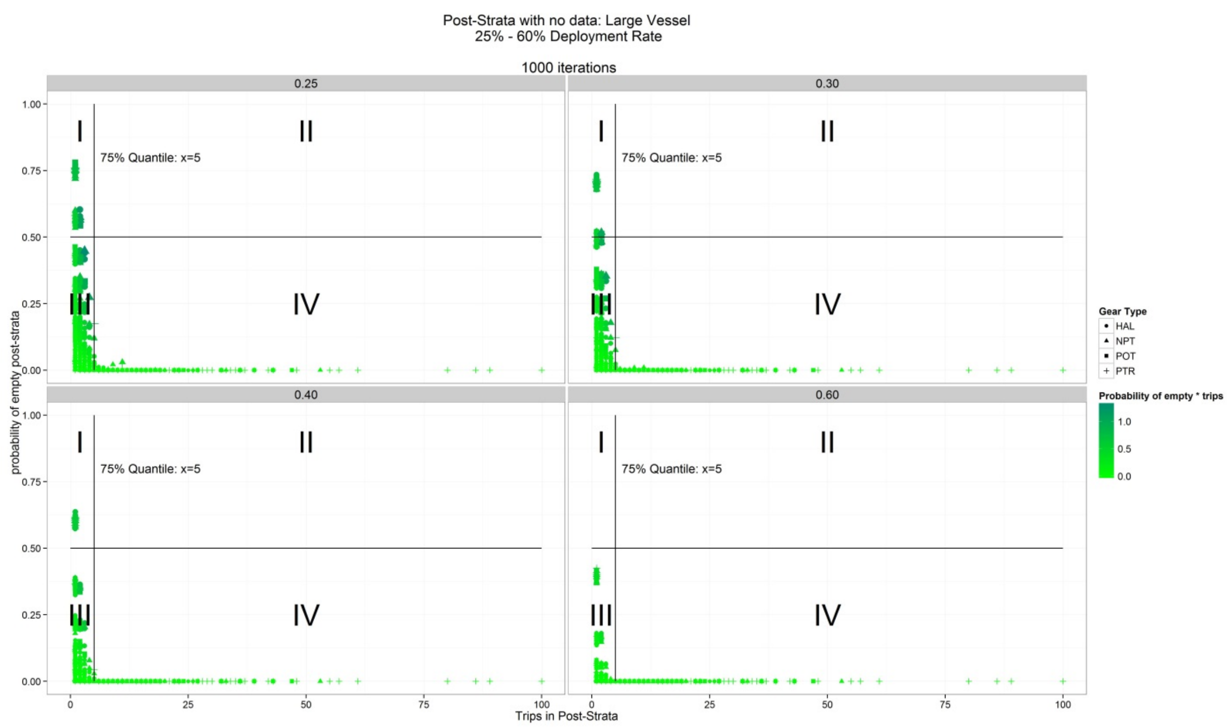
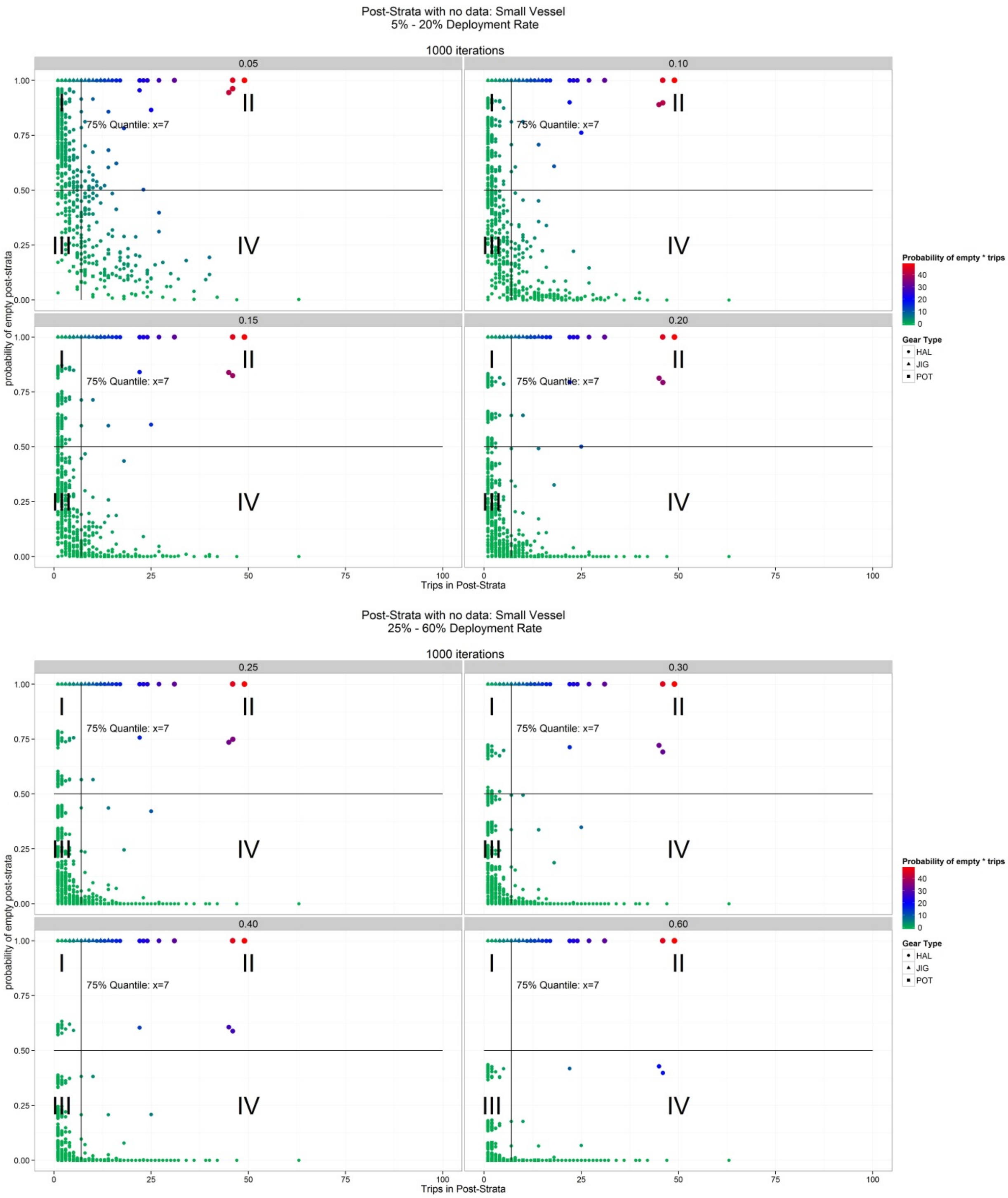


Figure 19 The size and probability of small vessel post-strata not having any observer data at the reporting-area based on a range of deployment rates. Points represent individual post-strata summaries over 1,000 simulations. Colors represent an index calculated as the size of the post-strata (#trips) multiplied by the probability of the post-strata being empty. The graphs are divided into quadrants based on a 50% probability of a post-strata being empty (horizontal line), and the vertical line represents the 75th percentile of trips in the population (i.e., 75% of all trips are left of the line). Point shapes reflect gear definitions: HAL = hook and line, JIG = jig gear, and POT= pot gear.



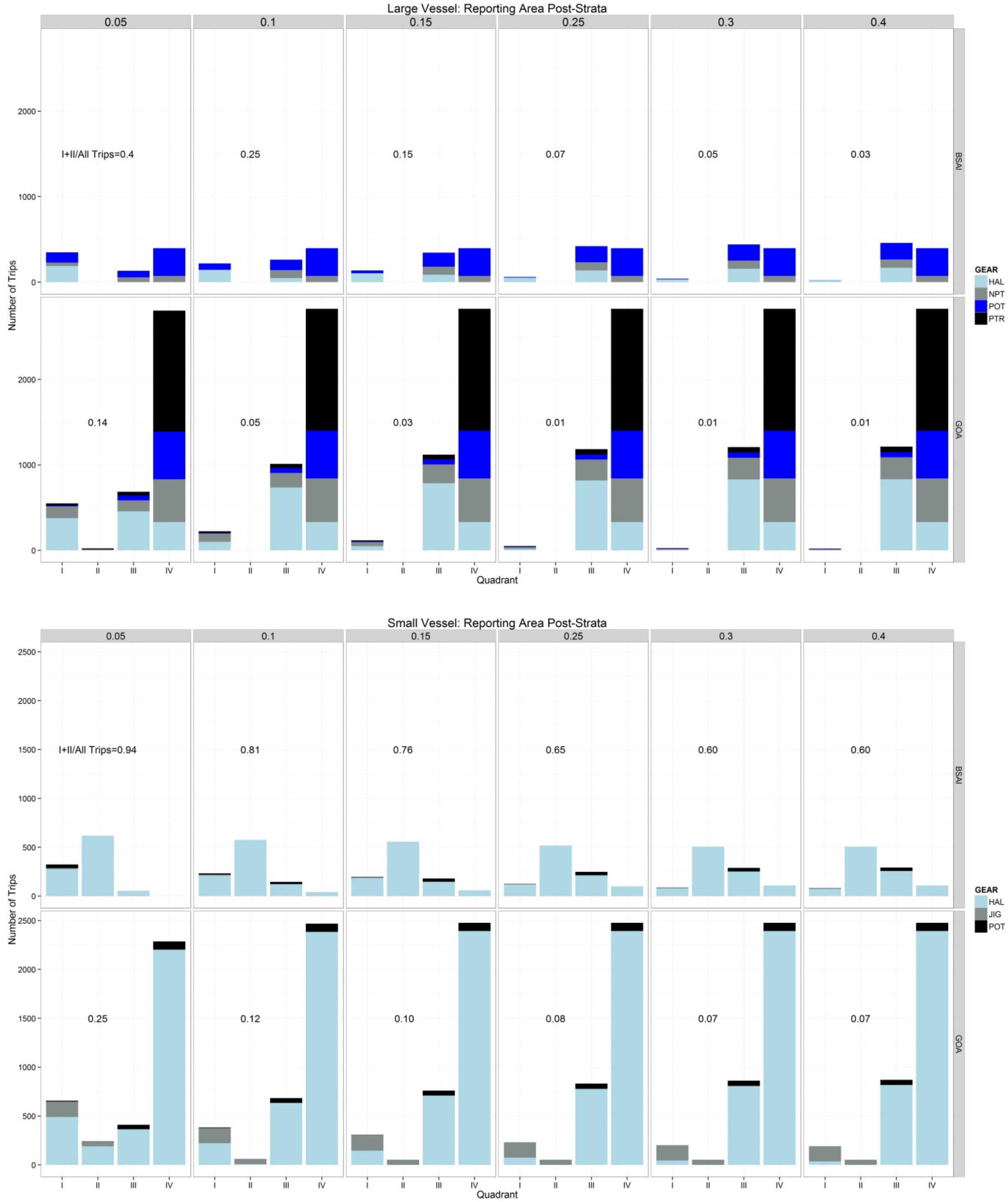
Two broad trends associated with the deployment rate were apparent across both small and large vessels: 1) as deployment rates increased, the probability of a post-strata being empty declined; and (2) large post strata (i.e., quadrant IV) generally had low probabilities of being empty, even at deployment rates <15%. However, there were important differences between small vessel and large vessel patterns. The lack of alignment of the target population with the sampling frame was evident in the small vessel selection graph (Figure 18). Some post-strata were inelastic to changes in observer rates due to trips taken by vessels less than 40 ft LOA, resulting in post-strata slowly changing position as deployment rates were adjusted, or being completely insensitive to deployment rates and remaining in quadrants I and II regardless of sampling level. Gear types associated with zero coverage vessels were jig and hook-and-line.

Changes in the quality of information available for estimation can be evaluated relative to a ≥50% probability of a post-strata being empty. This measure indicates that, on average, we would expect these post strata to be empty more than half the time. The barplot in Figure 20 summarizes the information from Figure 18 and Figure 19 by quadrant, vessel deployment category, gear, and FMP area.

For large vessels, the number of trips impacted by empty post strata leveled off at a 25% deployment rate in the GOA and at rates ≥40% in the BSAI (3% of all trips not estimated for in the BSAI and <1 % of trips not estimated for in the GOA). The probability of a post-strata being empty improved with increasing deployment rates for all post-strata in quadrant I since they were all in the sampling frame. The largest reduction in the number of trips in empty post-strata occurred at deployment rates ≤15% for the GOA and ≤ 25% for the BSAI (Figure 20). Further increases in deployment rates resulted in only small reductions in the number of trips likely to be empty based on our 50% probability criteria (see Appendix A for other risk thresholds).

The probability of a post-strata being empty in the small vessel category was less responsive to changes in deployment rates. Vessels outside of the sampling frame (vessels less than 40 ft LOA and jig vessels) drove this pattern. The pattern was particularly obvious in the BSAI where more than half of all post-strata had a high probability of being empty over all evaluated deployment rates. Several large hook-and-line strata in Quadrant II drove this pattern (Figure 20). In the GOA, increasing deployment from 5% to 15% resulted in a substantial decrease in the number of trips associated with Quadrant I and II; the percentage of trips associated with at least a 50% probability of being empty dropping from 25% to 10%. The proportion of trips impacted by changes in deployment rates leveled off at deployment rates ≥25% for the GOA, however, the number of trips impacted was low, at <3% of all trips at 15% deployment and <1% at deployment rates ≥25%.

Figure 20 **Proportion of large vessel (upper panels) and small vessel (lower panel) trips in each quadrant (quadrants identified in Figure 18 and Figure 19) broken out for the BSAI and the GOA and by gear type. Numeric annotation indicates the proportion of all trips that fall in post-strata with a >=50% probability of being empty. Note the legend annotation HAL = hook-and-line gear, PTR = pelagic trawl, POT = pot gear, JIG = jig gear, and NPT = non-pelagic trawl.**



Details associated with the post-strata in the GOA and BSAI for the estimates that were in quadrant I or II are provided in Figure 21 (large vessel) and Figure 22 (small vessel). There were far too many post-strata to graph individually (over 1,700) since post-strata were specific to a week in which fishing occurred. To simplify display of the gaps, broad post-strata categories were summarized such that the impact of an empty post-strata were aggregated across weeks within an area, target, gear, and quadrant. Only quadrants I and II were displayed since theses quadrants show post-strata with at least a 50% probability of being empty, noting that other risk definitions would change this graph (see Appendix A).

To aid the reader in understanding Figure 21 and Figure 22, a brief explanation is as follows. The "y" axis shows post-strata categories, ordered by reporting area, trip target, gear, and quadrant. For example, the first row in the top panel of Figure 21 is "543 S HAL I", this is abbreviated for reporting area 543, sablefish target, hook-and-line gear, and occurring quadrant I of Figure 18 (see Table 6 for target definitions). Thus, this row summarizes all post-strata that meet the criterion in the category label. The shapes within each cell indicate the total number of trips associated with a post strata category that have at least a 50% probability of being empty. This is important since post-strata on a week-level may have few trips, but across many weeks the post-strata category may account for many trips. For example, a fishery could be spread out over many weeks with each week having a low amount of effort.

Table 6 Target code definitions

Target	Species	FMP	Target	Species	FMP	Target	Species	FMP
A	Atka mackerel	BSAI/GOA	I	Halibut	BSAI/ GOA	S	Sablefish	BSAI/GOA
B	Pollock - bottom	BSAI/GOA	K	Rockfish	BSAI/GOA	T	Greenland turbot	BSAI
C	Pacific cod	BSAI/GOA	L	Flathead sole	BSAI/GOA	W	Arrowtooth flounder	BSAI/GOA
D	Deep water flatfish	GOA	M	Kamchatka flounder	BSAI	X	Rex sole	GOA
E	Alaska plaice	BSAI	O	Other species	BSAI/GOA	Y	Yellowfin sole	BSAI
F	Other flatfish	BSAI	P	Pollock - midwater	BSAI/GOA			
H	Shallow water flatfish	GOA	R	Rock Sole	BSAI			

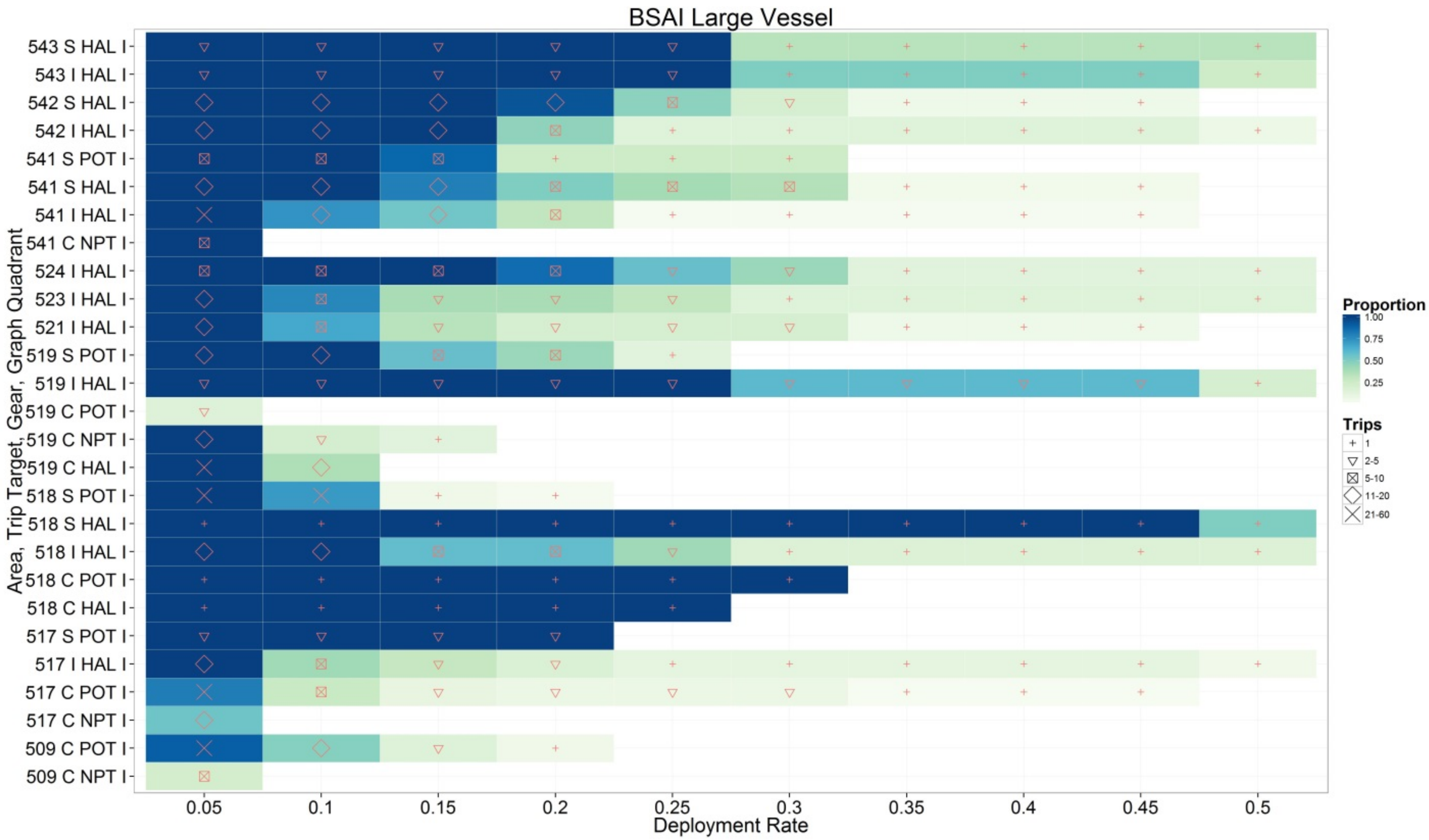
The color gradient in each row of Figure 21 and Figure 22 indicates the proportion of trips within a post-strata that have at least a 50% probability of being empty. For quadrant I post-strata, the proportion was calculated as the sum of all trips within a post-strata category in quadrant I divided by the sum of all trips in quadrant III and I. A similar calculation was done for trips in quadrant II; the proportion for each post-stratum category was equal to the sum of the category-specific trips in quadrant II divided by the total category-specific trips in quadrant II and IV. So as more trips were observed, the probability of no coverage reduced to levels below 50%, resulting in no post-strata having at least a 50% probability of being empty.

The general pattern for large vessels, regardless of FMP, was that larger post-strata had fewer trips impacted due to non-coverage. Post-strata with more than 5 trips in quadrant I or II at a 5% deployment rate were generally reduced to <5 trips with no coverage at a 25% deployment rate in the BSAI and a 20% rate in the GOA (Figure 21 and Figure 22). Overall, the impacts of estimation gaps were highest at coverage rates <15% as demonstrated by a large number of trips (>20) belonging to post-strata with at least a 50% probability of no coverage. All post-strata were observed at a deployment rate greater than 60%, which is not included in the graphs.

Estimation gaps in the small vessel post-strata in the GOA were largest for halibut and sablefish hook-and-line and jig vessels (Figure 22). These gaps persisted in the BSAI and included some large post-strata that occurred in quadrant II. These large post-strata correspond to the red and purple points in Figure 19. Estimation gaps in these large post-strata were the result of vessels not in the sampling frame. As a result, the post-strata susceptible to missing data persisted regardless of changes in deployment rate. The GOA also showed sampling frame-related coverage issues for fisheries that have larger number of vessels (e.g., hook-and-line halibut) and required very high levels of coverage to eliminate them from quadrant I, noting that post-strata were small and numerous, thus in a sample of trips over all fishing activities, observed trips are unlikely to fall within the post-strata. Note that some strata were very close to the 50% probability line and thus a change from 5% coverage to 10% coverage was enough to push them below the line (e.g., hook-and-line sablefish).

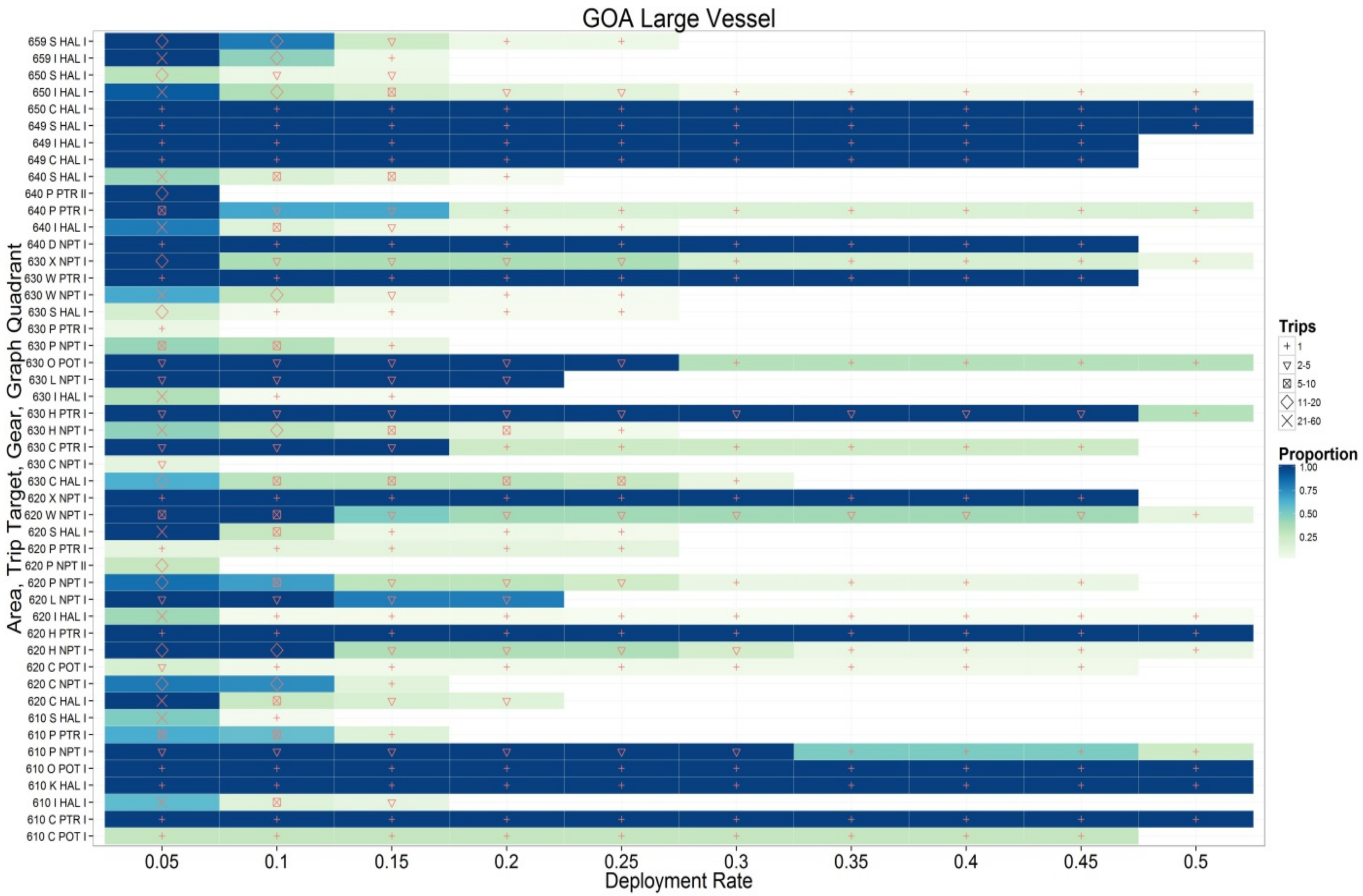
It is important to recognize that the outcomes shown in Figure 21 and Figure 22 are not the actual gaps that occurred in 2014. The CAS currently is not configured to summarize information for the groundfish deployment rates such that gaps can be identified. Thus, the simulation outputs are to be viewed as guidance towards evaluating the likelihood of potential estimation gaps in the future, and to illustrate that data-gaps are more likely to occur for small post-strata or post-strata with trips outside the sampling frame. These post-strata definitions will be evaluated as part of the ongoing evaluation of catch estimation methods used by the CAS.

Figure 21 Summary of large vessel post-strata categories that have at least a 50% probability of no data at the reporting-area under varying deployment rates. The "y" axis represents post-strata categories summarized by reporting area, trip target, gear, and Figure 18 quadrant. The points within each cell represent the potential number of trips without estimates, and the color represents the impact of an empty cell. The color is calculated as the proportion of trips with at least a 50% probability of no coverage relative to the total number of trips within a post-strata category and quadrant pairing (I+III for y-axis quadrant =I or II+IV for a y axis quadrant =II) .



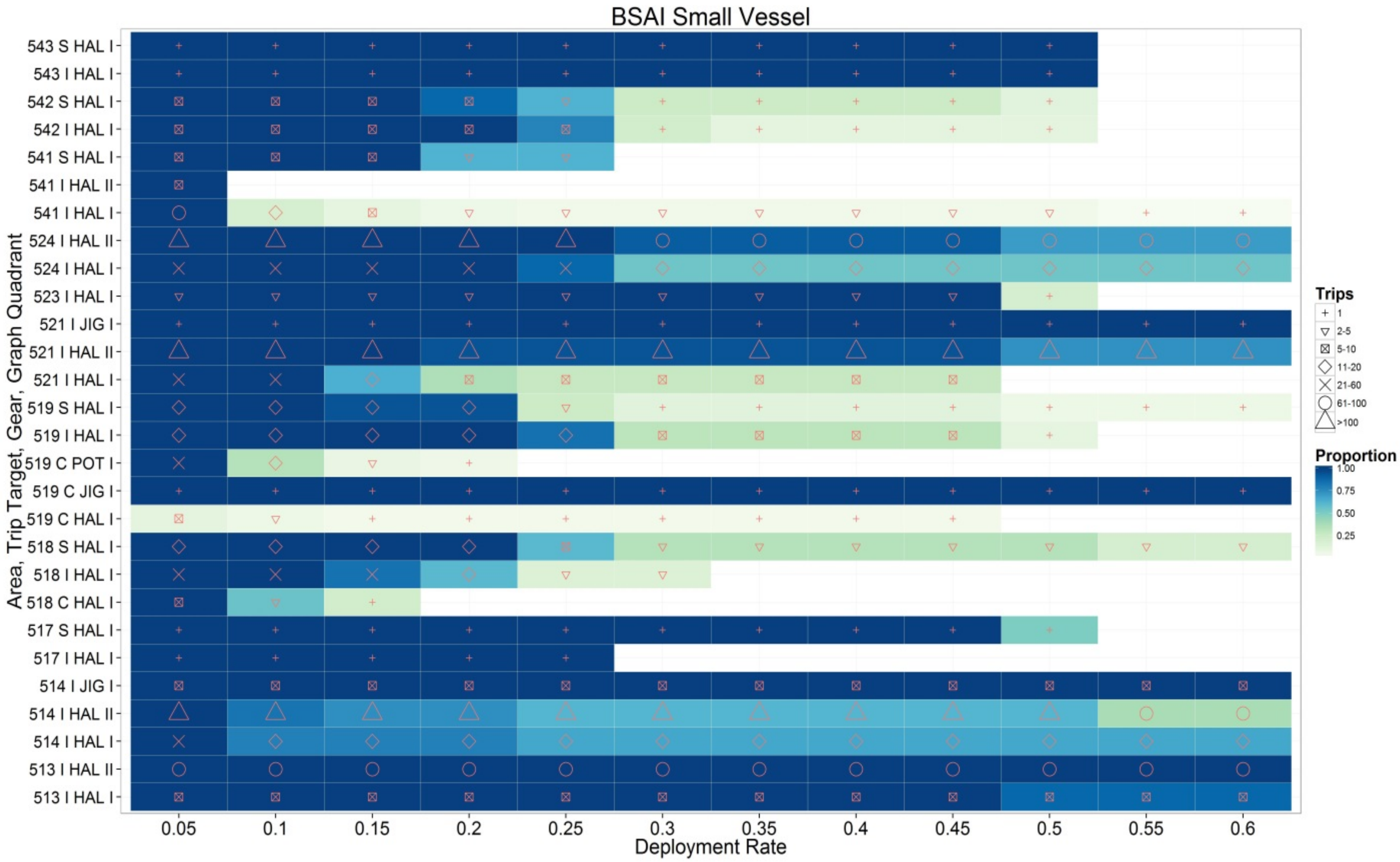
Target codes: S= Sablefish. I= Halibut, C=Pacific Cod, K=Rockfish, P=Pollock, D = Deep Water Flatfish, X= Rex Sole, W=Arrowtooth Flounder, H=Shallow water flatfish, L= Flathead Sole, O= Other species.

Figure 21 cont'd



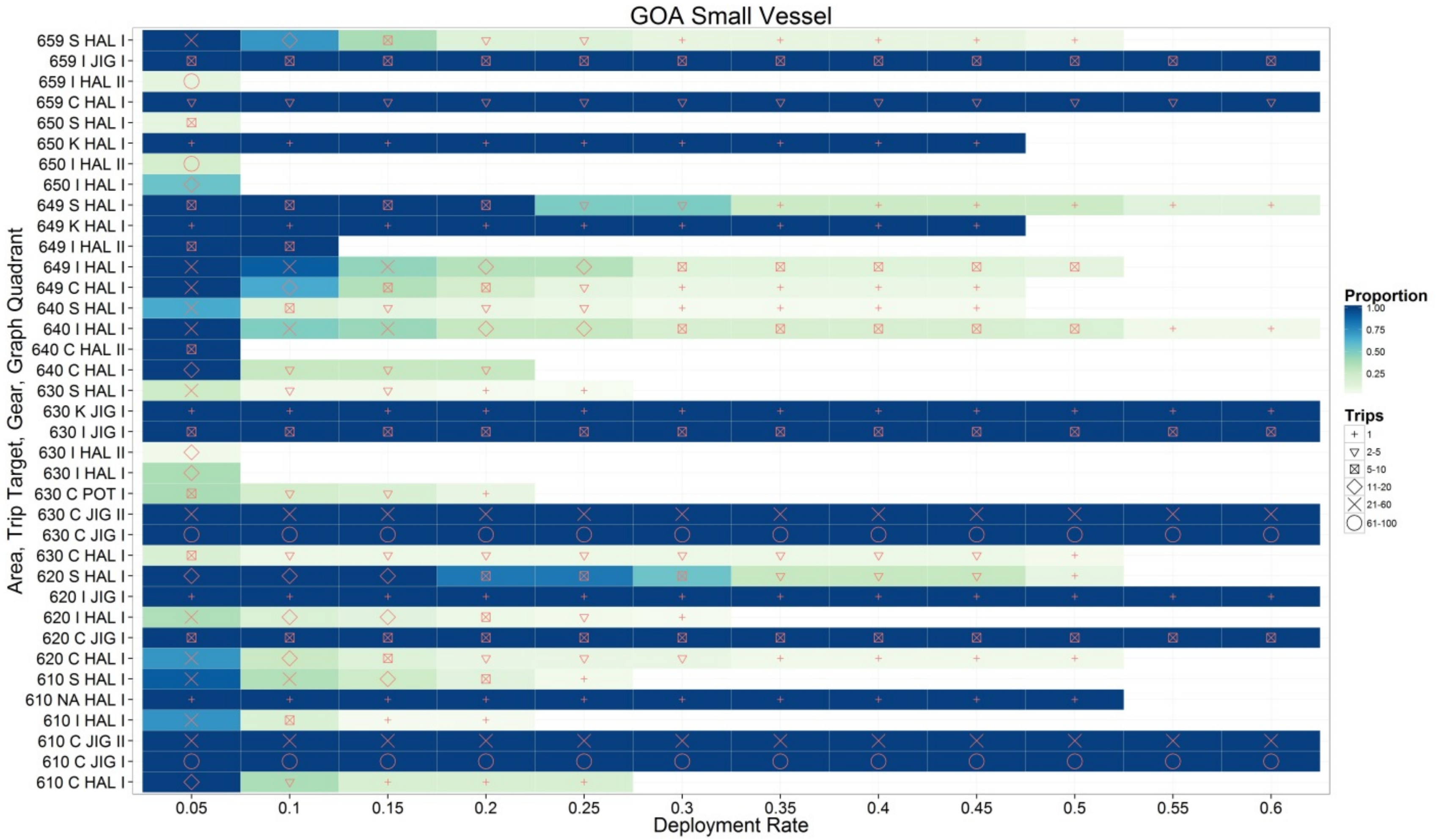
Target codes: S= Sablefish. I= Halibut, C=Pacific Cod, K=Rockfish, P=Pollock, D = Deep Water Flatfish, X= Rex Sole, W=Arrowtooth Flounder, H=Shallow water flatfish, L= Flathead Sole, O= Other species.

Figure 22 **Summary of small vessel post-strata categories that have at least a 50% probability of no data at the reporting-area under varying deployment rates. The "y" axis represents post-strata categories summarized by reporting area, trip target, gear, and Figure 19 quadrant. The points within each cell represent the potential number of trips without estimates, and the color represents the impact of an empty cell. The color is calculated as the proportion of trips with at least a 50% probability of no coverage relative to the total number of trips within a post-strata category and quadrant pairing (I+III for y-axis quadrant =I or II+IV for a y axis quadrant =II).**



Target codes: S= Sablefish. I= Halibut, C=Pacific Cod, K=Rockfish, NA= no retention or no groundfish target (e.g. salmon troll bycatch)

Figure 22 cont'd



Target codes: S= Sablefish. I= Halibut, C=Pacific Cod, K=Rockfish, NA= no retention or no groundfish target (e.g. salmon troll bycatch)

3.4.2.2 FMP Area Post Strata Gap Results

The analysis of estimation gaps was also done on the FMP post-strata (priority 2). The CAS only creates FMP estimates if a reporting area rate is unavailable. So estimation gaps at the reporting area result in estimates being generated at the FMP post-strata level. In contrast, a lack of information in the FMP post-strata represents a gap in discard estimation since there is no other source of information on which to base estimates. Therefore data gaps at the FMP level are an important measure of reliability relative to total catch accounting.

The realized deployment rates for FMP level post-strata were similar to the results obtained from the reporting area post strata (Figure 23). As with the reporting area post-strata, most of the small vessel post-strata have average rates below the 1:1 line. This pattern is driven by trips with no probability of selection since they occur on vessels less than 40 ft LOA or fishing jig gear and hence fall outside of the sampling frame. However, as mentioned previously, no trips being observed in the FMP post-strata indicates that estimates of discard cannot be made and these show up as points on the y-axis at 0 (Figure 23). The inclusion of all large vessels in the sampling frame provides a linear relationship between observed trips and the deployment rate as shown by the 1:1 line in Figure 23.

The probability of a large vessel post-strata being empty showed a similar trend to the reporting area post-strata. Most large-vessel post-strata were in quadrant III and IV, indicating a relatively low probability of being empty (Figure 24). However, post-strata did occur in quadrant I, indicating a >= 50% probability of being empty (Figure 26). Nearly all the quadrant I post-strata moved to quadrant III at a deployment rate of 20% for the GOA and 25% for the BSAI (Figure 26).

There were situations in the small vessel post-strata where estimates would not be made regardless of the amount of observer coverage (Figure 25). These situations were linked to vessels not in the sampling frame that were fishing within those post-strata designations. In general, the number of trips in the small-vessel strata exposed to the estimation gap was low when coverage rates were at least 25% in the BSAI and 15% in the GOA (Figure 26).

Appendix A provides information on different coverage probabilities and enables an assessment of risk at more levels than the 50% probability of coverage presented here. For example, a 90% probability of a cell not being empty in the small vessel strata at a 25% deployment rate across both FMPs results in approximately 200 trips not having estimates; whereas a 50% probability of a cell being empty results in very few trips not having estimates.

Figure 23 Summary of the average proportion of trips observed within each post strata and hypothetical deployment rate. The 1:1 line depicts the deployment rate and corresponding proportion of trips that should be observed. The large vessel stratum include all partial coverage trips on vessels greater than or equal to 57.5 ft LOA and all trawl vessels, and the small vessel post-strata includes all trips on vessels less than 57.5 ft LOA

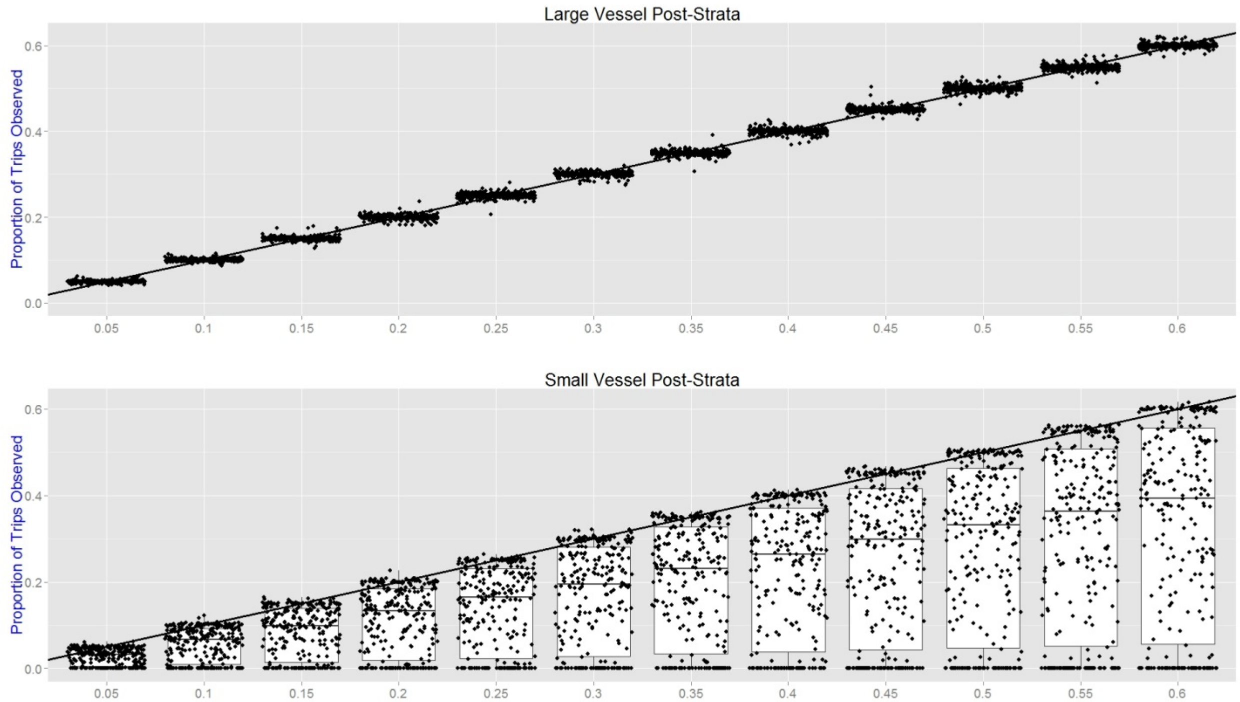


Figure 24 The size and probability of large vessel post-strata not having any observer data at the FMP-area based on a range of deployment rates. Points represent individual post-strata summaries over 1,000 simulations. Colors represent an index calculated as the size of the post-strata (#trips) multiplied by the probability of the post-strata being empty. The graphs are divided into quadrants based on a 50% probability of a post-strata being empty (horizontal line), and the vertical line represents the 75th percentile of trips in the population (i.e., 75% of all trips are left of the line). Point shapes reflect gear definitions: HAL = hook and line, NPT = non-pelagic trawl, POT = pot gear, and PTR = pelagic trawl.

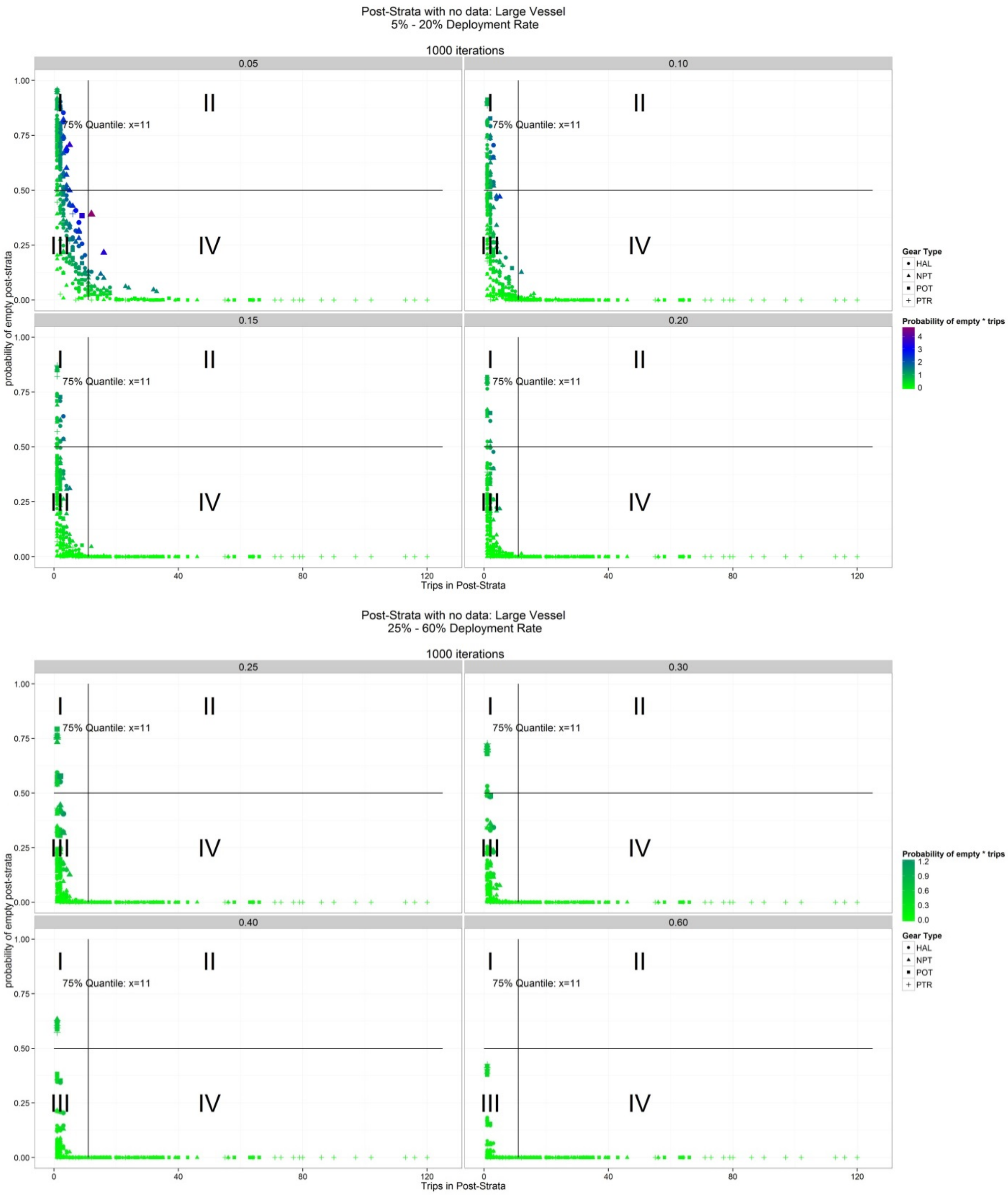


Figure 25 The size and probability of small vessel post-strata not having any observer data at the FMP-area based on a range of deployment rates. Points represent individual post-strata summaries over 1,000 simulations. Colors represent an index calculated as the size of the post-strata (#trips) multiplied by the probability of the post-strata being empty. The graphs are divided into quadrants based on a 50% probability of a post-strata being empty (horizontal line), and the vertical line represents the 75th percentile of trips in the population (i.e., 75% of all trips are left of the line). Point shapes reflect gear definitions: HAL = hook and line, JIG = jig gear, POT = pot gear.

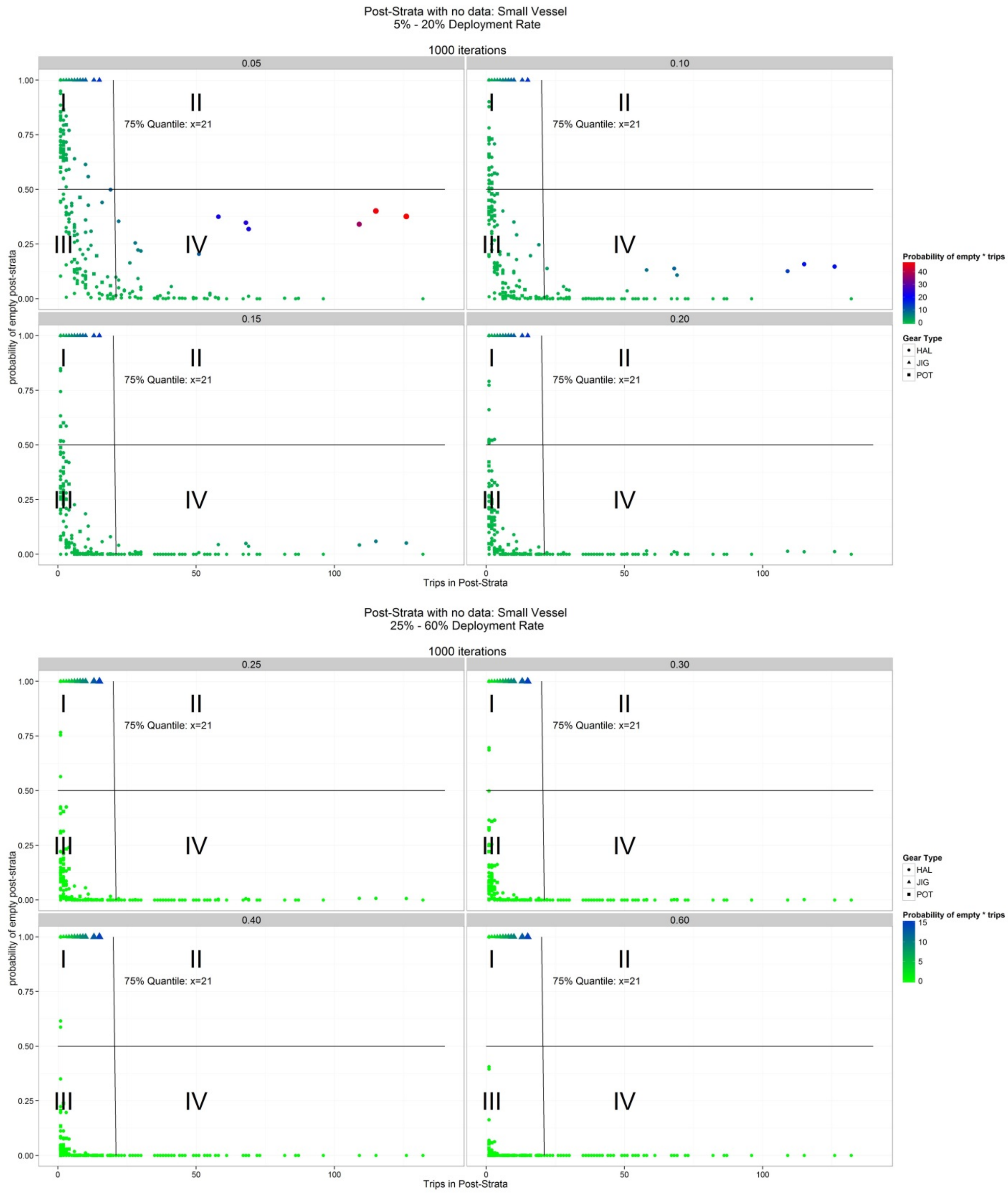
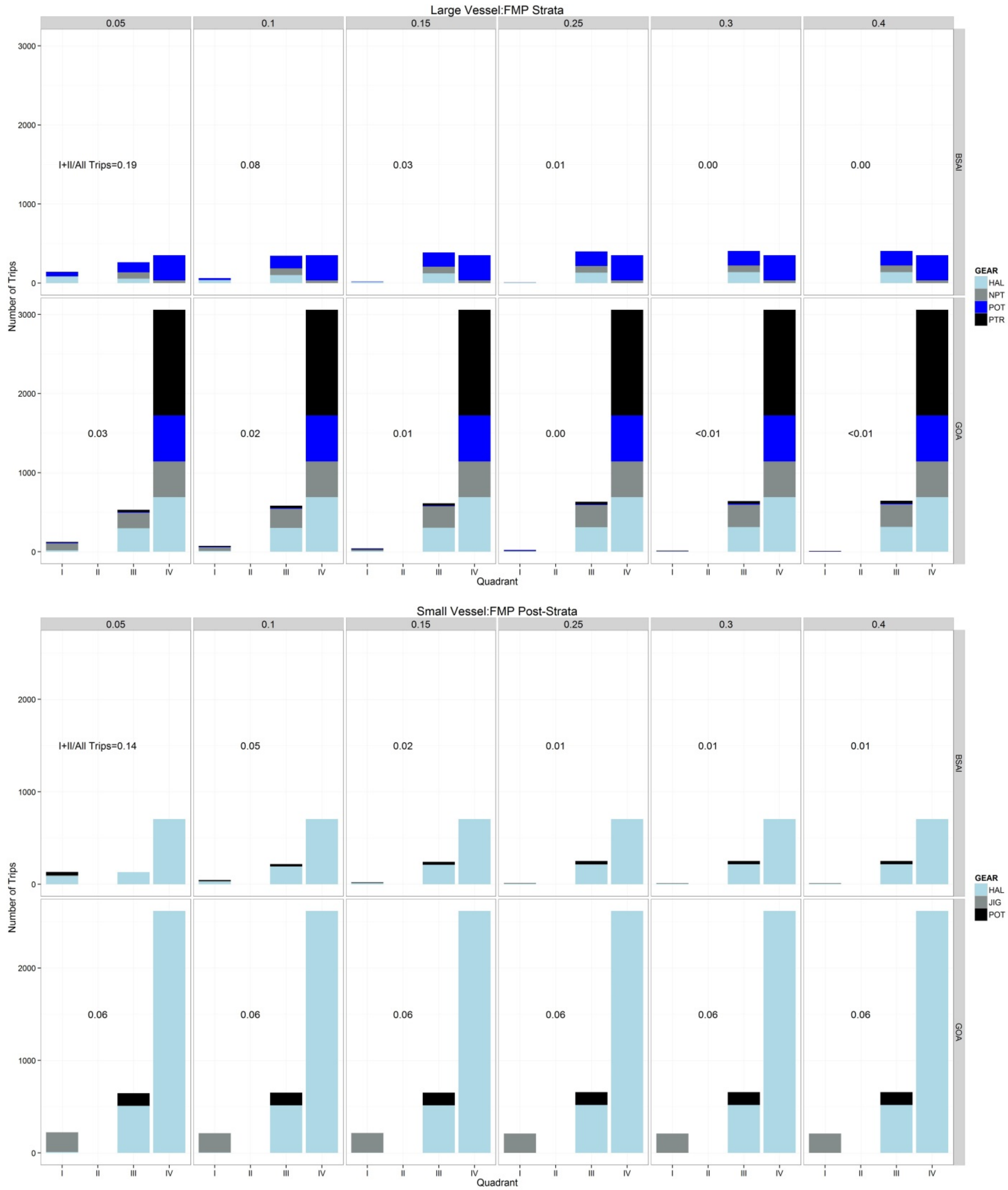


Figure 26 Large vessel (upper panels) and small vessel (lower panel) summary of Figure 24 and Figure 25 broken out for the BSAI and GOA and by gear type. Numeric annotation indicates the proportion of all trips that fall in post-strata with a >=50% probability of being empty. Note the legend annotation HAL = hook-and-line gear, PTR = pelagic trawl, POT = pot gear, JIG = jig gear, and NPT = non-pelagic trawl.



In the large vessel category, the distribution of gear types associated with low coverage probabilities in the GOA included hook-and-line, pot, and trawl gear (Figure 27 and Figure 28). A few of the post-strata categories with potential gaps are a result of the methods used to calculate trip target in the CAS or gear misidentification on the fish ticket. These include the pairing of shallow water flatfish, Pacific cod, or arrowtooth targets (target code "H", "C", or "W") with pelagic trawl gear, pot gear with other species ("O" target likely reflecting octopus), and non-pelagic trawl gear with a pollock target (generally caught with pelagic trawl gear). These categories generally had a small number of trips (Figure 28).

Other types of trawl activity may represent commercially important fishing activity, but occurrence of relatively few trips in these post-strata are also artifacts of the targeting system. In these cases, enough of the target species relative to all other species caused a certain species to be predominant and thus a trip target. This is likely the situation for non-pelagic trawl gear targeting rex or flathead sole, in the GOA (target codes "X", "W","L", "D", and "H"), all of which are target species with that gear type, but are usually coincidental to other fishing activities, resulting in few trips during a 5-week period falling into the target category. Because the trawl activity is generally specific to a reporting area, the jump from priority 1 post-strata (reporting area level) to priority 2 (FMP level) does not bring in new information, resulting in a persistent estimation gap regardless of priority level. This is likely not the same situation for PSC estimation where a 3-month window is used to aggregate observer information, resulting in estimates being made.

The small vessel category saw gaps in hook-and-line, pot, and jig gear (Figure 26). With the exception of jig gear, most of these gaps were greatly reduced at deployment rates of 15% or higher in the BSAI and GOA (assuming 50% probability of a cell being empty). Post-strata categories with trip impacts of < 5 trips persisted for hook-and-line in the BSAI due to effort by vessels not in the sampling frame (Figure 25).

The sampling frame does not include jig gear, resulting in no estimates ever being made for these trips in both the BSAI and the GOA (Figure 27 and Figure 28). While NMFS is authorized to place observers on vessels fishing jig gear, it was explicitly excluded from coverage in the 2013, 2014, and 2015 ADPs under the premise of that jig vessels accounted for a small amount of catch. Retained catch in 2013 was 566 mt and increased in 2014 to 1,103 mt (predominantly cod in both years) and the amount of discard is unknown. A few trips in the GOA fished a combination of jig and hook-and-line gear. At high coverage rates, post-strata containing these trips had a greater probability of having observer data and resulted in a slight decrease in the proportion of jig trips occurring in post-strata with <50% probability of being empty. This resulted in a slight increase in observed trips (i.e., lighter color at a 0.5 deployment rate) in the jig category in the GOA. Interestingly, observers have not yet observed a jig/hook-and-line combination trip.

Figure 27 Summary of large vessel (top panel) and small vessel (bottom panel) post-strata categories in the BSAI that have at least a 50% probability of no data at the FMP-area under varying deployment rates. The "y" axis represents post-strata categories summarized by reporting area, trip target, gear, and Figure 24 and Figure 25 quadrants. The points within each cell represent the number of trips without coverage, and the color represents the impact of an empty cell. The color is calculated as the proportion of trips with at least a 50% probability of no coverage relative to the total number of trips within a post-strata category and quadrant pairing (I+III for y-axis quadrant =I or II+IV for a y axis quadrant =II).

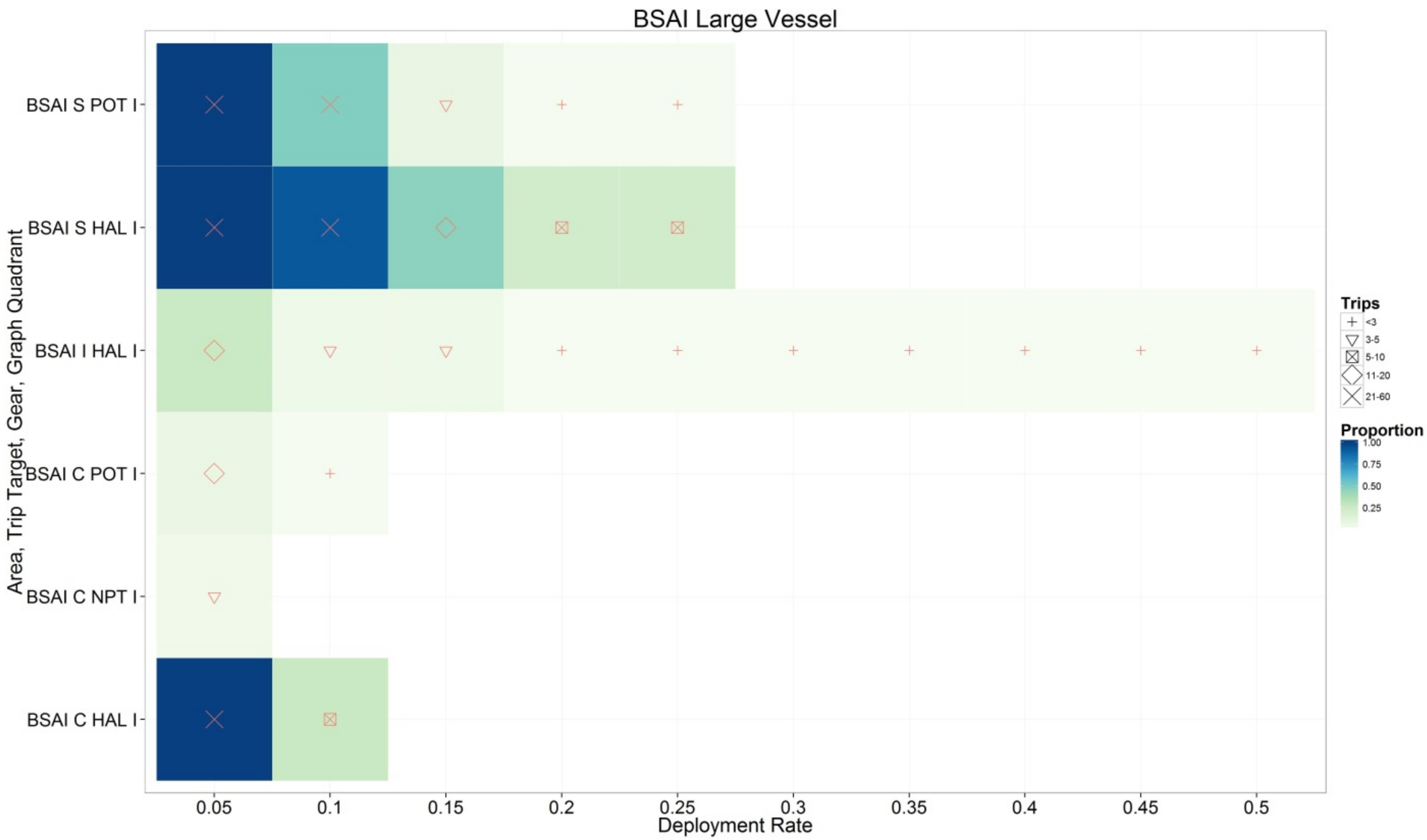
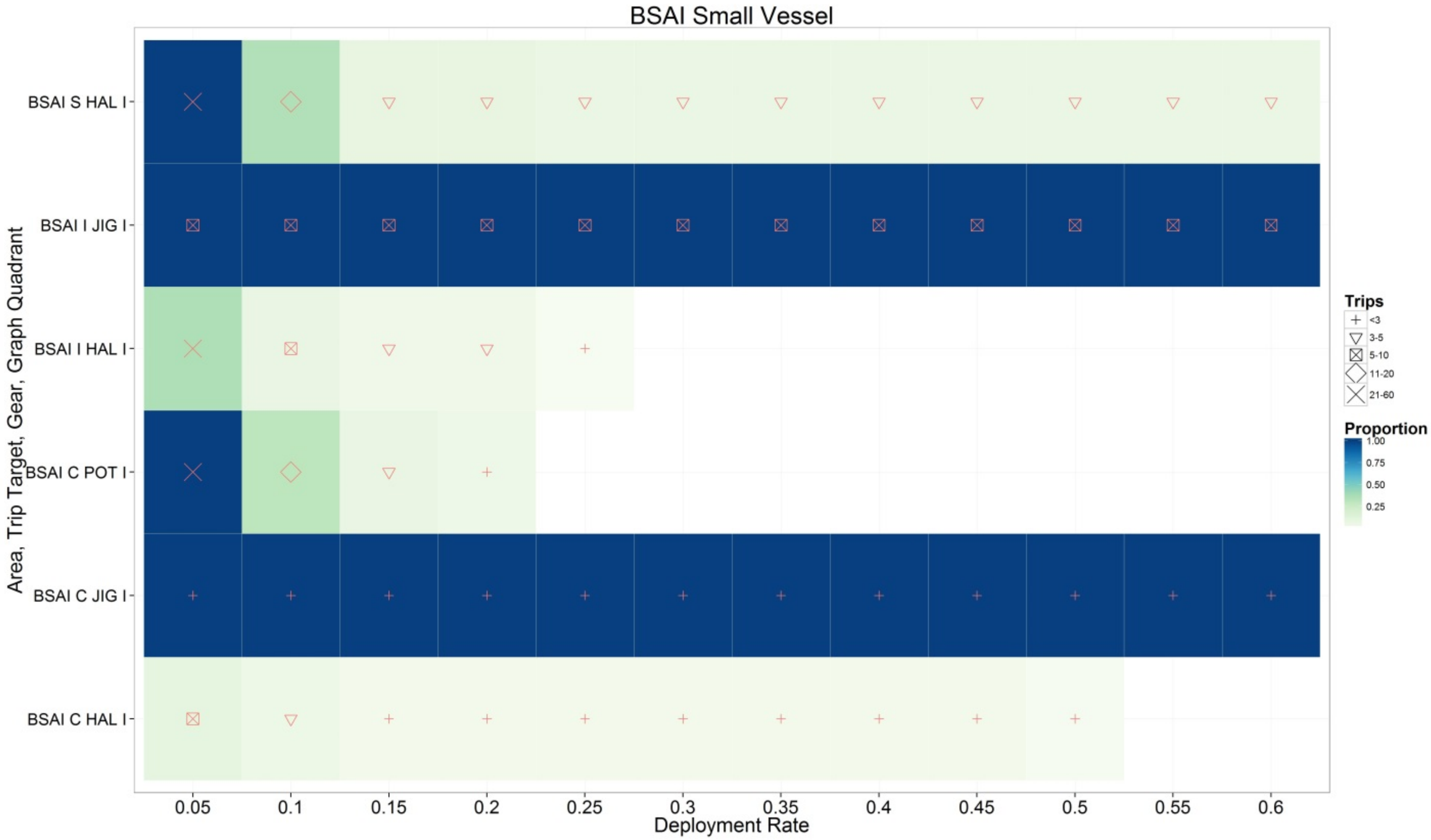
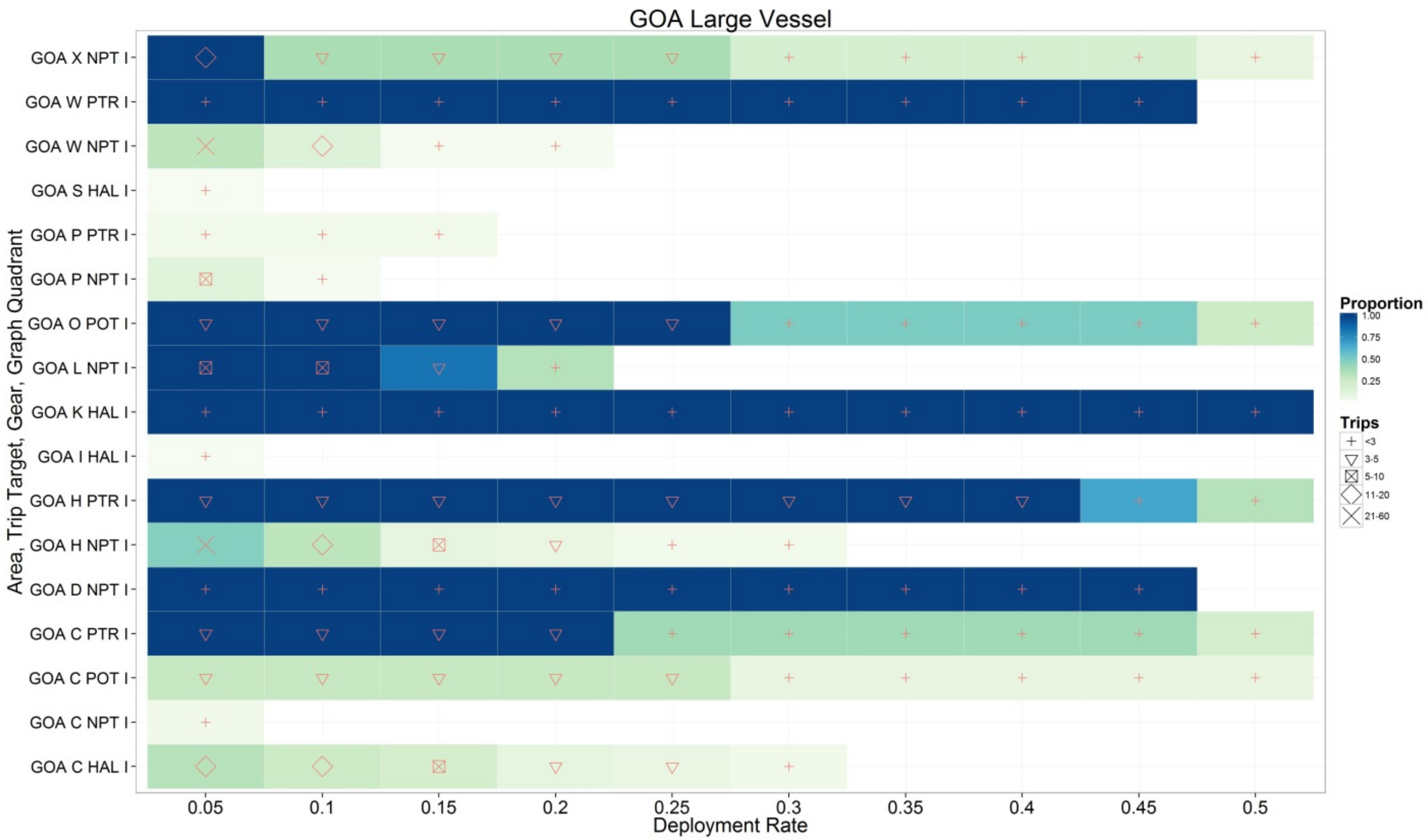


Figure 27 cont'd



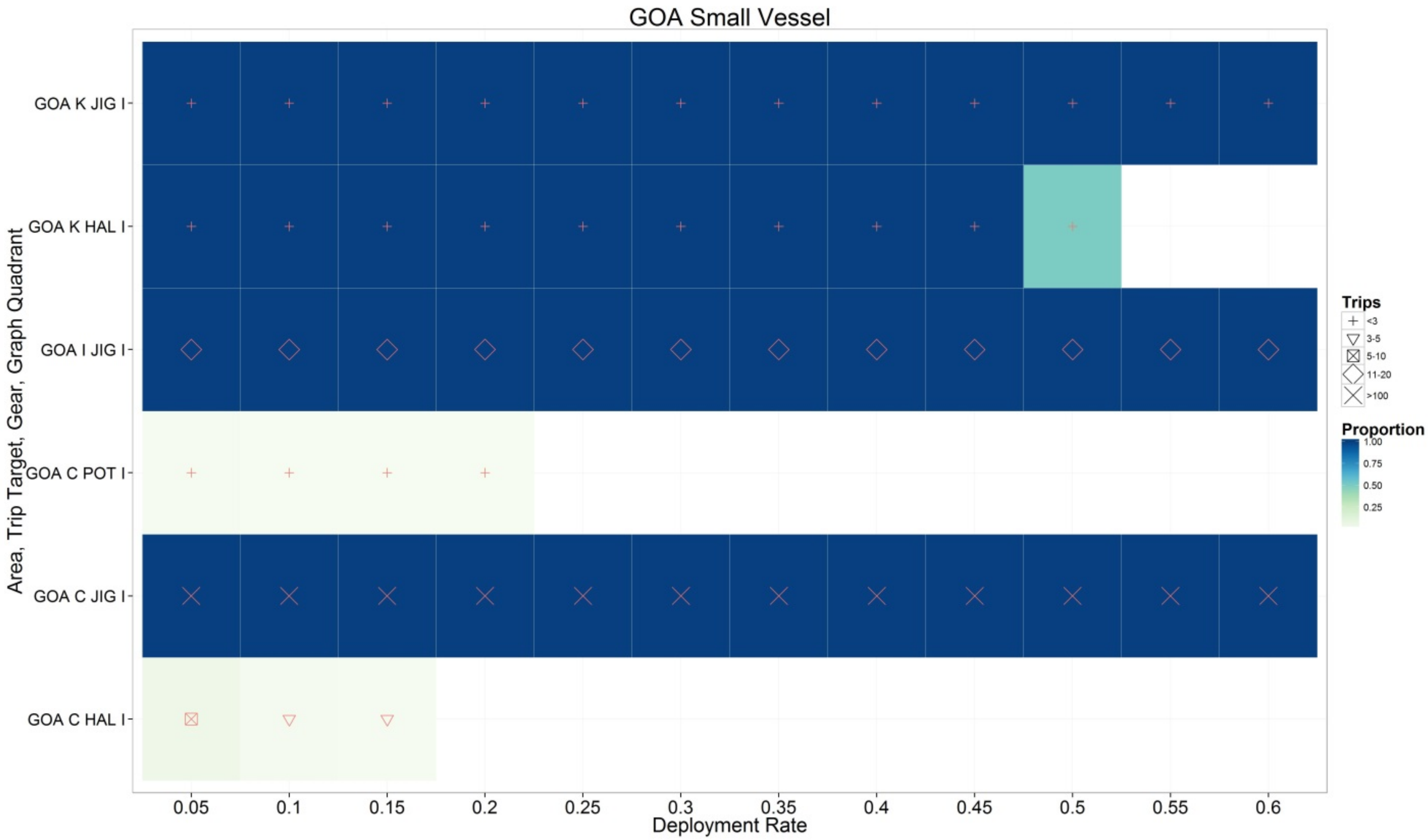
Target codes: S= Sablefish. I= Halibut, C=Pacific Cod, K=Rockfish, P=Pollock, D = Deep Water Flatfish, X= Rex Sole, W=Arrowtooth Flounder, H=Shallow water flatfish, L= Flathead Sole, O= Other species.

Figure 28 **Summary of post-strata large vessel (top panel) and small vessel (bottom panel) categories in the GOA that have at least a 50% probability of no data the FMP-area under at a varying deployment rates. The "y" axis represents post-strata categories summarized by reporting area, trip target, gear, and Figure 24 and Figure 25 quadrants. The points within each cell represent the number of trips without coverage, and the color represents the impact of an empty cell. The color is calculated as the proportion of trips with at least a 50% probability of no coverage relative to the total number of trips within a post-strata category and quadrant pairing (I+III for y-axis quadrant =I or II+IV for a y axis quadrant =II).**



Target codes: S= Sablefish. I= Halibut, C=Pacific Cod, K=Rockfish, P=Pollock, D = Deep Water Flatfish, X= Rex Sole, W=Arrowtooth Flounder, H=Shallow water flatfish, L= Flathead Sole, O= Other species.

Figure 28 cont'd



Target codes: S= Sablefish. I= Halibut, C=Pacific Cod, K=Rockfish, P=Pollock, D = Deep Water Flatfish, X= Rex Sole, W=Arrowtooth Flounder, H=Shallow water flatfish, L= Flathead Sole, O= Other species.

As previously noted, the 50% probability of a post-strata being empty threshold can be changed to evaluate other risk thresholds relative to estimation gaps. These other thresholds are presented in Appendix A. In general, the lower the risk tolerance for empty for post-strata, the higher the observer coverage needed for estimation. A risk threshold where the probability of every cell being filled requires very high coverage rates using the *current post-strata definitions*. Alternative post-strata definitions should be evaluated before a post-strata definition change; use of different post-stratification schemes would change the outcome of the gap analysis. Increasing the size of the post-strata (in terms of trips in the sampling frame) would reduce the probability of it being empty, but there could be consequences for estimation by combining heterogeneous information and increased uncertainty associated with final estimates. Thus, any potential changes to reduce gaps should be statistically evaluated in context with the estimators used and bias/variance.

3.5 Summary of deployment and estimation

Overall, this analysis describes several broad trends associated with the deployment across both small and large vessels: (1) observer data collected under the restructured program is more reliable than the previous program; (2) as deployment rates increased, the probability of not having FMP-level and reporting-area data on discarded catch in a fishery declined; and (3) even at observer deployment rates <15% there was generally sufficient observer coverage to provide estimates of discards at an FMP-level for vessels in both the small vessel and large vessel categories. For example, at coverage rates of 10%, potential estimation gaps (i.e., no estimates under the FMP) under the current CAS configuration are likely to develop for only 5%-6% of all trips in the small vessel stratum. Many of these estimation gaps were related to vessels not being in the sample frame (i.e., there is no coverage for vessels under 40 ft LOA), resulting in gaps that persisted even at high coverage levels (i.e., 6% of the trips were estimated regardless of coverage level). The sampling frame issue is a problem that can only be addressed through improvements in deployment (i.e., change in the ADP to start data collection on vessels <40 ft LOA).

Data quality issues arise when post-strata have a high risk of not containing data and catch estimates cannot be generated (addressed in next section), and assumptions are made about trips outside of the sampling frame. In the large vessel categories, the number of trips impacted by data gaps showed large decreases in empty post-strata for deployment rates <=15% for the GOA and <=20% for the BSAI at the reporting area level. However, estimation gaps at the FMP level persisted at coverage levels much higher than 15% and 20% these. In small vessel categories, the deployment rate for which most reporting area-post strata had data was less delineated then the large vessel stratum. This was primarily due to the fisheries being spread out in time and many vessels not being in the sample frame.

The data quality issues caused by gaps in estimation at the reporting area level are dependent on the bycatch characteristics of the fishery and whether estimates can be made at the FMP level. If bycatch is heterogeneous across space and time, then utilizing an FMP bycatch rate would result in biased estimates. However, for some post-strata categories where bycatch characteristics are homogenous in space and time, an FMP rate will not bias estimates and may even increase the statistical reliability compared to estimates with small sample sizes.

Data gaps at the FMP post-strata level for both small and large vessel strata are situations where no estimation can occur. The simulation results showed only a few gaps at the FMP post-strata level regardless of the vessel size category. Most gaps disappeared or were severely minimized at deployment rates less than or equal to 15% (relative to a 50% probability of a post-strata being empty). Data gaps in the small vessel estimation process that persist at higher coverage levels are linked to a sample frame that does not match the target population. Alternatively, changes to post-stratification coupled with model-based estimation methods and assumptions about the fishing characteristics of these vessels can be used to address these estimation gaps. However, the assumptions from these types of inferences are difficult to verify and the methods are less statistically reliable than moving these vessels into the sampling frame.

Estimating discard for vessels outside of the sampling frame requires assuming those vessels in the sampling frame fish like vessels outside of the sampling frame; this assumption has not been evaluated and we note that vessels outside of the sampling frame are smaller and may fish differently than larger vessels in the sampling frame. In some situations, increasing the coverage rate in the small vessel strata will improve the amount of information available to be used in estimation; however, the problem of estimating discard for vessels outside of the sampling frame remains. The lack of discard information from these vessels prevents evaluation of these assumptions. In the case of jig gear, any discard estimation would require changes in deployment and/or a change to post-strata design to estimate discard rates for jig gear using data from non-jig gear types.

In evaluating the restructuring action, it is important to recognize that many of the post-strata issues identified in the simulation are resolved through changes to the post-strata design and not necessarily changes in deployment. While increasing deployment rates may increase the likelihood of having data in the post-strata, further evaluation of the post-strata definitions may find efficiency gains that are independent from deployment. While the ADP process can change deployment rates within a given budget, it is not a tool to change post-strata and estimation methods.

Prior to restructure, NMFS had no control over deployment rates and during the estimation process data from 100% catcher vessels would be combined with data from vessels covered under the previous program’s 30% regulations. This resulted in under-and-over representation of sampling information for particular classes of vessels within a post-strata, potentially biasing discard rates that are applied to specific landings (trips). In addition, all post-strata in the small vessel category had no at-sea coverage (i.e., all figures labeled small vessel), hence estimation of discard was solely based on data from larger vessels or was unavailable (e.g., halibut targets). Expansion of the sampling frame under the new program represents a significant improvement in the statistical reliability of estimates for these vessels. For the first time, the statistical characteristics of at-sea discard on vessels between 40 ft and 60 ft LOA can be characterized. Thus, even at very low deployment rates, the restructured program significantly improves NMFS ability to estimate discards when compared to the pre-restructured program.

The statistical reliability of coverage in the large vessel fleet is directly linked to its representativeness of the fishery. Data gaps in post-strata that cause estimation issues can be addressed through improvements to post-strata design and are not necessarily caused by low observer coverage. Post-strata are designed to parse out a population into homogenous groups to improve both the variance and bias characteristics of estimates. The tradeoff, however, is that the more subdivided a population becomes, the greater the risk of not having information available from which to generate catch estimates. Based on current post-stratification methods in the CAS, deployment levels below 15% result in a substantial increase in the number of trips for which estimation cannot be made (assuming a 50% probability of no observer coverage for the post-strata) and recognizing that alternative post-stratification schemes would likely reduce the number of data gaps.

Recent work by NMFS and Pacific States Marine Fisheries Commission has begun to evaluate the use of ratio estimators to estimate catch in Alaska waters. Cahalan et al (2015) used a simulation approach to evaluate the statistical properties of three estimators of trip-specific catch on fully observed CPs and catcher vessels in the BSAI and GOA: imputation, simple-mean, and a ratio estimator. The study expected the simple mean estimator to be more robust to biases and have higher variance compared to the ratio estimator since the simple mean estimator does not rely on the use of auxiliary information (and is always unbiased). This was not the case. The study found the simple mean estimator to have a consistently lower bias and variance estimate then the ratio method. The degree to which the simple mean performed better was related to the rarity the catch of a species being estimated. For example, on trips where species proportions were low (less than or equal to 15% of total catch), the simple mean estimator performed better, whereas, on trips where species proportions were high (greater than 50%), the ratio estimator performed similarly to the mean estimator. This was likely due to strong correlations between the species caught and the haul size for the more dominant species in the catch. Future evaluation of the post-strata will require that both the estimators and the sampling strata definitions in the ADP are considered. From this perspective, methods outlined in the ADP will influence the flexibility in any redesign of or use of CAS post-strata.

4 Observer Fee Revenues and Coverage

As pointed out in the Court Order, the 2011 EA/RIR/IRFA did not include analyses of the potential for the restructured Observer Program to have adverse impacts on observer data quality. The Court Order identified that adverse impacts could result from low coverage in years with low revenues or high costs. This section discusses the anticipated coverage amounts presented in the 2011 EA/RIR/IRFA under the restructured Observer Program and how those compare with the actual coverage rates in 2013, 2014, and anticipated coverage for 2015.

The restructured Observer Program was designed so that NMFS could maximize the coverage, using a scientific sampling method, each year depending on the amount of funds available. Observer coverage for the partial coverage category is funded through a system of fees based on the ex-vessel value of groundfish and halibut, with potential supplements from Federal appropriations. The Magnuson-Stevens Act set up the structure to establish a system of fees to pay for the cost of implementing the Observer Program for the partial coverage category. The fee system used in the restructured Observer Program follows the Magnuson-Stevens Act requirements in 16 U.S.C. 1862(a)(2) and (b)(2). A fee equal to 1.25% of the ex-vessel value is assessed on the landings of groundfish and halibut subject to the fee.

The 2011 EA/RIR/IRFA explained that the sectors in the partial coverage category would pay up to 1.25% of their ex-vessel value to NMFS to pay for observer services, and all vessels and processors in the partial coverage category would be subject to the sampling design in the ADP. Those vessels and processors requiring at least 100% coverage would continue to directly pay for their observers. The determination of general coverage needs (less than 100% versus greater than or equal to 100%) is discussed in the 2011 EA/RIR/IRFA Sections 3.2.7 and 3.2.9. In sum, those operations determined to need greater than or equal to 100% coverage include: most catcher/processors and all motherships; catcher vessels in cooperatives with transferable quotas; and shoreside processors taking deliveries of pollock in the Bering Sea.

Section 2.10 of the 2011 EA/RIR/IRFA presents a comparison of the number of observer days that were estimated to be funded under the restructured Observer Program, compared to the number of observer days that were used in 2008. This information is summarized here. In the 2011 EA/RIR/IRFA, the 2008 coverage level estimate was 4,867 observer days for the partial coverage category (see Table 48 in the 2011 EA/RIR/IRFA). A fee of 1.25% was estimated to generate $4.2 million in revenues and fund approximately 9,000 observer days at a cost of $467 per day (see Table 46 in the 2011 EA/RIR/IRFA), or about 2,600 to 5,700 more observer days than were used in 2008. This range of days represents one standard deviation from the mean (2005 through 2008) of the ex-vessel revenue estimates for the catch that was included under an ex-vessel value fee. Using the mean of ex-vessel revenue estimates, the 2011 EA/RIR/IRFA estimated that fees would fund an estimated 4,160 more observer days compared to the status quo.

The cost estimates in the 2011 EA/RIR/IRFA were based on actual data reported from the existing contractors with cost increase assumptions based on Federal contracting. The costs estimates in the 2011 EA/RIR/IRFA were based on very efficient 100% coverage vessels. The 2011 EA/RIR/IRFA explained that, under all of the proposed alternatives, the cost of deploying observers in the partial coverage category would increase relative to the prior observer cost. Those increased costs are due to requirements to adhere to the Department of Labor wage rates for observer pay, including overtime and benefits that are required for Federal contracts. Also noted in the 2011 EA/RIR/IRFA were a suite of challenges, inefficiencies, and complexities associated with the preferred model for observer deployment. The potential costs of these inefficiencies were unknown in 2011. The Council noted early in the process of restructuring that the costs may not be possible to assess until contracts between NMFS and observer providers are finalized. The Council recognized that there will always be circumstances (e.g., weather delays, vessel break-downs, number of fishing days) that will create uncertainties about the costs of the preferred service delivery model.

Once the contract was awarded to AIS, Inc., NMFS informed the Council and the public of the actual costs for deploying observers in the first two years of the restructured Observer Program and the impacts on coverage when those costs were finalized and incorporated into the 2013 ADP. Based on the actual costs of deploying observers, the annual number of observer days that could be bought by the fees collected under the restructured Observer Program were overestimated in the 2011 EA/RIR/IRFA.

Information available following the completion of the second full year of the new observer program, estimates the average observer cost per day under partial coverage as $1,067 (NMFS 2015a). This is slightly higher than the average cost per day estimated following the completion of the first year under the new program. It is worth noting that during the first two years of the program, the partial coverage costs in the North Pacific have been on par with partial coverage, government-contracted observer costs in other regions (e.g., $1,200/day in the Northeast region).[14]

Several factors impact the costs in the partial coverage category, particularly when compared to costs for full coverage—

- The partial coverage contract is a Federal contract between NMFS and the observer service provider company whereas the full coverage observer providers do not operate under a Federal contract. Instead, full coverage observer providers are certified by NMFS and contract observer services directly with vessel owners.
- Federal contracts are subject to Federal Acquisition Regulations, Fair Labor Standards Act, and Service Contract Act requirements, and applicable Department of Labor Wage Rate Determination which establish, among other things, minimum wage and benefits for observers, including overtime.
- Partial coverage observers deploy out of many small, remote port locations which increases travel and lodging costs.
- The average trip duration for partial coverage observers is significantly shorter (3 to 5 days) than for full coverage observers (60 to 90 days), requiring more travel between vessels. All travel costs and expenses incurred are reimbursed in accordance with the Government's Travel Regulations which includes specified per diem rates which are paid regardless of actual expenses.
- Partial coverage is inherently inefficient compared to full coverage as days when observers are not deployed are expected, but difficult to predict; risk and uncertainty regarding the number of unobserved days are likely to influence costs.

The new information generated each year through the ADP and Annual Report process was anticipated in the design of the restructured Observer Program; the ADP process is flexible and the ADP is adjusted annually to incorporate this new information. The analysis of the preferred alternative for Observer Program restructuring presented in the 2011 EA/RIR/IRFA was conducted under the assumption that NMFS would use the best available information on funding, costs, and vessel days at-sea in the ADP for the upcoming year. In the 2011 EA/RIR/IRFA, it was explained that the cost of observer coverage and the amount of funding available for observer coverage would change over time, and this SEA supplements that analysis by considering whether the data being gathered by the restructured Observer Program could ever cease to be reliable, or of high quality, due to insufficient observer coverage. In the 2011 EA/RIR/IRFA, it was recognized that the coverage rate for any given year would be dependent on available revenue and anticipated costs and vessel days at-sea. Annual changes in revenue and costs are

[14] See: *http://www.nefsc.noaa.gov/fsb/SBRM/2014/Proposed_2014_Observer_Sea_Day_Allocation_05222014_rev.pdf*

inherent in the program and therefore the ADP process was established to ensure that the best available information was used to deploy observers each year.

Table 7 Budget and observer days from 2008 to 2015

Year	Budget $ million (fees + Federal funds)	Observer days
2008	$4.2 (projected fees)	4,867 (used)
2013	$6.6 (Federal funds)	3,533 (used)
2014	$4.26 ($4.25 + $0.55)	4,448 (used)
2015	$4.7 (fees + carryover)	5,518 (projected)

Funding for observer deployment in the partial coverage category in 2013 was provided through 2012 Federal start-up funds of $4.48 million. In 2013, NMFS managed the available observer days conservatively with coverage rates set to spend, on average, 90% of the days. This approach was necessary to ensure that NMFS did not spend beyond the budget since there was no buffer for cost over-runs. NMFS also considered that observer days would be needed at the beginning of 2014 until the fee proceeds became available. As the implementation of the observer fee was new, it was highly uncertain when the fee proceeds would be available for spending. With this uncertainty, NMFS provided 2013 Federal appropriations of $2.11 million late in the fiscal year that procured 1,913 additional observer days for use into 2014. At the close of 2013, NMFS had used 3,538 observer days and carried forward 2,910 observer days already procured with Federal funds. In other words, for 2013 and part of 2014, NMFS spent $6,600,128 to procure 6,448 observer days for an average cost per observer day of $1,024. NMFS collected a total of $4,251,452 in observer fees for 2013. The breakdown in contribution to the observer fee by species landed is 38% halibut, 31% sablefish, 19% Pacific cod, 10% pollock, and 2% all other groundfish species (2013 Annual Report). Given the buffer in days carried forward, NMFS incrementally increased the 2014 coverage rate. And, given fee proceeds were lower than initial projections, NMFS supplemented the 2014 fees with $1,892,808, in Federal appropriations.

The 2015 ADP used an identified target budget of $5.5 million, of which $3.2M is projected revenue from the fee for 2014. The remaining funding includes fees carried over from 2014 and Federal funds from NMFS. The projected fee proceeds for the 2014 fishing year are $1.1M less than the 2013 assessments. This is due to reductions in both the prices and TACs of key species. The 2015 target budget aims to ensure that the coverage rate and number of days observed between 2013, 2014, and 2015 are comparable and represent the available deployment budget.

For the 2015 ADP, NMFS used vessel activity from 2013 to estimate the amount of fishing effort expected for 2015. The budget for the deployment of observers was set equal to that in the 2014 ADP: 5,518 days. This value results from conversions of dollars to days derived using confidential contract information for 2013 and 2014 negotiated between NOAA's acquisition and grants office and the selected observer provider. In addition, experience gained from deployments in 2013 and 2014 allowed NMFS to reduce the amount of money set aside as a buffer in case fishing effort differed dramatically from the year used in the simulation. In 2014, NMFS had reduced the deployment days from 5,518 to 4,718 to provide a buffer. Reducing this buffer resulted in a gain of 800 days in 2015 compared to 2014.

Based on these calculations, NMFS projected a deployment rate of 12% of trips for the small vessel trip-selection pool and 24% of vessels for the large vessel trip-selection pool for 2015. This represents an identical selection rate in the former vessel-selection pool (small vessel pool) and a 50 percent increase in the selection rate in the large vessel trip-selection pool relative to the coverage rate in 2014. With this increase coverage in the large vessel trip-selection pool, NMFS will be collecting more observer data.

The 2015 ADP provides a detailed analysis of the rates and summarizes the decision record used to determine the rates.

4.1 Relationship between fee revenues and coverage rates

This section discusses a range of possible observer coverage rates in the partial coverage category by evaluating recent information on 1) catch and ex-vessel prices, which both contribute to the observer fee revenues; 2) observer costs per day; and 3) fishery effort. Because there are only two complete years of information available under the restructured Observer Program, the range of possible observer coverage rates that were estimated also reflects information from what would have been the partial coverage category if the restructured Observer Program had been in place in its current form between 2009 and 2012.

4.1.1 Observer fee revenues

The 2011 EA/RIR/IRFA examined possible revenues between 2005 and 2008 for funding observer coverage under a new observer program. Using catch and ex-vessel price data available following the completion of the 2011 EA/RIR/IRFA, this analysis is able to analyze revenue from 2009 through 2014. Rather than arbitrarily selecting possible revenue values, NMFS sought to identify a realistic range of revenue based on actual catch and ex-vessel value data from Alaska's groundfish and halibut fisheries over a 10-year timeframe.

Observer revenues are generated by applying a fee equal to 1.25% of the ex-vessel value on the landings of groundfish and halibut subject to the fee. Ex-vessel value is determined by multiplying the standard price for groundfish by the round weight equivalent for each year, species, gear, and port combination, and by multiplying the standard price for halibut by the headed and gutted weight equivalent for each year and port combination. Pacific cod, pollock, sablefish, and halibut catch accounted for 98% of the fees collected in 2013 and 2014 (NMFS 2014a; NMFS 2015a). While a hallmark of the restructured Observer Program is that each participant pays an equal percentage of the value they derive from the groundfish and halibut fisheries toward the cost of collecting observer data, the contribution from other groundfish species have been omitted from this analysis in order to simplify calculations for the historical data prior to the restructured Observer Program. Therefore, for this analysis, ex-vessel values were calculated for landings of Pacific cod, pollock, sablefish, and halibut from catcher vessels that would have constituted the partial coverage category if the restructured Observer Program had been in place in its current structure between 2009 and 2012.

The standard ex-vessel prices for Pacific cod, pollock, and sablefish were calculated for 2009 through 2012 using the same methods that are used to calculate standard groundfish prices under the new Observer Program. In other words, the analysis applied the methods and rules for the new program back in time in order to analyze a broader set of years. Details of the methods to derive standard prices are outlined in the *Federal Register* notice where standard prices are published each year (79 FR 74695, December 16, 2014, http://alaskafisheries.noaa.gov/notice/79fr74695.pdf); here we summarize those methods. Three years of volume and value from the State of Alaska's Commercial Fishery Entry Commission's (CFEC) gross revenue data were averaged to calculate standard ex-vessel prices. Because there is a time lag before groundfish price information is available for the calculation of the current year's standard ex-vessel prices, the same lagged data was used to calculate standard ex-vessel prices for past years for this analysis. Table 8 indicates the years of CFEC revenue data used to calculate groundfish standard ex-vessel prices for this analysis. This calculation resulted in a weighted average ex-vessel price per pound by species, port, and gear category. Three gear categories were used for the standard ex-vessel prices: pelagic trawl gear, non-pelagic trawl gear, and other gear (hook-and-line, pot, and jig).

Table 8 Years of CFEC Gross Revenue Data Used to Calculate Groundfish Standard Ex-vessel Prices

Fee Year	CFEC Gross Revenue Years
2009	2005, 2006, 2007
2010	2006, 2007, 2008
2011	2007, 2008, 2009
2012	2008, 2009, 2010

Standard ex-vessel prices for halibut IFQ or CDQ, sablefish IFQ, and sablefish accruing against the fixed gear sablefish CDQ reserve, were calculated for 2009 through 2012 in a manner consistent with how standard IFQ and CDQ ex-vessel prices are currently calculated for the restructured Observer Program. The IFQ and CDQ standard ex-vessel prices are based on the volume and value data collected on the IFQ Buyer Report from the previous year. Table 9 indicates the years of IFQ Buyer reports and the dates of landings covered by those reports that were used to calculate standard ex-vessel prices for this analysis for halibut IFQ or CDQ, sablefish IFQ, and sablefish accruing against the fixed gear sablefish CDQ reserve. The standard ex-vessel prices reflect a single annual average price per pound, by port.

Table 9 Years of IFQ Buyer Reports, and Associated Landing Dates, Used to Calculate IFQ and CDQ Standard Ex-vessel Prices

Fee Year	IFQ Buyer Report Years	Landing Dates Included
2009	2008	October 1, 2007- September 30, 2008
2010	2009	October 1, 2008- September 30, 2009
2011	2010	October 1, 2009- September 30, 2010
2012	2011	October 1, 2010- September 30, 2011

For the restructured Observer Program, NMFS does not publish any price information that would permit the identification of an individual or business. For groundfish, at least four persons must make landings of a species with a particular gear type at a particular port in order for NMFS to publish that price data for that species-gear-port combination. Similarly, at least three processors in a particular port must purchase a species harvested with a particular gear type in order for NMFS to publish a price for that species-port combination. For halibut IFQ or CDQ and sablefish IFQ, at least three registered buyers in a particular port must purchase a species in order for NMFS to publish a price for that species-port combination. The same confidentiality screening process was used to establish the ex-vessel prices used for this analysis in order to best simulate the prices that would have been used if the restructured Observer Program had been in place from 2009 through 2012.

The second piece of information that is needed to calculate the observer fee revenues is the landings. The round weight equivalent for Pacific cod, pollock, and non-IFQ sablefish landings from 2009 through 2012 was calculated for each year, port, gear, and species combination. These weights were multiplied by the corresponding standard ex-vessel prices for the year, port, gear, and species. The sablefish IFQ catch and sablefish catch that accrued against the fixed gear sablefish CDQ reserve were multiplied by the standard ex-vessel price calculated from the previous years' IFQ Buyer report based on the year and port. The headed and gutted weight equivalent of halibut that accrued against IFQ or CDQ quota was calculated for 2009 through 2012 for each year and port combination. These weights were multiplied by the corresponding standard ex-vessel prices calculated from the previous years' IFQ Buyer report based on the year and port.

A fee equal to 1.25% of the ex-vessel value is assessed on the landings of groundfish and halibut subject to the fee in the restructured Observer Program. For this analysis, an observer fee liability was calculated as if the restructured Observer Program were in place in 2009 through 2012. The ex-vessel values of catch were multiplied by 1.25%, resulting in fees expressed in nominal dollars. These fee estimates, and the actual observer fee revenues for 2013 and 2014, were adjusted to 2014 dollars using the Anchorage Consumer Price Index.[15]

4.1.2 Cost per observer day and number of observer days

The number of partial coverage observer days depends on available revenues and the cost per day of observer coverage. Current information from the first year of the new program on average cost per observer day was $1,024 (NMFS 2014a). For this analysis, that rate was adjusted to $1,040 per day in 2014 dollars using the Anchorage Consumer Price Index. Based on the observer fee revenues estimated for 2009 through 2012 and from actual observer fee revenues for 2013 and 2014, the number of partial coverage observer days possible was calculated by dividing the observer fees in adjusted dollars by the cost per day in adjusted dollars. The resulting observer coverage days, based on observer coverage fees, are used in the subsequent fishing year.

Table 10 contains the estimated fees for Pacific cod, pollock, sablefish, and halibut for 2009 through 2012 as if the new program had been in place during those years as well as the realized fees for those species in 2013 and 2014. The fees are presented in nominal dollars as well as 2014 dollars. The projected fees for 2015 are included in the table in nominal dollars. Over the time period examined, fees ranged from $3.4 million to $5.6 million with an average across all years of $4.5 million. The highest observer fee revenues would have been generated in 2012 and can be attributed primarily to high revenues from halibut and sablefish in that year. The realized fee revenues in 2013 and 2014 are lower than the estimated fees in 2012, mainly due to decreases in the halibut and sablefish quotas and lower ex-vessel prices for those species. Over this time period, the lowest fee revenue occurred in 2014. Projected fees for 2015 show an increase over the 2014 fees.

Table 10 Partial Coverage Observer Fees, Observer Cost Per Day, and Number of Observer Days Possible from Estimated, Realized, and Projected Observer Fees

Year	Fee Source	Fee (in nominal $)	Adjusted Fee (in 2014 $)	Adjusted Observer Cost per Day (in 2014 $)	Observer Days from Fees
2009	Estimated	$4,113,656	$4,629,858	$1,040.09	4,451
2010	Estimated	$3,962,866	$4,382,437	$1,040.09	4,214
2011	Estimated	$4,581,348	$4,908,368	$1,040.09	4,719
2012	Estimated	$5,304,495	$5,559,241	$1,040.09	5,345
2013	Realized	$4,164,016	$4,231,148	$1,040.09	4,068
2014	Realized	$3,373,159	$3,373,159	$1,040.09	3,243
2015	Projected	$4,123,238	$4,123,238	$1,040.09	3,964

Note: This reflects revenues from Pacific cod, pollock, sablefish and halibut. Revenues from other groundfish have been omitted.
Note: A 2015 Consumer Price Index for Anchorage, AK, is not currently available. As such, the 2015 projected fee has not been adjusted to 2014 dollars.

With estimated and realized fees over this time period as the basis, and a known cost of observer cost per day, it is estimated that between 3,243 and 5,345 observer days could be purchased through observer coverage fees alone. The smallest number of observer days is the result of low fee revenues in 2014 and the greatest number of observer days is due to the high fee revenues in 2012.

Information available following the completion of the second full year of the new observer program, estimates the average observer cost per day under partial coverage as $1,067 (NMFS 2015a). This is slightly higher than the average cost per day estimated following the completion of the first year under the

[15] State of Alaska, Department of Labor and Workforce Development, Research and Analysis, Consumer Price Index, http://laborstats.alaska.gov/cpi/cpi.htm (accessed 1/30/2015).

new program. Based on this cost, compared to the $1,040 cost per day used in Table 10, between 3,161 and 5,210 observer days could have been purchased using fee revenues and on average there would be 108 fewer observer days per year over the time-period of this analysis.

The observer coverage under the first two years of the program fell under a 2-year contract awarded to A.I.S., Inc. A second contract was finalized in April, 2015, for the next 5 years of the program. The contract and the cost per observer day that NMFS pays the observer services contractor were established through a competitive bidding process. The detailed costs on the Federal contract are protected by confidentiality as they contain competitive information and NMFS has been advised that it can only release information on the amount of services (observer days) after services have been procured. So future annual reports will provide information about the number of days procured and the average cost per day under the new contract. However, the new contract has several components designed to improve efficiency and reduce costs. For example, the new contract requires that partial observed sea day completed by the contractor are paid one-half the fixed price daily rate. A partial observed sea day is one in which the vessel leaves port after 1200 (noon) or returns to port before 1201. The lower rate would thus apply to all days in which an observed vessel leaves or arrives in port before or after the designated times. Each year, it is likely that average cost per observer day will be different (higher or lower) than the average cost of $1,040 used in this analysis, however the overall average is likely to be similar. In summary, NMFS anticipates that the average cost per observer day is likely to be fairly stable over the next 5 years and the cost of $1,040 provides a reasonable estimated average cost.

As noted in earlier sections of this supplemental EA, additional revenue sources have been used to fund observer days for the restructured Observer Program. Federal start-up funds were used during the first year of the program and supplemental Federal appropriations have been obtained in both 2013 and 2014. For this analysis, however, only fee revenues were considered as the source of funding for observer days. Under the restructured Observer Program, unused observer days may also be carried over to the next year. For this analysis, only the observer days funded from the fees of the preceding year were factored into observer coverage rates for a year.

4.1.3 Effort

The rate of observer coverage is dependent upon the amount of fishing that is observed and the total amount of fishing that occurred. Effort was determined for vessels that would have constituted the small and large vessel strata of the partial observer coverage category in 2009 through 2012, had the current program been in place during those years, and for vessels in those strata under the existing program in 2013 and 2014. Although vessels using jig gear and vessels under 40 ft LOA comprise a portion of the partial coverage category, they are part of the ‘no selection’ vessel pool or strata and do not carry an observer. As such their fishing activity was not included in effort calculations for this analysis.

Effort was calculated as the number of days fished. This reflects the number of days between when fishing began and when the catch was landed, and is inclusive of the days on both ends of the trip (i.e., (Date landed – date fishing began) +1).[16] Table 11 identifies the combined effort for vessels in the small vessel and large vessel strata for 2009 through 2014. During this time period, effort ranged from a low of 24,575 days in 2014 to a high of 32,306 days in 2010. Figure 29 summarizes this effort by year, FMP area, gear type, and strata.

[16] There were cases where a trip reflected effort in both the BSAI and GOA. When summarizing effort by year, these trips that cross FMP boundaries and their associated days of effort were only counted once, but when effort was summarized by FMP area, the effort corresponding to these trips were credited towards each FMP area, and as a result were double counted.

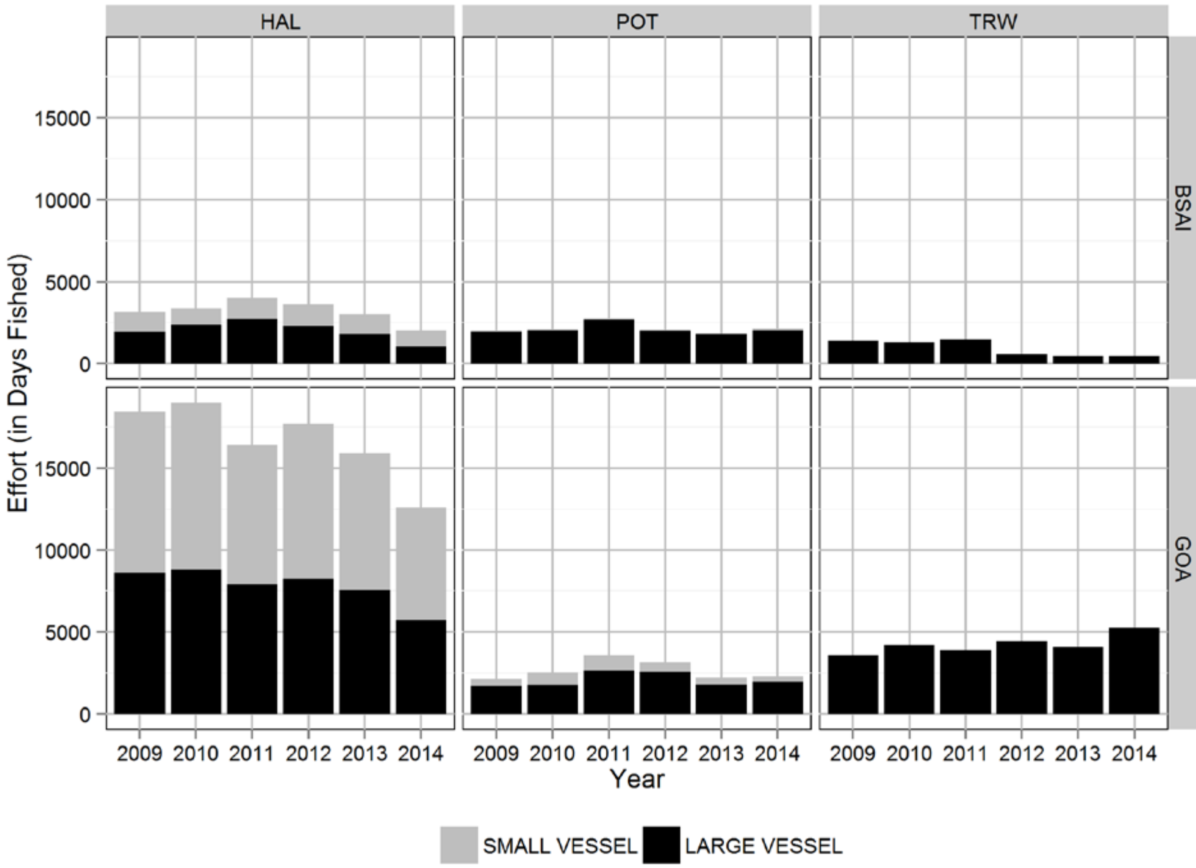
Table 11 Effort by Vessels in What Would Have Constituted Partial Observer Coverage in 2009-2012 and Actual Partial Observer Coverage in 2013-2014.

Year	Effort (in Days Fished)
2009	30,402
2010	32,306
2011	31,803
2012	31,385
2013	27,437
2014	24,575

Note: Effort by vessels in the Zero Selection strata has been omitted.

Figure 30 compares observer fee revenues, observer days, and effort by year. Estimated, realized, and projected observer coverage fees are illustrated in the top panel, showing the high fees in 2012 and the low fees in 2014. The number of observer days possible is based on fee revenues and the cost per day of observer coverage and is depicted in the middle pane. The observer fee revenues from one year fund observer coverage for the following year. Because there were no fees estimated for 2008, no observer days were estimated for the 2009 fishing year, but fees from 2009 would fund an estimated 4,451 observer days for the 2010 fishing year, and the 2010 fees would fund an estimated 4,214 observer days for the 2011 fishing year, and so forth. As observer fees declined from 2012 through 2014, the corresponding decline in observer coverage days is also seen, simply shifted one year to the right.

Figure 29 **Effort, in the number of days fished, by year, FMP area, gear, and strata, for what would have constituted the partial observer coverage category had the current program been in place in 2009 through 2012, and the partial coverage category under the restructured program for 2013 and 2014. Note: the effort of vessels less than 40 feet in length and vessels fishing jig gear are not included.**



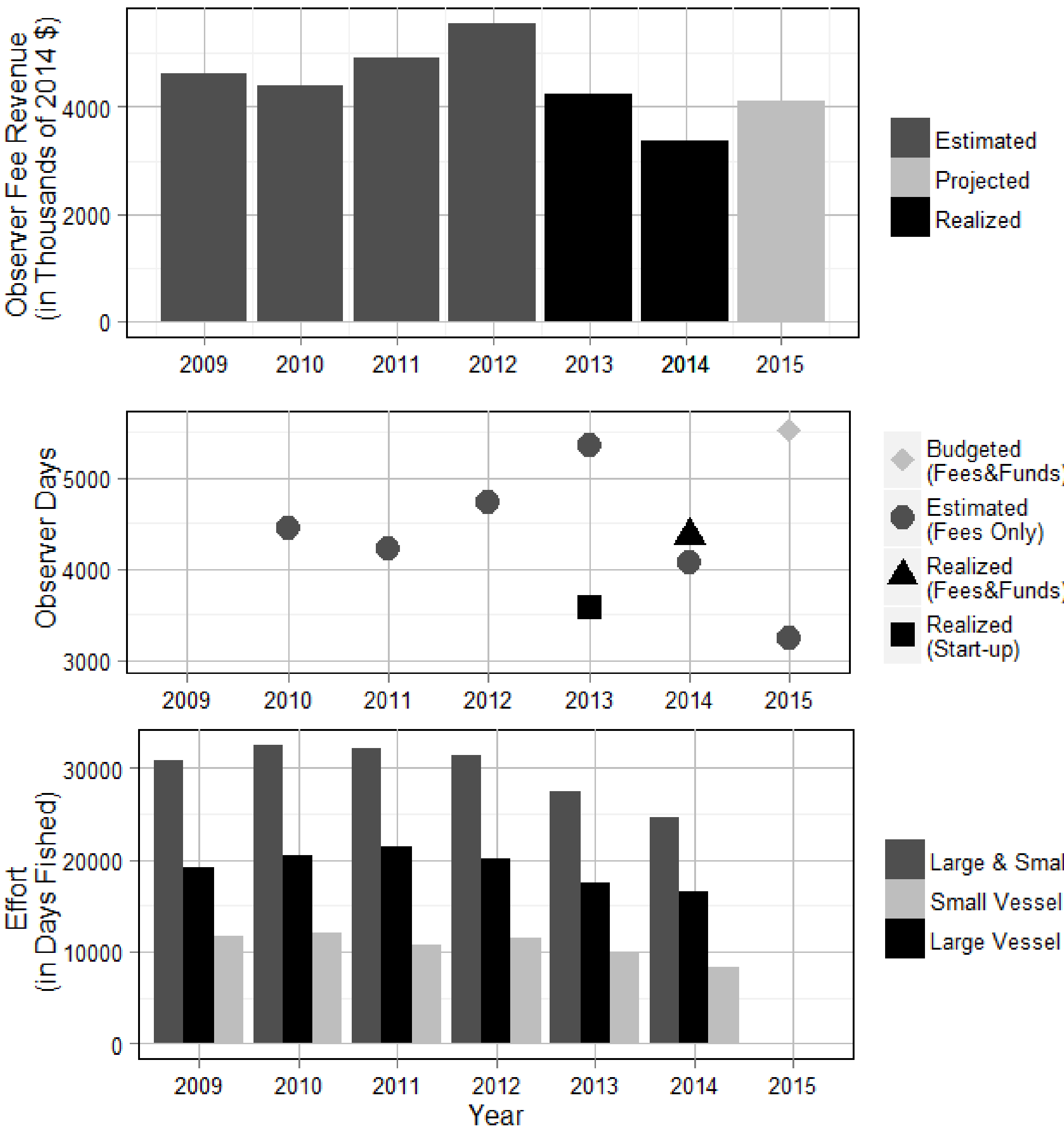
Also depicted in the middle pane in Figure 30 are the number of observer days used in the partial coverage category in 2013 and 2014. The estimated number of observer days possible for 2013 from the estimated fees in 2012 far exceeds the actual number of observer days used in 2013. Because the Observer Program was deployed conservatively in its first year with coverage rates set to spend, on average, 90% of the days available through the start-up funds and an additional Federal appropriation was received later in 2013, 2,910 observer days were carried over to 2014. A conservative approach was necessary to ensure that NMFS did not spend beyond the budget since there was no financial buffer for cost over-runs. NMFS also needed to consider that observer days would be needed at the beginning of 2014 until the fee proceeds from the first year of the program became available.

The number of observer days available for the 2014 fishing year, based on the actual fee revenues collected from the restructured Observer Program in 2013, is fewer than the number of observer days used in 2014. This is not due to the Observer Program overspending their budget in 2014, but due to the availability of additional Federal appropriations and the 2,910 unused observer days rolled over from the previous year.

The number of observer days budgeted for the 2015 fishing year is also depicted in the middle pane. The number of budgeted days also exceeds the number of observer days available from realized fee revenues in 2014. Again, this is due to the availability of Federal funds and fees carried over from the previous year in addition to those afforded through 2014 fee revenues. A total of 2,705 observer days were available at the start of 2015 (NMFS 2015a).

The bottom panel in Figure 30 identifies effort in the number of days fished for the large and small vessel strata from 2009 through 2014. Effort was lower in 2013 and 2014 than in the preceding four years under what would have been partial coverage if the restructured Observer Program had been in place in those years. Although there has been fishing effort in 2015, the season is not complete, and therefore effort is not included in this figure.

Figure 30 **Estimated, realized, and projected observer fee revenues from halibut, sablefish, pollock, and Pacific cod, adjusted to 2014 dollars, by year (top pane). A 2015 Consumer Price Index for Anchorage, AK, is not currently available, so the 2015 projected fee has not been adjusted to 2014 dollars. Estimated, realized, and budgeted observer days available based on estimated and realized observer fee revenues, Federal start-up funds, or fee revenues and Federal funds, by year (middle pane). Effort, in the number of days fished, for what would have constituted the large and small vessel strata of partial observer coverage in 2009 through 2012, and for the large and small vessel strata of partial observer coverage under the restructured program, 2013 and 2014 (bottom pane).**



4.1.4 Range of potential observer coverage rates

Observer coverage rates reflect the proportion of fishing that is observed to the total amount of fishing that occurred. With a range of estimated and realized fee revenues, and the different effort levels realized across the time period examined, a range of possible observer coverage rates were estimated based on recent fishing history. Because deployment by the Observer Program has been by vessel or by trip, coverage rates have been expressed as the number of observed vessels to the number of vessels that fished or the number of observed trips to the total number of trips. For this analysis, however, observer coverage rates were estimated as the number of observer days to the number of days fished. While this calculation is fairly simplistic, because it does not consider that trips may last a different number of days or that vessels may undertake a different number of trips (which may each last a different number of days), it provides an idea of the kind of rates possible during this time period.

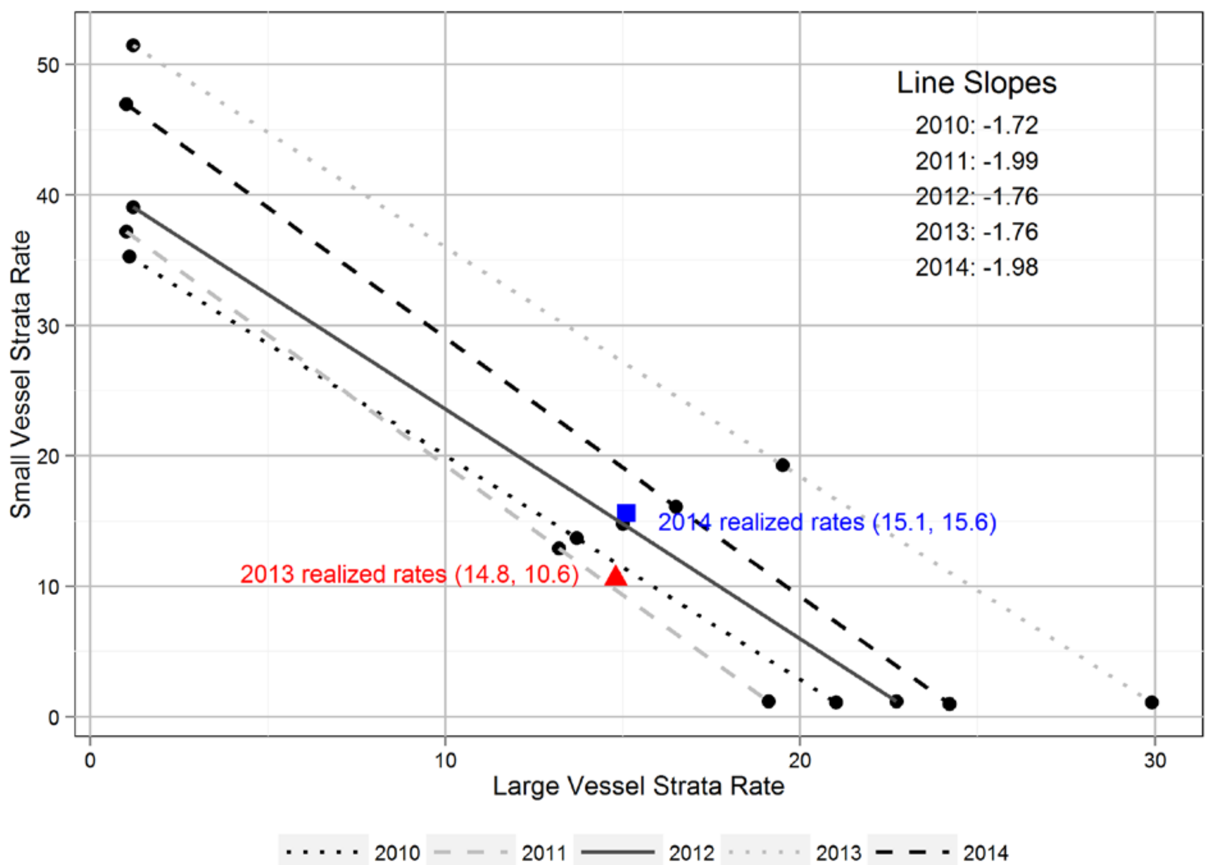
The number of observer days possible from fee revenues generated the previous year was split between the two sampling strata, and coverage rates were calculated as the number of observer days divided by the number of days fished. These available observer days were initially allocated to strata such that the resulting coverage rates were equal between the two strata. Figure 31 illustrates the range of possible observer coverage rates in the small and large vessel strata based on the estimated number of observer days funded through fee revenues and fishing effort between 2010 and 2014. The black circles toward the middle of the graph represent the distribution of observer days within a year where observer coverage rates for the two strata were approximately equal. Depending on the year, this rate ranges from 13.7% in 2011 to 19.4% in 2013.

Since the restructured Observer Program went into place in 2013, the Council has recommended higher priority for coverage in the large vessel strata, and NMFS implemented differential coverage rates between the large and small vessel strata. To simulate this policy choice, the range of observer coverage rate combinations between the two strata was evaluated (Figure 31) and each line represents the possible combinations of large and small vessel strata observer coverage rates for a year between 2010 and 2014. As you increase the number of days attributed to the large vessel strata within a year, the large vessel strata coverage rate increases (horizontal axis) and the corresponding small vessel strata coverage rate decreases (vertical axis). With a fixed number of observer days available for the year, as more days are associated with one stratum, fewer can be attributed to the other. The slope of each line indicates how much the small vessel coverage rate decreases with each increase in the large vessel coverage rate within a year. For example, with each 1% increase in the large vessel strata coverage rate in 2011, there is a corresponding 1.99% decrease in the small vessel strata coverage rate for the year. The large vessel coverage rates can be increased to between 19.1% and 29.9% depending on the year, but the observer coverage days remaining allow for approximately a 1% small vessel coverage rate.

Conversely, if you increase the number of observer days attributed to the small vessel strata within a year, the small vessel strata coverage rate increases and the corresponding large vessel strata coverage rate decreases. The slope of each line also indicates how much the large vessel coverage rate decreases with each increase in the small vessel coverage rate within a year. For example, with each 1.72% increase in the small vessel coverage rate in 2010, the large vessel coverage rate decreases 1%. The small vessel coverage rates can be increased to between 35.3% and 51.5% depending on the year, but the number of observer coverage days remaining allow for approximately a 1% coverage rate for the large vessel strata.

In general, the lines towards the right in Figure 31 reflect either higher fee revenues, and therefore a greater number of available observer days, or a lower effort. Lines towards the left reflect either lower fee revenues, and fewer available observer days, or higher effort.

Figure 31 **Range of possible observer coverage rate combinations for the large and small vessel strata based on estimated or realized fee revenue, observer cost per day, available observer days, effort, and distribution of observer days between strata by year. For comparison, the realized observer coverage rates for 2013 (red triangle) and 2014 (blue square) are provided. In the first two years of the Restructured Observer Program, NMFS managed the available observer days conservatively with coverage rates set to spend, on average, 90% of the days available.**



The realized observer coverage rates for 2013 and 2014 are also plotted in Figure 31. In 2013, coverage rates of 14.8% and 10.6% for the large vessel (trip selection) and small vessel (vessel selection) strata were achieved, respectively, based on observed trips to total trips and observed vessels to total vessels (NMFS 2014a). This point falls below the 2013 line (gray dotted) of possible observer coverage rate combinations afforded through estimated observer coverage fees. The difference can be attributed to several factors. The estimated fees from 2012 were $5.6 million dollars (in 2014 dollars). This exceeds the amount of Federal start-up funds available ($4,700,351 in 2014 dollars[17]) by roughly $860,000 dollars. That difference accounts for approximately 826 additional observer days being factored into the calculation of rate combinations for 2013 in Figure 31. Secondly, the possible observer rate combinations were calculated based on spending every dollar of the hypothetical fees on observer coverage days, whereas the actual Observer Program had to factor in the risk of overspending the budget. In the first year of the program, NMFS managed the available observer days conservatively with coverage rates set to spend, on average, 90% of the days. This approach was necessary to ensure that NMFS did not spend beyond the budget since there was no financial buffer for cost over-runs. In addition, NMFS also needed

[17] Federal start-up funds were $4,484,962 in nominal dollars. This corresponds to $4,700,351 in 2014 dollars, based on a conversion using the Anchorage Consumer Price Index.

to consider that observer days would be needed at the beginning of 2014 until fee proceeds from the first year were available to pay for observer coverage at the beginning of the second year of the program.

In 2014, coverage rates of 15.1% and 15.6% for the large vessel (trip selection) and small vessel (vessel selection) strata were achieved, respectively, based on the number of observed trips to total trips for either stratum (NMFS 2015a). These realized rates also fall below the 2014 line (black dashed) of possible observer coverage rate combinations afforded through observer coverage fees in Figure 31. Although the estimate of observer coverage rate combinations for 2014 is based on the realized fees from the first year of the restructured program (2013) instead of hypothetical fees, the 2014 observer coverage days were paid for by a combination of fees, Federal funds, and observer days carried over from 2013. Also, NMFS again managed the available observer days conservatively in 2014 with coverage rates set to spend, on average, 90% of the days available. Remaining fees were carried over to fund 2015 observer days

Estimates of observer coverage in the 2011 EA/RIR/IRFA were made based on a projected observer cost per day of $467. It was anticipated at the time that the cost would increase due to contract requirements, and challenges, inefficiencies, and complexities with partial coverage deployment. The realized observer cost per day for partial coverage under the new observer program was substantially higher than the estimated cost in the 2011 EA/RIR/IRFA. In light of the higher costs under the first two years of the new program, we estimated a range of observer days and coverage rates in this analysis using recent catch, ex-vessel value, effort, and the realized observer cost per day. With equal deployment between the large and small vessel strata, possible coverage rates for both strata ranged between 13.7% and 19.4%. This range of rates falls within the range of deployment rates examined earlier in Chapter 3.

5 Risk that fee revenues will not buy adequate observer coverage

This chapter synthesizes the information in Chapters 3 and 4 to assess the risk that fee revenues will not buy adequate observer coverage.

Do we have reliable data given higher costs under the restructured Observer Program?
The higher costs of the new program resulted in less observer coverage than anticipated. In the 2011 EA/RIR/IRFA, NMFS did not consider whether the restructured Observer Program would yield reliable data with the increase in the actual cost per observer day. The main highlights of the restructure action were improvements to the sampling methods and sampling frame. Despite the increased costs, these improvements have greatly the increased reliability of observer information compared to the previous program.

The inclusion of small vessels and IFQ vessels under the restructured Observer Program improved the representativeness of data compared to the previous program (see section 3.2), even at very low deployment rates in the small vessel frame (given the rate prior to restructuring was 0%). These improvements resulted in more nearshore data and better representation of the small vessels and halibut fisheries in 2013 and 2014. This improved data in turn allowed estimation to occur when it previously had not under the previous program. These new estimates provided important new information to stock assessment authors and inseason managers on sensitive species such as skate, sharks, and rockfish (Figure 9 and Figure 10).

Implementation of the random sampling methods for the large vessel stratum has improved the representativeness of effort for vessels in the 30% deployment category relative to the previous program (Section 3.3). This was apparent by the lack of coverage peaks and the lower absolute deviation during the restructured year (Table 5 and Figure 16). There were also spatial improvements in the trawl fishery as noted by coverage in the western GOA (Figure 7). Coverage in 2013 and 2014 also resulted in most PSC estimates being made specific to a target and reporting area, which is a result of deployment better representing fishing effort.

Will we have reliable data with variations in costs and revenue?
The number of observer days afforded will vary between years in concert with changes in revenue generated from fees. Variation in the number of days afforded is described in Table 12, and shows a range of days afforded from fee revenue to be 3,243 in 2015 to 5,345 in 2013. The number of trips estimated from the days afforded ranges from 811 (2015) to 1,242 (2012). Note these revenues do not include NMFS contributions, which are summarized in Table 7.

Table 12 Effort, Observer Days from Estimated and Realized Observer Fees, and Estimated Observed Trips from Observer Fees

Year	Effort		Average Days/Trip	Estimated Observer Days from Fees	Estimated Observed Trips from Fees
	Trips	Days Fished			
2009	7,172	30,402	4.2	-	-
2010	7,889	32,306	4.1	4,451	1,086
2011	7,993	31,803	4.0	4,214	1,054
2012	8,322	31,385	3.8	4,719	1,242
2013	6,220	27,437	4.4	5,345	1,215
2014	6,481	24,575	3.8	4,068	1,071
2015	n/a	n/a	4.0	3,243	811

Note: The observer fee revenues from one year fund observer coverage for the following year. Because there were no fees estimated for 2008, no observer days were estimated for the 2009 fishing year, but fees from 2009 would fund an estimated 4,451 observer days for the 2010 fishing year.
Note: Complete effort information for 2015 was not available at the time of this analysis (n/a), so the average days/trip reported for 2015 in this table reflects the total days fished 2009 through 2014 divided by the total trips 2009 through 2014.

The main highlights of the restructure action were improvements to the sampling methods and sampling frame that, taken together, have greatly improved the reliability of observer information compared to the previous program. The analysis in Chapter 3 also contained a range of potential estimation outcomes relative to the amount of observer information available. The amount of available information relates to policy choices made by the Council and NMFS in allocating observer coverage, and available revenue from which to purchase observer days.

With equal deployment between the large and small vessel strata, possible coverage rates for both strata ranged between 13.7% and 19.4% across the 2010 through 2014 time-period. The average observer coverage rate afforded from fees, if equal coverage rates exist for the two sampling strata, was 15.5% (Figure 31). However, looking at this range and average ignores the variation and the range of possible rates between years. There are a couple of methods to evaluate the range of deployment rates that could be realized from past fee revenue. One method is to compare the days afforded to the effort in 2014 so direct comparisons can be made directly to the simulations on the 2014 fishery effort. This comparison results in a range of estimated deployment rates between 12% and 19%. However, this latter comparison fails to evaluate extreme combinations of rates that could occur if there was a large increase in effort coupled with a low number of days afforded. Another method is to evaluate extreme situations by taking the lowest estimated number of trips afforded (811 in 2015) and dividing it by the highest amount of effort (8,322 trips in 2012), and taking the highest estimated number of trips afforded (1,242 trips in 2012) and dividing it by the lowest effort (6,220 trips in 2013). This provides a range of rates that could be afforded from fees (not including NMFS contributions) across the entire sampling frame of 10% to 20%.

All of the previously mentioned rates assume even coverage rates between the two strata (small and large vessel). NMFS also has the ability to allocate deployment between sampling strata through the ADP process. These policy choices have influenced the allocation of observer coverage between the small vessel and large vessel strata. Forecasting future decisions by the Council is not possible; however, for informational purposes, the tradeoff of differing rates between the sampling strata can be evaluated along a continuum of choices. Figure 31 provides a range of outcomes that could have occurred between 2010 and 2014. The intercepts indicate the highest possible rate for a sampling stratum, while the slopes show the financial tradeoff in allocating coverage between the two strata: for example, a 1% increase in deployment rate for the large vessel stratum in 2010 resulted in a 1.72% decrease in the small vessel stratum deployment rate.

The amount of available information relates to policy choices made by the Council and NMFS in allocating observer coverage, and available revenue from which to purchase observer days. There are potential impacts on data quality as observer coverage rates decrease whether a reduction in deployment is due to a decline in the observer deployment rate or policy choices. The analysis in Chapter 3 contained a range of potential estimation outcomes relative to the amount of observer information available and analyzed rates beyond (higher and lower) the range of 10%-20%. However, as described in Chapter 3, these impacts are based on a continuum of risk associated with estimation gaps and choices about the definition of the sampling frame. For example, estimation gaps can be evaluated using different probabilities of risk thresholds, such as 50% or 100%. While the magnitude of the outcome changes based on the risk threshold, the general pattern of coverage gaps is consistent across risk levels, with differing impacts on the small vessel versus large vessel stratum, including those caused by the sample frame definition.

The important caveat with this analysis is that the restructuring action was specific to the collection of representative data and not biases or other estimation issues. However, there is obviously a connection between the amount of coverage and the impact on estimation *as currently configured in the CAS.* Although the specific impacts on estimation are different for the small vessel stratum and large vessel stratum, there were two broad trends associated with both strata: (1) as deployment rates increased, the probability of having FMP-level and reporting-area data on discarded catch in a fishery declined; and (2) even at observer deployment rates less than 15% there was generally sufficient observer coverage to provide estimates of discards at an FMP-level for vessels in both the small vessel and large vessel categories.

Chapter 3 demonstrates that there is not a specific level of observer coverage below which the data cease to be statistically reliable. In other words, there is no “hard-line” with reliable data on one side and unreliable data on the other side. Instead, there are a multitude of potential risks related to missing data along a continuum of coverage rates and fishing effort. For example, at a coverage rate of 10% (and a probability of missing data of 50%), potential estimation gaps (i.e., no estimates at the FMP-level) under the current CAS configuration are likely to develop for only 5% to 6% of all trips in the small vessel stratum. Many of these estimation gaps were related to vessels not being in the sample frame (i.e., there is no coverage for vessels under 40 ft LOA), resulting in gaps that persisted even at high coverage levels (i.e., 6% of the trips were estimated regardless of coverage level). The sampling frame issue is a problem that can only be addressed through improvements in deployment (i.e., change in the ADP to start data collection on vessels less than 40 ft LOA) and adjustments to CAS methods to insure estimation occurs.

As with the small vessel stratum, potential estimation gaps under the large vessel sampling stratum increased with decreasing deployment rates (Figure 18 and Figure 24). There were clearly some post-strata in the CAS that were small and defined by fisheries that only occurred in certain reporting areas during short periods of time. These gaps persisted from the reporting area level of estimation (Figure 21) to the FMP-level of estimation (Figure 27 and Figure 28). High coverage rates are required to cover these post-strata due to the low number of trips and relatively short time period for which the fishery is conducted. However, to try and fill these target-specific gaps through changes to the sampling stratum would not be effective since they are specific to a trip target, which is unknown prior to deployment. NMFS plans to evaluate these gaps through ongoing assessment of the design of post-strata and the statistical properties of the estimators used in the CAS. Changes can also be made using the ADP process to address some gaps caused due to low probabilities of coverage by creating new sampling strata (e.g., gear-specific). In this way, many of these coverage gaps can be addressed and situations where they cannot be addressed through changes to CAS methods can be exposed. In these situations, the ability to leverage the ADP process under the new program will be a powerful tool to improve data collections and hence also improve the quality of the estimates based on these data.

Observer deployment rates at about 25% greatly reduce estimation gaps in a fishery at the regulatory-area in both the large vessel and small vessel stratum. Section 3.4 notes that in order to have the very low risk of estimation gaps for nearly all gear and reporting area combinations it would likely require deployment rates of at least 20% in the large vessel stratum and even higher coverage rates (>30%) for the small vessel stratum (Figure B-2 in ADP 2014). However, not filling these gaps does not mean NMFS cannot estimate; estimates will be made by aggregating information across reporting areas. The consequence of aggregating information across reporting area is a potential loss of precision and an increased risk for bias in some situations. Based on past evaluations (e.g., Cahalan et al. 2015 and Cahalan et al. In Press), the impact on estimation from crossing reporting areas will vary for each species estimated (and hence across 100's of species) and hence will not be uniformly "bad" or "good."

Summary

Even at higher than anticipated costs, the improvements described in Chapter 3 have resulted in better information for the management and conservation of the North Pacific fisheries resources. There is not a specific amount of coverage at which NMFS is unable to manage the groundfish fisheries in the BSAI or GOA, rather there are levels of observer coverage at which NMFS may not have data in specific strata or fisheries. Section 3.4 notes that NMFS could potentially address some of these concerns by changing the methods for estimating discarded catch by modifying the level of data aggregation at which NMFS creates estimates (e.g., by combining several flatfish fisheries in the Central GOA into a single fishery category for purposes of applying discard estimates). Therefore, the response to the risk of not having observer data in a specific fishery to estimate discards at either the FMP-level or the reporting-area-level could be addressed by: (1) ensuring that observer coverage is maintained above a minimum level that corresponds to a risk or probability of no estimation at the FMP-level; (2) ensuring observer coverage is greater than some risk level for each sampling strata and at the reporting-area; and (3) by exploring methods to modify the CAS to improve catch estimates.

6 Probable Environmental Impacts

The analysis presented in the 2011 EA/RIR/IRFA used the best available information to analyze the potential environmental impacts of the restructured Observer Program and its alternatives (NPFMC and NOAA 2011). The 2011 EA/RIR/IRFA analyzed the effects of the proposed action and its alternatives on the biological, physical, and human environment in Section 4.3.

This chapter provides new analysis of the environmental impacts of the action (Alternative 3, the restructured Observer Program) using the new information and analysis from Chapters 3, 4, and 5 to build on the analysis of the environmental impacts completed in the 2011 EA/RIR/IRFA.

The Observer Program collects data necessary to support the management of the North Pacific fisheries. This includes monitoring harvest amounts relative to specified TACs and the collection of data that are incorporated into annual stock assessments. The Observer Program provides information to monitor the effectiveness of, and compliance with, fisheries management decisions made through the annual TAC-setting process.

Note that the annual TAC specifications and PSC limits that are implemented each year through proposed and final rulemaking are separate and distinct actions from the restructured Observer Program. Those actions are informed by an environmental impact statement (EIS) and supplemental reports prepared annually on the TAC specifications and PSC limits, as referenced above. Likewise, parameters under which the North Pacific groundfish and halibut fisheries operate (who, what, where, when), remain in effect. Therefore, the effects of this action, which determine some of the parameters under which those fisheries are monitored, are evaluated based on the assumption that the effects of the fisheries themselves on the marine resources have been evaluated in separate NEPA analyses. It is thus assumed that the action is implemented in conjunction with harvest limits set annually by the harvest specification process and according to current regulations governing fishing within the exclusive economic zone off Alaska (50 CFR 679).

6.1 Benefits from improved observer data

Improving data reliability was one of the primary drivers for restructuring the Observer Program. The restructuring of the Observer Program expands observer coverage to fill scientific data gaps, reduce bias in the data, and equitably distribute costs. The 2011 EA/RIR/IRFA identified that the previous program would not achieve some of the objectives outlined in the problem statement such as:

- a reduction in bias that jeopardizes the statistical reliability of catch and bycatch data for the currently observed sectors;
- inclusion of the less that 60 ft LOA groundfish sector and the commercial halibut sector in the Observer Program in order to collect observer data; and
- the reduction of disproportionate observer costs borne by many small vessel operators.

The previous program also would not have advanced the data quality objectives contained in the preferred alternative of the Programmatic Supplemental Environmental Impact Statement (PSEIS, NMFS 2004b). The core structure of the previous observer requirements (0, 30, or 100% coverage) were based on vessel length, and industry control of observer deployment in the sectors with 30% coverage requirements would remain in place. The 2011 EA/RIR/IRFA, in Section 3.2.6, provides detail on the need for unbiased data on catch and bycatch in the North Pacific fisheries, as well as the most common sources of bias that can be introduced into catch estimates under the previous system, specifically in the 30% sectors (fishing in non-representative areas and fishing at non-representative times).

The Council and NMFS expected additional benefits from improved observer data from the action, compared to the previous program. Under the action, the greatest increase in improvement in the collection of observer data was expected in the sectors that had either 30% observer coverage requirements or no observer coverage requirements under the previous program. The 2011 EA/RIR/IRFA identified three types of benefits from improved observer deployment methods under Alternative 3—

- Reducing sources of bias.
- Reducing data gaps: lack of data in 30% sectors and sectors without observer coverage requirements.
- Targeting observer coverage to address data needs.

The restructured Observer Program achieves these benefits predicted in the 2011 EA/RIR/IRFA at the realized coverage rates and with the deployment methods implemented in 2013, 2014, and 2015. Additionally, due to the implementation of a statistically reliable sampling design and estimation procedures in the CAS, NMFS expects to realize these benefits at a range of coverage levels resulting from variable fee revenues, effort levels, and costs.

6.1.1 Reducing sources of bias

Under the previous Observer Program, vessels that were required to carry observers for 30% of their fishing days chose when and where to carry observers provided that they met the minimum coverage requirement of 30% of fishing days per quarter and at least one observed fishing trip for each target fishery defined in regulations. Many vessel owners preferred to get their required coverage later rather than earlier during each quarter for several reasons. First, when vessels carry observers later in the quarter or fishing season they may have a better idea of how many coverage days will actually be needed to meet the regulatory requirement than vessels carrying observers during the start of a quarter or fishing season. Therefore, vessels carrying observers later in each quarter or season are better able to avoid exceeding their coverage requirement and paying for additional observer days that are not required. Second, some vessel owners may prefer to carry observers later in each quarter so that they can first earn revenues required to pay for observer coverage and other expenses. Third, some vessel operators chose when and where to take an observer based on their forecast of discard conditions (e.g., avoid areas with high bycatch) or data needs for fishery (e.g., voluntary increase observer coverage).

The preference for coverage later in the quarter was tempered to some extent by observer providers who have observers under contract and must keep their observers deployed in order to minimize unpaid downtime. Consequently, there was a constant give and take between observer providers and vessel owners in the existing 30% coverage fleet over when and where to carry observer coverage. However, these types of coverage decisions were generally driven by the observer provider's desire for efficiency and the vessel owner's desire for predictability, with little or no regard given to scientific or management objectives. This is because NMFS did not decide when and where observers are deployed in the 30% coverage fleet. Because catch and bycatch rates fluctuate by season and area, biased decisions about when and where to deploy observers in the 30% coverage fleet had the potential to greatly affect the quality and reliability of observer data. Refer to the 2011 EA/RIR/IRFA Sections 3.2.2 and 3.2.6 for the sample design, and 2011 EA/RIR/IRFA Appendix 8 for a more detailed treatment of this issue.

For Alternative 3, the 2011 EA/RIR/IRFA explained that the 30% coverage requirements in regulation would be eliminated, and NMFS would determine when and where to deploy observers and how much coverage would be necessary for each fishery in those sectors required to have less than 100% coverage. Fishery managers would be able to address these and other known sources of bias, to the benefit of the resulting data. In Section 3.3.1, the SEA investigates the temporal patterns in observer coverage before and after implementing the restructured Observer Program.

The 2011 EA/RIR/IRFA explained that examinations of the prior Observer Program had focused on operational aspects of the program and had dealt with such issues as sampling protocols, reducing bias, estimate expansion, and the statistical properties of estimates (e.g. Jensen et al. 2000, Dorn et al. 1997a, Dorn et al. 1997b, Volstad et al. 1997, Pennington 1996, and Pennington and Volstad 1994). Results from these and other studies suggest that sources of bias can be reduced and the statistical reliability of observer data improved through improvements in the manner in which observers are deployed. In particular, bias can be reduced by changing the previous system, in which 30 percent coverage vessels can chose when and where to take observers, to a new system in which NMFS is responsible for the sample design that governs the deployment of observers among vessels in a more statistically sound manner.

In a March 2004 report, the U.S. Department of Commerce, Office of Inspector General (OIG) recommended that NMFS work with the Council to establish requirements for an Observer Program that includes a vessel selection process that is scientifically valid and unbiased. NOAA concurred that improved vessel selection procedures are needed for scientific data collection, and indicated that it was working with the Council to address these biases. A follow-up memorandum from the OIG to NMFS's Assistant Administrator in September 2008, documented that the OIG recommendation for this issue remains open, as fishery managers still cannot control when and where observers are placed in the North Pacific groundfish fisheries. All other recommendations in the 2004 OIG report for improving data quality, performance monitoring, and outreach efforts in NMFS Observer Programs have been addressed.

The Council's SSC supported conclusions presented in the 2011 EA/RIR/IRFA which stated that the proposed observer deployment design will facilitate production of statistically creditable estimates of catch and bycatch. Further, the ADP process will enable NMFS to develop alternative sampling designs (including sample size analyses and optimization) as scientific information is gathered and becomes available.

Expanding the Observer Program and implementing a statistical method for deploying vessels increases NMFS's ability to reliably estimate catch and bycatch in all Federal managed fisheries. Better coverage under the restructured Observer Program has several important elements to consider:

- Decreased potential for bias – vessels are not self-selecting which trips are observed and thereby having an opportunity to fish in a non-representative manner;
- Improved temporal and special coverage throughout the fleets; and
- Improved coverage across vessels.

At its most basic level, in estimating catch, sample information must be extrapolated to a population of interest. Bias is introduced when the sample (i.e., observed trip) does not represent the target population to which it is expanded (i.e., population of all fishing trips). There were several issues associated with bias in the design of the Observer Program prior to restructuring:

- <u>Non-representative samples</u>: Prior to restructuring the Observer Program, vessel operators chose when to take observers to fulfill their observer coverage requirement. The ability for vessels to choose when data were collected was a fundamental flaw with the previous observer deployment and violated the assumption of representative sampling.
- <u>Spatial and temporal bias</u>: Since vessel operators were allowed choice in when they took an observer within the requirements of the "30%" observer coverage category, some vessel operators waited to deploy observers until the end of the quarter or when observers were available. This

created patchy observer coverage that was not representative of fishing effort throughout the entire quarter or across all fisheries.

- Population not represented in sample: Vessels fishing for halibut and those less than 60 ft length overall were not required to carry observers so they were not included in the sampled population. These vessels comprise an important portion of the fishing fleet. Like all fishermen off Alaska, they fish in ecologically sensitive areas and harvest longlived and vulnerable species that require accurate accounting to ensure long-term sustainability. In addition, these previously unobserved vessels harvest species that NMFS is responsible to assess and protect under annual catch limits and accountability measures required by the Magnuson-Stevens Act. It is important for NMFS to obtain some independent information about catch and bycatch by these vessels to ensure that data used to estimate total catch is representative of the fishing activity by these vessels.
- Incentives to bias data ("observer effect"): Alaska groundfish fisheries have limits on the amount of bycatch that is allowed to be caught, particularly for halibut, salmon, and crab. Since bycatch accounting relies on at-sea data collection from observers, incentives exist to fish differently when an observer is on board a vessel than when a vessel is unobserved (i.e., to fish in areas where bycatch is expected to be lower).

The restructured Observer Program uses scientific methods to deploy observers, as explained in Chapter 3. The random sampling established under the restructured Observer Program eliminates bias that federal regulations built into the previous program. The goal of sampling under the restructured program is to randomize the deployment of observers into fisheries to collect representative data used to estimate catch and bycatch, assess stock status, and determine biological parameters used in ecosystem modeling efforts and salmon stock-of-origin analyses (NMFS 2013a). Random sampling results in better spatial and temporal distribution of observer coverage across all fisheries. This generates data that is representative of fishing and greatly improves our confidence in catch and bycatch estimation and the quality of data collected in all Federal fisheries.

NMFS Alaska Region requires representative sampling method (e.g., random) to provide the unbiased discard information used in CAS. Providing unbiased at-sea discard information is a critical function of the observer program. In addition, the random sampling methods currently used allow for a qualitative evaluation of how the distribution of observer data will change relative to the estimation procedures in the CAS. The random deployment methods described in the ADPs are evaluated using performance metrics described in the Annual Reports. These performance metrics rely on random sampling theory to evaluate whether unobserved events are similar (a basic premise for random sampling and assessment of deployment bias), and the degree to which sampling targets were achieved. The annual review and deployment process will result in continuous improvement in the representativeness of observer data through scientific evaluation of the sampling plan.

6.1.2 Reducing data gaps: lack of data in 30% sectors and sectors without observer coverage requirements

Under the previous Observer Program, groundfish vessels less than 60 ft LOA were not required to carry observers and vessels greater than or equal to 60 ft but less than 125 ft LOA were required to carry and pay for observers for 30% of their fishing days, by quarter and by target fishery, regardless of gear type or target fishery.[18] These two size categories made up the majority of vessels fishing in the GOA and out of ports other than Dutch Harbor and Akutan in the BSAI.

[18] Unless participating in a limited access quota program as described previously, which may require additional coverage.

The requirement to carry an observer on 30% of fishing days was a standard for each vessel, not for the fishery as a whole. Therefore, NMFS never had observer data from 30% of total fishing days under the previous program and the actual coverage was far lower than 30%. Additionally, because fishermen picked when to carry an observer, NMFS did not have observer data for vessels greater than or equal to 60 ft but less than 125 ft LOA throughout a fishing season or over the entire area of a fishery.

Observers deployed on vessels greater than 60 ft LOA recorded the total size of the haul or set (total unsorted catch or a proxy measure) for a randomly selected portion of the hauls or sets, and sampled these hauls or sets for species composition. NMFS extrapolated these data to make estimates of species-specific catch for the entire fishery, including unobserved vessels. Observer data from observed vessels were assumed to be representative of the fishing activity of all vessels, and were used to estimate total catch of prohibited species for the entire fishery.[19]

In addition to no observer coverage on vessels less than 60 ft LOA, there was no observer coverage in the halibut IFQ fishery. Halibut catch was only observed incidentally to other groundfish operations, specifically when a vessel is also retaining sablefish IFQ. In 2008, 3,141 permit holders fished halibut and sablefish IFQ using 1,157 vessels.[20] There are a number of bycatch issues pertaining to the halibut fleet, catch and discard of sublegal halibut and other groundfish species, such as rockfish, and interactions with seabirds.[21] On average, vessels less than 60 ft LOA harvested 27% of the total GOA groundfish catch from 2003 through 2007, and all of this catch was unobserved.

Prior to observer coverage in the vessels less than 60 ft LOA fleet, most of the information gathered for management of halibut vessels and vessels less than 60 ft LOA took place at shoreside processors, which may provide adequate catch accounting for retained target species and retained incidental catch species. However, discards were self-reported for all vessels in the less than 60 ft LOA fleet and in the halibut IFQ fishery. NMFS did not have a verifiable measure to account for these discards, nor did it have a method for assessing the accuracy of its management decisions. Additionally, the self-reporting requirements did not include information about vessel fishing behavior.

Under the restructured Observer Program, coverage was expanded to nearly all catcher/processor vessels, the halibut IFQ fishery, and vessels between 40 feet and 60 ft LOA. In summary, Chapter 3 shows that restructuring dramatically reduced the proportion of trips that do not have any coverage (i.e., no data) and, compared with the previous program, discard estimates were made using observer information that better represents the fishing activities across the entire federal fishing fleet. The restructured Observer Program results in better spatial and temporal distribution of observer coverage across all fisheries. Taken together, the improvement in data quality greatly improves our confidence in catch and bycatch estimation and greatly improves the quality of data collected in all Federal fisheries.

Prior to 2013, vessels less than 60 ft LOA and halibut vessels were unobserved, and the new data from these vessels is providing important information on discards, as explained in Section 3.2. Species that currently present catch accounting and management challenges in GOA fixed-gear (hook-and-line and pot) fisheries include: most rockfish species, sharks, skates, Pacific cod, Pacific halibut, and sablefish. Current TACs of some species, including sablefish, in the GOA groundfish fishery are already close to their ABC amounts. In particular, many rockfish and skate species are of management concern because

[19] This has resulted in additional data problems owing to fishing behavior by some boat operators, when an observer is aboard, that is clearly not representative of fishing practices when unobserved. Referred to as "fishing for observer coverage", these resulting data, when extrapolated to other vessels that are unobserved, compound the potential catch and bycatch estimation errors, but to an unknown degree.

[20] Includes CDQ halibut fisheries.

[21] Note that NMFS and the International Pacific Halibut Commission are evaluating the potential for electronic monitoring systems on these vessels.

the fixed-gear fisheries catch most of the TAC of these species and the TAC is set equal to ABC. Sculpins and sharks present a management challenge because of the high discards of these species by the hook-and-line fisheries. In addition, the key element for seabird issues that came along with the restructured Observer Program is that for the first time we have fishery observers on board halibut vessels and can then monitor seabird interactions and calculate estimates of the seabird bycatch. This is of particular importance for short-tailed albatross (see Section 6.2.4).

6.1.3 Targeting observer coverage to address data needs

The 2011 EA/RIR/IRFA identified an additional benefit to a restructured program for fisheries with partial coverage, the ability for NMFS to adapt coverage to address specific data needs. Under Alternative 3, the 2011 EA/RIR/IRFA predicted that fishery managers would have the flexibility to adjust coverage as necessary to fill data gaps and address specific conservation or management issues for the fisheries included in the preferred alternative. For example, if questions arise about catch or bycatch by vessels using a particular gear or operating in a certain FMP area, NMFS would have the ability to develop the sampling design such that observers are deployed on vessels to address those questions. In addition, because NMFS would have greater control over the deployment of specific observers, observers could be directed and trained to engage in more specialized data collection or research than is possible today. These types of specialized projects could include more intensive data collection on specific species or species groups, data collection on gear performance and gear interactions, and more intensive data collection on interactions with marine mammals and other protected species.

In the first year of the ADP process, NMFS considered prioritization input from the Council and the public as well as scientific recommendations to increase observer coverage rates in the trip selection pool (mainly trawl vessels) relative to the vessel selection pool (mainly hook-and-line vessels) to reflect the Council's recommendation to prioritize PSC estimation. NMFS made this adjustment to the 2013 ADP to balance the data collection needs specific for PSC estimation on larger vessels with the need for estimating total catch of all species from all vessels. NMFS maintained this prioritization in the 2014 and 2015 ADPs.

The Council also identified the collection of salmon genetic and bycatch information as a priority for the deployment of observers to shoreside and floating processors in the GOA. This information is used to identify the origin of Chinook salmon caught as bycatch in groundfish fisheries and is important for the management of Chinook salmon PSC. This priority followed promulgation of Amendment 93 to the GOA FMP, which requires the retention of salmon at-sea and retention of salmon until an observer has been provided the opportunity to collect samples. Given the multiple priorities of observers, the collection of genetic tissues must be conducted efficiently and effectively.

Under the 2013 ADP, NMFS deployed observers to shoreside and floating processors to complete salmon sampling during all pollock offloads in the GOA in 2013. However, as pointed out in Faunce 2015, the progressive increase in sampling effort and priority given to obtaining genetic tissues from salmon bycatch from the pollock trawl fishery was not offset by a decrease in competing priorities for observers and the Observer Program.

To obtain the best information and make efficient use of funds in 2014, NMFS investigated alternative sampling methods for Chinook salmon bycatch on observed GOA pollock trawl trips. The analysis showed that the number of genetic samples is anticipated to increase under the new method compared with the sampling methods used in 2013 (NMFS 2013b in Appendix B, Faunce 2015). The results of this study demonstrate that the alternative sampling method represents a much more efficient approach to obtaining Chinook salmon bycatch genetic tissues from observers in the GOA trawl pollock fishery given the limits to obtaining an observer census of deliveries in this region. Most importantly, the sampling method utilizes the randomization of trips afforded to the Observer Program since 2013 to obtain an unbiased sample of trips from the fishery and does not require that a census of bycatch salmon be obtained. Prior to the restructuring of the Observer Program, this sampling protocol was not possible (Faunce 2015).

Therefore, in the 2014 ADP, NMFS revised the 2013 methods for collecting Chinook salmon in the GOA to improve the representativeness of samples. NMFS is using the same sampling protocol in 2015. The flexibility afforded to NMFS to deploy observers through restructuring has enabled NMFS to explore alternative designs for genetic Chinook salmon bycatch sampling in the GOA pollock fishery that should result in representative data being collected cost-effectively. Through the annual process, the restructured Observer Program allows for iterative adaptation so as to make continuous improvements, rather than rely on fixed regulation for change (Faunce 2015).

6.2 Physical and biological impacts

The 2011 EA/RIR/IRFA identified potential physical and biological impacts of the alternatives. This section compares the conclusions of the 2011 EA/RIR/IRFA with NMFS's analysis of the implemented restructured Observer Program in Chapters 3, 4, and 5.

Restructuring observer deployment methods allowed NMFS to redesign observer coverage requirements to reduce bias and improve data quality. Improved observer data and monitoring is anticipated to generate better information to make in-season management and policy decisions, facilitating the attainment of optimum yield, and enhancing the sustained health of the resource, fishing sectors, and dependent communities. The restructured Observer Program achieves these benefits predicted in the 2011 EA/RIR/IRFA at the realized coverage rates and with the deployment methods implemented in 2013, 2014, and 2015. Additionally, due to the implementation of a statistically reliable sampling design and estimation procedures in the CAS, NMFS expects to realize these benefits at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

According to the 2011 EA/RIR/IRFA, given that an overall increase in fishing activity was not expected under Alternative 3, and there are measures currently in place to protect the physical and biological environment, no significant adverse impacts to target species, other species, prohibited species, marine mammals, seabirds, habitat, or ecosystem relations are anticipated.

6.2.1 Target and incidental catch

The 2011 EA/RIR/IRFA explained that the effects on target species should not be significant under Alternative 3. The TACs are determined annually based on the biomass of the fish species, and effective monitoring and enforcement would continue to ensure that the overall TACs are not exceeded. Therefore, regardless of the observer deployment and fee system in place, target species TACs would not increase under the action.

The 2011 EA/RIR/IRFA explained that Alternative 3 proposed restructuring the program to include various fleets that did not have observer coverage requirements. These include groundfish vessels less than 60 ft LOA and commercial halibut vessels. The 2011 EA/RIR/IRFA concluded that, to the extent that the proposed changes to the Observer Program would provide managers with better estimates of target and incidental harvest and bycatch, increase flexibility in deploying observers, and ensure harvest remain within TAC levels, impacts to the target species or species groups are predicted not to be significant for target fish stocks. Also, to the extent observer data are improved under the action alternatives and increasingly reflect the temporal and spatial distribution of fishing effort, the more closely fishery managers would be able to open and close fisheries to meet, but not exceed, TAC levels.

The 2011 EA/RIR/IRFA concluded that the restructured Observer Program may improve the reliability of the information used to manage the fisheries and set harvest levels. However, the 2011 EA/RIR/IRFA anticipated no significant adverse or beneficial impacts to target or incidental catch species from Alternative 3, compared to the status quo.

NMFS manages for total catch accounting. Total catch includes retained catch and discarded catch (also called bycatch). For example, NMFS collects data on rockfish catch and bycatch in the rockfish fishery and rockfish bycatch in the Pacific cod fisheries. NMFS uses all of this information to estimate total rockfish catch by all fisheries. The restructured Observer Program focuses on achieving representative samples of catch in the partial coverage category. Observer data is then used by the CAS to estimate catch and bycatch. The estimation routines used by the CAS rely on the expansion of available observer data and on catch reports provided by industry. These are combined to obtain estimates of retained catch, at-sea discards of groundfish species, and at-sea discards of nontarget and prohibited species. Additional details are provided in Chapter 3 and Cahalan et al. (2014).

Prior to 2013, the vessels less than 60 ft LOA and halibut vessels were unobserved, and the new data from these vessels is providing important information on discarded catch.

Despite the per-day costs being higher than anticipated in the 2011 EA/RIR/IRFA, inclusion of small vessels and halibut IFQ vessels under the restructure Observer Program improved the representativeness of data compared to the previous program (see Section 3.1); improvement occurred even at very low deployment rates in the small vessel frame (given the rate prior to restructuring was 0%). These improvements also resulted in more nearshore data and better representation of the small vessels and halibut fisheries in 2013 and 2014 (see Section 3.2.1).

One huge improvement under the new program is that for the first time, NMFS has observer data from which to estimate the bycatch of groundfish (e.g., skates, sharks, rockfish), invertebrates (e.g., crab and coral), and seabird and marine mammal interactions in the halibut fishery. This improves NMFS's ability to assess the status of each stock and estimate total catch in compliance with Magnuson-Stevens Act's requirement for annual catch limits (16 U.S.C. 1853(a)(15)). This improved data in turn allowed estimation to occur when it previously had not under the previous program. These new estimates provided important new information to stock assessment authors and inseason managers on sensitive species such as skates, sharks, and rockfish. This new information raised management concerns for rockfish in the BSAI and skates in the GOA due to catch exceeding ABC limits because inseason mangers did not previously have information from which to manage these species. As discussed in Sections 3.2.2 and 3.2.3, species that currently present catch accounting and management challenges in GOA fixed-gear fisheries include most rockfish species, sharks, skates, Pacific cod, Pacific halibut, and sablefish. Current TACs of some species, including sablefish, in the GOA groundfish fishery are already close to their ABC amounts. In particular, many rockfish and skate species are of management concern because the fixed-gear fisheries catch most of the TAC of these species and the TAC is set equal to ABC. Sculpins and sharks present a management challenge because of the high discards of these species by the hook-and-line fisheries.

Implementation of the random sampling methods for the large vessel stratum improved the representativeness of effort for vessels that had had observer coverage under the previous program. This was apparent by observer coverage better tracking actual fishing effort through the year rather than deviating from effort as fishery participants chose when to carry an observer. There were also spatial improvements in the trawl fishery as noted by coverage in the western GOA, which previously had limited coverage.

The data collected in 2013 and 2014 has improved NMFS's total catch accounting and ability to make effective conservation and management decisions. The restructured Observer Program provides data to managers from more vessels in more fisheries and in more areas, and more data enters the CAS more consistently throughout the season. These facts greatly improve managers' ability to manage catch limits and seasonal apportionments. Additionally, due to the implementation of a statistically reliable sampling design and estimation procedures in the CAS, NMFS expects to realize these benefits at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

6.2.2 Prohibited species catch

Prohibited species in the groundfish fisheries include Pacific salmon (Chinook, coho, sockeye, chum, and pink), steelhead trout, Pacific halibut, Pacific herring, king crab, and Tanner crab. The effects of the groundfish fisheries in the BSAI and GOA on prohibited species are primarily managed by conservation measures developed and recommended by the Council over the history of the FMPs for the BSAI and GOA and implemented by Federal regulation. These measures can be found at 50 CFR 679.21 and include PSC limits on a year-round and seasonal basis, year-round and seasonal area closures, gear restrictions, and an incentive plan to reduce the incidental catch of prohibited species by individual fishing vessels.

Changes in interactions with other fish species, including prohibited species, are tied to changes in target fishery effort. As described above, the 2011 EA/RIR/IRFA expected that overall fishing effort in the groundfish and halibut fisheries would not change due to the action; the issue is one of changing the way observers are deployed and the funding mechanism used. Limits regulate the catch of prohibited species in Federal waters, and these limits would not be affected by the restructured Observer Program.

In general, harvest information collected by observers, together with information from other sources, is used by NMFS's in-season managers to assess PSC. Where harvest information is not timely or accurate, NMFS may inadvertently close fisheries after PSC levels have been reached, resulting in overharvest of PSC species. Or, NMFS may inadvertently close fisheries early, resulting in an underharvest of the target species. The restructured Observer Program minimizes these two cases by providing observer data consistently during the fishery. While this does not necessarily represent a conservation concern for these species, the more observer information available to managers on a near real-time basis, the more closely the closures would approximate the intended PSC levels set by the Council.

The 2011 EA/RIR/IRFA explained that Alternative 3 proposed restructuring the observer deployment and funding mechanism of the previous Observer Program and extending the ability to deploy observers to various fleets that did not have coverage requirements (groundfish vessels less than 60 ft LOA and halibut vessels). To the extent that overall fishing effort in the groundfish and halibut fisheries is not expected to change, effects on mortality levels of each prohibited species group are not expected to be significant. The 2011 EA/RIR/IRFA concluded that changes to the deployment of observers would likely provide managers with better estimates of incidental and directed take of prohibited species, more flexibility in deploying observers, and harvest rates that would remain below PSC limits, ensuring that the groundfish fisheries would not reasonably be expected to cause a conservation concern for PSC species.

Many of the vessels that catch PSC are in the full coverage category (CPs and vessels that participate in a catch share program with PSC limit). This category was expanded with the restructure Observer Program so more vessels that catch prohibited species are in the full coverage category compared to the previous program, which improves the data collected on PSC.

NMFS relies on at-sea observer data to estimate PSC, including Pacific halibut and different salmon species, such as Chinook salmon. When a particular PSC limit is reached, NMFS closes those fisheries that would otherwise incur additional PSC to that limit. NMFS closes fisheries based on attainment of PSC limits per applicable regulatory requirements that detail the specific areas, fisheries, and sectors (i.e., gear type or management program) subject to such closures. Since 2011, NMFS has improved the use of PSC limits (see Section 6.2.2.1 and 6.2.2.2). Coverage in 2013 and 2014 also resulted in most PSC estimates being made specific to a target and reporting area, which is a result of deployment better representing fishing effort. This means that the PSC estimates are more representative of PSC in the fisheries.

The restructured Observer Program collects timely and accurate bycatch data for use in inseason management to prevent fisheries from reaching their PSC limit. One of the many improvements from using a scientific deployment method is that observers are deployed steadily throughout the season, as discussed in Section 3.3.1. This results in a steady input of bycatch data and decreases the variability of data during a season. This improves NMFS's ability to manage fisheries to prevent exceeding PSC limits. Additionally, due to the implementation of a statistically reliable sampling design and estimation procedures in the CAS, NMFS expects to realize these improvements in PSC estimation at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

6.2.2.1 Chinook salmon PSC

The restructured Observer Program made PSC limits possible for Chinook salmon in the GOA pollock trawl and non-trawl fisheries. Concerns with the amount of salmon bycatch, the uncertainty with bycatch estimates, and the need for genetic sampling were largely addressed with Amendment 93 to the GOA FMP. Amendment 93 was a comprehensive action to reduce and account for Chinook salmon caught in the GOA pollock fishery. Starting in 2013, Amendment 93 and its implementing regulations established a PSC limit of 25,000 Chinook salmon for the pollock trawl fisheries in the western and central GOA. NMFS will close the directed pollock fishery in the central or western GOA, if the applicable limit is reached (77 FR 42629, July 20, 2012).

The restructured program increased observer coverage to GOA pollock trawl vessels less than 60 ft LOA, a large part of the pollock fleet in the Central and Western GOA, improving our ability to estimate Chinook salmon bycatch and manage to the PSC limit. For the GOA, unlike the Bering Sea, approximately 40% of the pollock trawl catcher vessels that catch Chinook salmon as bycatch are less than 60 feet LOA and therefore had no observer coverage before 2013. Under the restructured Observer Program, NMFS expanded observer coverage to these pollock trawl fisheries in the GOA. Observers are now providing more data on Chinook salmon bycatch by the GOA pollock trawl catcher vessels than was previously available under the previous program. And, NMFS is receiving observer data throughout the fishing season, which allows NMFS to better manage the new PSC limits to prevent exceeding the limits. NMFS would not be able to accurately manage PSC limits under the previous Observer Program. This greatly improves NMFS's ability to estimate Chinook salmon PSC and manage to the new Chinook salmon PSC limits.

The regulations implementing Amendment 93 also require catcher vessels to retain all salmon caught in the pollock fishery. The operator of a vessel or the manager of a shoreside processor or stationary floating processor is prohibited from discarding any salmon taken incidental to a central or western GOA directed pollock fishery until an observer at the processing facility is provided the opportunity to estimate the number of salmon and to collect any scientific data or biological samples from the salmon. This requirement is necessary to ensure observers are provided the opportunity to count salmon and to take biological samples. Observers collect genetic samples of Chinook salmon following the protocol in the ADP.

The restructured Observer Program directly addressed concerns raised in the Supplemental Biological Opinion regarding the impacts on Endangered Species Act (ESA)-listed salmon from authorization of the GOA groundfish fisheries (NMFS 2012b). That document explained that the previous salmon bycatch estimates were problematic because of the substantial extrapolations of catch from observed pollock catcher vessels greater than or equal to 60 ft LOA to catcher vessels less than 60 ft LOA that did not require observer coverage. The number of catcher vessels less than 60 ft LOA had increased resulting in a lower proportion of the catch observed. Improving observer coverage by extending observer coverage to pollock trawl catcher vessels less than 60 ft LOA reduces the uncertainty in bycatch estimation identified for coded-wire tag expansions in order to improve bycatch estimation and reduce concerns that the PSC limits for the GOA pollock fishery might result in some unobserved catcher vessels discarding Chinook salmon bycatch. Under the restructured Observer Program, NMFS now deploys observers on pollock trawl catcher vessels less than 60 ft LOA.

In June 2013, the Council took final action to recommend Amendment 97 to the GOA FMP to limit Chinook salmon bycatch in the non-pollock trawl fisheries. In 2015, NMFS implemented Amendment 97 (79 FR 71350, December 2, 2014). Amendment 97 applies GOA Chinook salmon PSC limits to the non-pollock groundfish trawl fisheries in the central and western GOA. Amendment 97 apportions the PSC limits between Rockfish Program catcher vessels, non-Rockfish Program catcher vessel, and catcher/processor sectors, with closure of directed fishing for any non-pollock groundfish trawl fishery if the PSC limit for a sector is reached. The majority of the non-pollock trawl vessels in the GOA are in the full coverage category because they are catcher/processors or participate in the Rockfish Program, a catch share program.

6.2.2.2 Halibut PSC

Halibut are caught and discarded in the groundfish fisheries and the directed halibut fishery, however, discarded halibut are only managed as PSC in the groundfish fisheries.

The halibut fishery discards undersized halibut. This halibut wastage is estimated and accounted for by the IPHC. But, since 2013, NMFS and the IPHC have observer data from the directed halibut fishery on wastage from the IFQ halibut fishery (Williams 2015). However, as pointed out in the 2014 IPHC report, current observer coverage in the Alaskan directed halibut fishery is low, and therefore estimates of wastage are of unknown accuracy; however, improved monitoring via increased observer coverage and/or electronic monitoring offer potential for improvement in these estimates (Stewart et al. 2014).

Halibut bycatch in the GOA and BSAI groundfish fisheries is constrained by PSC limits that are apportioned by gear type and season. Halibut PSC limits for groundfish fisheries in the BSAI and GOA are set in regulation and do not vary in response to changes in halibut biomass. NMFS first established a 2,000 mt halibut PSC limit for the GOA trawl fisheries in 1989. In 2012, NMFS reduced the 2,000 mt halibut PSC limit by 27.4 mt with the implementation of the GOA Rockfish Program (77 FR 38013, June 26, 2012). The 300 mt halibut PSC limit for the groundfish hook-and-line fisheries has remained unchanged since 1995. Recent declines in halibut exploitable biomass, have exacerbated concerns about the amount of halibut PSC taken by the groundfish fisheries because of the potential effect it has on directed commercial, charter, unguided, and subsistence halibut fisheries.

In 2012, the Council recommended Amendment 95 to the GOA FMP to change the process for setting halibut PSC limits and reduce halibut PSC limits in the GOA trawl and hook-and-line groundfish fisheries. NMFS published a final rule for this action on February 20, 2014 (79 FR 9625). Amendment 95 sets the halibut PSC limits in Federal regulations and reduces the halibut PSC limit in the –

- groundfish trawl gear sector by 15% over 3 years: 1,848 mt in 2014, 1,759 mt in 2015, and 1,705 mt in 2016.
- groundfish catcher vessel hook-and-line gear sector by 15% over 3 years: 161 mt in 2014, 152 mt in 2015, and 147 mt in 2016.
- catcher/processor (CP) hook-and-line gear sector by 7% in 2014. The new CP hook-and-line halibut PSC limit may change annually, based on the GOA Pacific cod split formula. Using 2012 Pacific cod TACs in the Western and Central GOA as an example, the hook-and-line CP sector would fish under a 109 mt PSC limit.
- demersal shelf rockfish fishery from 10 mt to 9 mt in 2014.

In the BSAI, most halibut bycatch in the groundfish fishery is taken by vessels in the full coverage category. The IPHC recognizes that the most reliable information on incidental catch is from on-board observers. Observations on halibut bycatch in BSAI fisheries are among the more extensive for fisheries in Alaska (Stewart et al 2014).

Halibut bycatch mortality in BSAI groundfish fisheries is managed by establishing annual halibut prohibited species catch (PSC) limits, and apportioning those limits to fishery categories and seasons to accommodate halibut PSC needs in specific groundfish fisheries. The intended effect of the apportionment is to increase the opportunity to harvest groundfish TACs before established halibut PSC limits are reached. When a halibut PSC limit is reached in an area, further fishing with specific types of gear or modes of operation is prohibited by those who take their halibut PSC limit in that area. The total amount of halibut biomass available for harvest has declined since the mid-2000s, which has resulted in substantial declines in catch limits for the directed commercial halibut fishery in the BSAI. Halibut PSC in groundfish fisheries has also declined over this time period, but the rate of decline was not proportional to the decline in directed fishery catch limits.

The Council has considered the impacts of halibut bycatch on the directed halibut fisheries in the BSAI and determined that action is necessary to further reduce halibut PSC mortality and to provide additional harvest opportunities in the directed commercial fishery. In June 2014, the Council initiated an analysis of halibut PSC limit reductions for trawl and hook-and-line groundfish fisheries in the BSAI. The analysis considers PSC limit reductions from 10% to 50% for all trawl and hook-and-line vessels currently subject to halibut PSC limits in the BSAI. The Council is considering options to apply different PSC limit reductions to six sectors of the BSAI trawl and longline groundfish fleet. The different PSC limit options recognize differences in PSC use among sectors as well as differences in the operational and economic impacts of PSC limit reductions for each sector. The Council is scheduled to take final action to recommend BSAI halibut PSC limit reductions in June 2015.

6.2.3 Marine mammals

Changes in interactions with marine mammals are also tied to changes in target fishery effort. Under Alternative 3, the 2011 EA/RIR/IRFA predicted that managers of marine mammal resources would have better information on direct and indirect interactions with groundfish fisheries and increased flexibility to meet management objectives. The effects of these alternatives on marine mammals and their habitat are considered insignificant. Significant incentives for compliance with marine mammal protection management measures would remain in place. Spatial and temporal concentration effects by these fisheries, vessel traffic, gear moving through the water column, or underwater sound production which could affect marine mammal foraging behavior, would not be affected by the action.

The 2011 EA/RIR/IRFA explained that, under the action, vessels would still have to comply with existing Federal regulations protecting Steller sea lion rookeries and haulouts. As the western distinct population segment of the Steller sea lion is listed as endangered under the Endangered Species Act, current Steller sea lion protection measures close much of the Aleutian Islands region to trawling up to 10 or 20 nautical miles offshore from rookeries and haulouts, with less restrictive no-fishing zones for hook-and-line and pot gear.

In 2014, NMFS published a final EIS, biological opinion, and final rule to implement modified Steller sea lion protection measures (79 FR 70286, November 25, 2014). The 2014 biological opinion included the following Reasonable and Prudent Measure as necessary and appropriate to minimize the impact of incidental take of western distinct population segment of Steller sea lions (NMFS 2014c): NMFS will monitor the take of ESA-listed marine mammals in the BSAI groundfish fisheries. In order for any incidental takes to be exempt from the prohibitions of section 9 of the ESA, NMFS must comply with the associated terms and conditions below, which implement the Reasonable and Prudent Measure:

1. NMFS-trained observers will be deployed on vessels in these fisheries per the Observer Program's Annual Deployment Plan.
2. NMFS will use observer data to estimate the minimum mean annual mortality for each fishery.
3. NMFS will evaluate the observer coverage to determine if changes in coverage are warranted to better assess take of listed marine mammals.

Observers are important sources of data for the marine mammal stock assessment reports (Allen and Angliss 2013) and the List of Fisheries (79 FR 77919, December 29, 2014) for compliance with the Marine Mammal Protection Act. Under the restructured Observer Program, NMFS is monitoring the take of all marine mammals in the BSAI and GOA groundfish fisheries and deploys NMFS-trained observers on vessels per the ADP. NMFS is now placing observers on boats that operate closer to shore and in more areas that under the previous program. As explained in Section 3.2, the expanded sampling frame created by the restructured Observer Program resulted in a better special distribution of sampling relative to fishery footprint. Marine mammals occur nearshore and prior to restructuring no observer information was collected in the inside waters of southeast Alaska, and nearshore waters in southeast Alaska and the Kenai Peninsula had limited to no coverage (Figure 6). Now we have the ability to collect observer data of fishery interactions with marine mammals nearshore. These facts greatly improve managers' ability to manage catch limits and seasonal apportionments. Additionally, due to the implementation of a statistically reliable sampling design, NMFS expects to realize these improvements in data on fishery interactions with marine mammals at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

6.2.4 Seabirds

The 2011 EA/RIR/IRFA anticipated that Alternative 3 would result in better observer data related to direct and indirect interactions with groundfish fisheries and increased flexibility to meet management objectives. The effects of these alternatives on seabirds are considered insignificant. The changes to the Observer Program proposed under Alternative 3 were not expected to affect current rates of interaction. No changes in the indirect effects of fisheries on prey (forage fish) abundance and availability, benthic habitat as utilized by seabirds, and processing of waste and offal, all of which could affect seabirds, are expected under the alternatives.

However, the 2011 EA/RIR/IRFA explained that the action would further the requirements of a 1998 biological opinion that the U.S. Fish and Wildlife Service (USFWS) prepared on the commercial Pacific halibut hook-and-line fishery in the GOA and BSAI, and its effects on the short-tailed albatross (USFWS 1998). One of the conclusions of the USFWS is that NMFS needs to institute changes to the halibut fishery deemed appropriate based upon the evaluation of the seabird deterrent devices and methods. The biological opinion states that: "Changes may range from requiring minimal observation of the fishery due to the effectiveness of the deterrent devices to requiring extensive observer coverage and expanded or modified use of seabird deterrent devices and methods" (USFWS 1998). The 2011 EA/RIR/IRFA concluded that it is expected that the action would help NMFS assess the effectiveness of seabird deterrent devices and monitor interactions and take of seabirds on observed halibut vessels.

There had only been logbook and some survey data in the past to inform the level of seabird observations and bycatch on halibut vessels. As of 2013, the restructured Observer Program provides data, including seabird takes, on previously unobserved halibut vessels. This new data will help quantify and describe halibut fisheries interactions with seabirds, which will provide a better overall understanding of potential fisheries impacts on seabirds. This new observer data will be crucial in estimating total bycatch of seabirds, and particularly those birds of conservation concern at risk of interaction with hook-and-line gear including albatrosses. Also, new information has been obtained from tagging additional short-tailed albatrosses. Both of these new sources of information could lead to more effective seabird avoidance measures and fewer interactions in the future. New observer data recording techniques are likely to lead to better estimates of seabird trawl bycatch takes.

Estimation of seabirds is also a concern in the hook-and-line fisheries and observer coverage improves NMFS's ability to detect additional short-tailed albatross interactions. Last fall NMFS observers on a longline catcher/processor in the Bering Sea documented the take of two short-tailed albatross. The world population of the endangered short-tailed albatross is currently estimated at approximately 4,400 individuals. The short-tailed albatross is protected in Alaska waters by the ESA. The USFWS issued an incidental take statement of four short-tailed albatross takes during each two-year period for the BSAI and GOA hook-and-line groundfish fisheries. In instances where the amount or extent of incidental take is exceeded, reinitiation of formal ESA consultation is required. These takes occurred in the two-year period that began on September 16, 2013.

The addition of observers to many vessels in the GOA contributed important data for our understanding of seabird bycatch patterns and quantities. The key element for seabird issues that came along with the restructured Observer Program is that for the first time we have fishery observers on board halibut vessels and can then monitor seabird interactions and calculate estimates of the seabird bycatch.

The 2011 EA/RIR/IRFA concluded that it is expected that the action (Observer Program Restructuring) would help NMFS assess the effectiveness of seabird deterrent devices and monitor interactions and take of seabirds on observed halibut vessels. NMFS-certified observers have been deployed to about 6% of halibut trips in 2013 and 9% in 2014. These deployments have supported NMFS's ability to serve a broad suite of clients interested in seabird/fishery interactions and to further the goals of the 1998 Short-tailed albatross Biological Opinion for the Pacific Halibut Fisheries in Waters Off Alaska (USFWS 1998). Our partners and collaborators at the USFWS and various environmental non-governmental organizations have requested monitoring of the halibut fleet since 1993 when we expanded seabird duties for observers on the groundfish fisheries.

The restructured Observer Program, which includes deployments to the halibut fleet, has provided critically important information. Observers have submitted 28 affidavits to the NOAA Office of Law Enforcement in the first two years of monitoring which address failure to properly deploy required seabird mitigation measures. This provides for work with individual vessels to come into compliance with required regulations and also raises awareness throughout the fleet and in fisheries management offices. Data collected by observers are captured in long-standing routines and processes of the FMA and the CAS. These allow for annual estimates of seabird bycatch by species and species groups for the halibut fishery. Data supplied by observers allows managers to understand which vessels in which areas are responsible for the bycatch, it allows for industry groups to internally monitor their own bycatch and take actions to avoid seabird bycatch, and we can now compare seabird bycatch across fisheries and areas to determine where best to place continued efforts to mitigate seabird bycatch.

The restructured Observer Program has addressed a critically important and long-standing information gap. NMFS is now able to include seabird bycatch estimates for the halibut fishery in its annual reports of total estimated seabird bycatch for Alaskan fisheries. This information is provided to a broad suite of interested parties globally, and is especially important for highly migratory species such as the black-footed albatross and for ESA-listed species such as the short-tailed albatross. Observer Program restructuring has been very successful in allowing NMFS to assess the effectiveness of seabird deterrent measures, monitor interactions and takes of seabird on halibut vessels, and begin to take actions to reduce seabird bycatch within this fleet. Additionally, due to the implementation of a statistically reliable sampling design, NMFS expects to realize these improvements in data on fishery interactions with seabirds at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

6.2.5 Ecosystem and habitat considerations

Ecosystem characteristics of the BSAI and GOA have been described annually since 1995 in the "Ecosystem Considerations" section of the annual "Stock Assessment and Fishery Evaluation" (SAFE) reports. An overview of North Pacific ecosystem issues was provided in Section 3.10 of the PSEIS, and an evaluation of the impacts of the preferred FMP alternative bookends was provided in Section 4.9.10 of the PSEIS (NMFS 2004). Ecosystem indicators are separated into categories. The indicators provide information about three key ecosystem attributes: (1) predator/prey relationships, (2) energy flow and removal, and (3) species, functional, and genetic diversity. The impact on each attribute is evaluated with respect to two or more indicators.

The 2011 EA/RIR/IRFA explained that Alternative 3 was intended to improve the utility of observer data by improving the ability of NMFS to deploy observers when and where necessary to improve the quality of observer data and allow for the deployment of observers and the collection of data on vessels that are not covered under the status quo (less than 60 ft LOA groundfish vessels and halibut vessels). Overall fishing effort, including the spatial and temporal distribution of fishing effort, in the groundfish and halibut fisheries was not expected to change under the alternatives. Thus, the 2011 EA/RIR/IRFA concluded that Alternative 3 was not expected to have negative impacts on the ecosystem.

The marine waters and benthic substrates in the management areas comprise the habitat of all marine species. Additionally the adjacent marine waters outside the EEZ, adjacent State waters inside the EEZ, shoreline, freshwater inflows, and atmosphere above the waters, constitutes habitat for prey species, other life stages, and species that move in and out of, or interact with, the fisheries' target species, marine mammals, seabirds, and the ESA listed species. The 2011 EA concluded that the action was not anticipated to have additional impacts on essential fish habitat (EFH) beyond those identified in previous analyses discussed above, as none of the alternatives affect how, where, and when fishing is conducted.

The 2011 EA/RIR/IRFA also identified that the Council and NMFS have also recently closed areas in the Bering Sea to non-pelagic trawling, and much of the Aleutian Islands, to mitigate any potential adverse effects to essential fish habitat,[22] and vessels would continue to be subject to those closure areas. Given that Alternative 3 would not result in an increase in fishing activity, and there are measures currently in place to protect the physical and biological environment, the potential effect of the action on an ecosystem scale is very limited. As a result, no significant adverse impacts to habitat or ecosystem relations are anticipated.

[22]See http://www.alaskafisheries.noaa.gov/habitat/efh.htm for further details.

6.3 Cumulative effects

NEPA requires that EAs analyze the potential cumulative effects of a proposed action and its alternatives. An EA must consider cumulative effects when determining whether an action significantly affects environmental quality. Cumulative effects are those combined effects on the quality of the human environment that result from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable future actions. (40 CFR 1508.7, 1508.25(a), and 1508.25(c)) Cumulative impacts can result from individually minor, but collectively significant, action taking place over time. The concept behind cumulative effects analysis is to capture the total effects of many actions over time that would be missed by evaluating each action individually.

The 2011 EA/RIR/IRFA concluded that no cumulative significant impacts on these resources are anticipated with the action to restructure the funding and deployment system for fishery observer coverage, because no direct or indirect effects on BSAI or GOA resources have been identified. This SEA did not identify any additional direct or indirect effects on BSAI or GOA resources, beyond the improvements in the observer data collected. The reasonably foreseeable future actions that may change how the Observer Program functions are possible future changes to the program itself.

6.3.1 Possible Future Changes to the Observer Program

The Council is considering a number of amendments to the regulations governing the Observer Program that may be implemented in the next few years. Some of these amendments would make relatively minor changes in the circumstances under which vessels are placed in the partial versus full observer coverage categories. Other proposals would make more significant or large scale changes to the program. Several of the proposed regulatory amendments were suggested in comments on the proposed rule on Observer Amendments 86/76 (77 FR 23326; April 18, 2012) but were outside of the scope of changes NMFS could make in the final rule. Other proposals were brought to the Council after implementation of Observer Program Restructuring.

For purposes of this SEA, the most important aspects of these possible future regulatory actions are 1) the impacts on observer fee collections, 2) the total number of trips in the partial coverage category, 3) information relative to the cost or efficiency of deploying observers in the partial coverage category, and 4) impacts on data quality. The impact of an action on amount of the observer fee is important because it determines the amount of money available to deploy observers in the partial coverage category. The impact of an action on the total number of trips in the partial coverage category is important because it affects the sampling or deployment rate that can be achieved for a given amount of observer fees or budget. The cost of deploying observers in the partial coverage category is affected by a number of factors that are described in more detail in the 2014 Annual Report. Circumstances that affect travel costs or non-fishing days may affect the average cost of deploying observers in the partial coverage category in a particular year, or may effect bids in future contracts. Therefore, it is of note if a proposal would add or remove fishing trips that may be relatively more expensive to observe.

The proposed revisions to the Observer Program described in this section are:

1. Observer coverage requirements for small vessels in the Western Alaska Community Development Quota (CDQ) Program fisheries (“CDQ small HAL vessels”),
2. Observer coverage requirements for small catcher/processors (“small c/ps”),
3. Voluntary full coverage for trawl catcher vessels in the BSAI Pacific cod fishery (“BSAI Pacific cod”),
4. Observer coverage requirements for trawl catcher vessels harvesting groundfish from the GOA (“100% coverage GOA trawl catcher vessels”), and

5. Observer coverage requirements for vessels delivering to tenders (“vessels delivering to tenders”).

The Council has established the priority for analyses of these issues through both individual action to task its staff with preparation of a particular analysis (CDQ small hook-and-line vessels, vessels delivering to tenders, and 100% coverage GOA trawl catcher vessels) and through action in February 2014 on a discussion paper describing an additional five proposed regulatory amendments to the Observer Program (NMFS 2014d). The Council identified analysis of revisions to the allowance for small catcher/processors to be placed in the partial coverage category as its first priority and the allowance for trawl catcher vessels in the BSAI Pacific cod fishery to voluntary select to be in full coverage as its second priority. The other three issues described in the discussion paper were 1) develop alternatives to exempt from observer coverage vessels used to harvest small amounts of IFQ under several scenarios; 2) develop alternatives related to observer coverage or other options to monitor vessels used to fish for IFQ in multiple regulatory areas on the same trip, and 3) change the method of observer fee collection for the IFQ fleet to use standardized current year ex-vessel prices, rather than standard prices lagged one year. The Council did not specifically request staff to further analyze these three issues. More information on these issues is in the February 2014 discussion paper (NMFS 2014d). NMFS and Council staff record and report progress and assumed priority to the Council at each meeting.

The highest priority for the regulatory amendments generally has been given to revising regulations to address data quality concerns (vessels delivering to tenders) or to adjust coverage requirements to better balance data quality and cost considerations (CDQ small hook-and-line vessels, small catcher/processors, BSAI Pacific cod). For example, the Council’s highest priority for Observer Program related regulatory amendments was to allow small hook-and-line catcher vessels in the CDQ Pacific cod fisheries to be placed in the partial coverage category. The purpose of this action was to facilitate increased participation by small vessels in those fisheries and to provide opportunities for the fishermen in CDQ communities to diversify beyond the halibut fisheries. Another high priority is refining the allowance for small catcher/processors to be in partial coverage. Priorities for the additional projects have changed over time due to the interaction with other issues and availability of analysts.

Following is a short description of the proposed regulatory amendments under consideration by the Council and NMFS. Table 13 provides a very general overview of the possible magnitude and applicability of the proposed action on the key issues relevant to the SEA that were described at the beginning of this section.

Table 13 Summary of possible future Observer Program regulatory amendments with general information about potential impacts.

Possible future regulatory actions [1/]	Potential Impacts		
	Observer Fee Collection	# of Trips in Sampling Frame	Cost of Deploying Observers
CDQ small hook-and-line catcher vessels	minor increase	minor increase	minimal if any, trips starting in remote ports may add to the average cost of deploying observers
Small catcher/processors	increase of $23,000 (0.5% of total observer fee collection in 2013)	67 to 109 additional days subject to observer coverage, relatively sm. proportion of observed or fishing days in 2013	cost slightly more to observe than contribute to observer fee
BSAI Pacific cod trawl catcher vessels	reduction - up to 8% of annual fees	minor change because option has been in place since 2013	no change expected
100% GOA trawl catcher vessels	reduction – up to 25% of annual fees	reduction – about 22% of total days subject to observer coverage in 2014	unknown – will be analyzed
Vessels delivering to tenders	no change expected	increase in # of trips due to change in definition of the end of a trip	unknown – will be analyzed

[1/] These possible future regulatory actions and the associated short titles are described at the beginning of this section.

6.3.1.1 Observer coverage requirements for small vessels in the CDQ Program fisheries

This proposed action would implement a number of regulatory revisions that would apply to catcher vessels less than or equal to 46 ft LOA using hook-and-line gear in the CDQ fisheries (NPFMC 2015). One of those provisions is to move these small catcher vessels from full to partial coverage. These vessels currently are in the full coverage category because the groundfish CDQ fisheries include transferable PSC limits as part of a catch share program. Full coverage for fisheries with transferable PSC limits as part of a catch share program is one of the requirements implemented under Observer Program Restructuring. The Council took final action on this amendment in February 2015 and NMFS anticipates implementation in early 2016.

Although analysts were not able to specifically project the number of vessels that may participate in the CDQ small hook-and-line gear fisheries or the number of additional fishing trips that may be added to the partial coverage category, this additional fishing is expected to be small relative to the total number of participants and trips in the partial coverage category. Therefore, the projected increase in observer fees collected as a result of this action also is expected to be small. In addition, some of the vessels affected by this action are less than 40 ft LOA so will be placed in the no selection pool under the current and recent ADPs. If a small CDQ hook-and-line catcher vessel is selected for observer coverage, these vessels likely depart from more remote ports so they may represent some of the more expensive trips to observe based on travel costs and possibly wait time or non-fishing days. However, all of approximately 230 hook-and-line catcher vessels less than 46 ft LOA that participated in the halibut CDQ fisheries already are in the partial coverage category. Those over 40 ft LOA are in the trip selection pool, and any vessels selected for observer coverage likely already are being deployed from remote ports in Western Alaska.

6.3.1.2 Observer coverage requirements for small catcher/processors

This action would revise allowances for small catcher/processors to be placed in the partial coverage category. Under current regulations, all catcher/processors are assigned to the full coverage category unless the vessel meets a few limited allowances to be placed in the partial coverage category. These allowances were developed by the Council as part of its final action on Observer Program Restructuring. Three catcher/processors have qualified for partial coverage under these allowances. NMFS received comments on the proposed rule for Observer Program Restructuring requesting revisions and additions to these allowances but determined that such changes were outside of the scope of revisions that could be made to the proposed rule. Starting in early 2013, the Council received requests from industry to modify these allowances and identified this issue as one of its highest priorities for analysis. The objective of the proposed action is to maintain a limited exception to the general requirement for full coverage for catcher/processors, provide an appropriate balance between data quality and the cost of observer coverage, and not be unduly difficult to apply or enforce.

The Council reviewed an initial draft analysis at its April 2015 meeting (NMFS 2015b) and identified a preliminary preferred alternative that would establish a maximum production threshold that would be applied on an annual basis to identify those catcher/processors that would be eligible to request to be placed in partial coverage in the upcoming year. The preliminary preferred alternative would increase the number of catcher/processors eligible to be placed in the partial coverage category from three to between six and ten. Newly qualifying small catcher/processors may contribute about $23,000 to the observer fee collection (based on 2013 fishing activity and standard ex-vessel prices). This amount is about 0.5% of the 2013 observer fee collection of $4,251,452. The newly qualified vessels will add more additional days subject to observer coverage in the partial coverage category than they will fund through additional observer fee proceeds. However, this additional number of days (67–109) is small relative to the total number of observer days in partial coverage in 2014 (4,368) or the total number of days fished by vessels in the vessel or trip selection pools 2013 (27,437 total days [Table 11]). The newly qualifying catcher/processors generally have longer fishing trips than the catcher vessels in partial coverage and for those fishing in more remote areas, the trips have a greater proportion of non-fishing days. The Council is scheduled to take final action on this proposal at its June 2015 meeting.

6.3.1.3 Voluntary full coverage for trawl catcher vessels in the BSAI Pacific cod fishery

Catcher vessels participating in the BSAI Pacific cod fishery are in the partial coverage category under current Observer Program regulations. These vessels were placed in the partial coverage category based on NMFS's data needs for this fishery. The BSAI Pacific cod fishery is not managed under a catch share program managed with transferable PSC allocations. Therefore, NMFS recommended that full coverage was not needed for catcher vessels participating in this fishery. In public comment on the proposed rule, owners of some of these vessels requested to be allowed to voluntarily carry full coverage in their BSAI Pacific cod fisheries so that they could use observer data to manage internal allocations of halibut PSC among AFA cooperative members rather than use the halibut PSC rates that would have been generated from partial observer coverage. NMFS could not make this change in the final rule but has allowed participants in this fishery to voluntarily take full coverage under certain circumstances that they agree to in writing. Vessel owners are required to pay their share of the observer fee liability for landings subject to the observer fee, because the fee assessment is required under current regulations and cannot be suspended without a regulatory amendment. In addition, owners of vessels voluntarily taking full coverage also must pay the per day cost of the observer procured from an observer provider. Not all participants in the BSAI Pacific cod fishery are expected to voluntarily take full coverage. The Council is scheduled to review a draft problem statement and alternatives at its June 2015 meeting and direct staff about further analysis of this proposal.

In general, this action will reduce the observer fees available to deploy observers in the partial coverage category. The analysis of this proposed action will provide more detailed information about the projected reduction in fees that will be paid by vessels voluntarily choosing full coverage. Information in the Observer Program 2014 Annual Report provides some information about the maximum amount of the reduction in the observer fee that could result from this action (NMFS, 2015a). Table 2-4 in the 2014 Annual Report shows that BSAI trawl catcher vessels contributed $276,454 in observer fees for Pacific cod in 2014. This amount represented about 8% of the $3,458,716 collected overall in 2014. This represents a rough estimate of the maximum amount of reduction in observer fee proceeds because not all of the trawl catcher vessels in the BSAI Pacific cod fishery will choose to take full coverage. Thirty-one out of a total of 48 participants in the 2015 BSAI Pacific cod fishery opted for full coverage. This is a reduction from prior years (40 out of 53 in 2013 and 37 out of 48 in 2014). Although some vessels will move from partial to full coverage, this will not result in a significant reduction in the number of fishing trips subject to selection in the partial coverage category because many of these fishing trips have been out of the partial coverage sampling frame since 2013 under the policy of allowing vessels to voluntarily select full coverage.

6.3.1.4 Observer coverage requirements for trawl catcher vessels harvesting groundfish from the GOA

In October 2012, the Council initiated development of the “GOA trawl bycatch management” program, which was a proposed catch share program for trawl vessels that harvest groundfish in the GOA. The objective of the proposed action was to improve incentives for bycatch reduction and management in trawl fisheries, and to increase utilization of groundfish, provide additional flexibility to participants, and increase economic efficiency in the fisheries. Among many of the monitoring and management components of this proposed action was the requirement for 100% or full coverage for trawl catcher vessels harvesting groundfish from the GOA. The Council reviewed numerous discussion papers in 2013 and 2014 to further develop the elements and options for the proposed action. However, in December 2014, the Council suspended further analysis of this proposal and stated its intent to take up the issue no earlier than October 2015.

In February 2015, the Council tasked its staff to prepare a discussion paper that evaluates the effects of moving all GOA trawl vessels currently in the partial observer coverage category to the full (100%) observer coverage category. The Council requested that the paper address the effects on Observer Program fee revenues, industry costs, and the availability of observers in the full coverage category. This discussion paper currently is listed on the Council’s “3-meeting outlook” as a separate agenda item at the October 2015 meeting.

Movement of all trawl catcher vessels that fish in the GOA would create a significant modification to the Observer Program and would impact costs to industry, observer fee collections, and the number and type of fishing trips subject to observer coverage in the partial coverage category. Table 2-3 in the Observer Program 2014 Annual Report shows that GOA trawl catcher vessels contributed $874,919 of the total 2014 observer fee proceeds of $3,458,716, which was about 25% of the total. The total days fished by catcher vessels using trawl gear in the GOA in 2014 was about 5,300 days. These days represent about 22% of the total number of days fished by vessels in the trip and vessel selection pools in 2014 (5,300 days/24,575 days, see Table 11 and Figure 29).

One important question is whether the Council will move forward with this proposal independent of the GOA rationalization program. Current regulations are designed to place all catcher vessels in a catch share program with transferable PSC in full coverage. The Council's proposal for 100% coverage for GOA trawl catcher vessels as part of a rationalization program is consistent with this approach. However, if the Council moves forward with full coverage for GOA trawl catcher vessels independent of a rationalization program with transferable PSC, this would represent a change in one of the primary guidelines for placement of vessels in full versus partial coverage. Such an action likely would require examination of whether the rationale that applies to full coverage for GOA trawl catcher vessels should also be considered in analysis of the allowance for trawl catcher vessels in the BSAI Pacific cod fishery to voluntarily select full coverage.

6.3.1.5 Observer coverage requirements for vessels delivering to tenders

Tender vessels are vessels that receive catch from catcher vessels and deliver it to a processing plant. NMFS and the Council have identified two potential data quality issues with catcher vessels delivering to tenders: 1) a possible bias in the data, and 2) a decrease in stock-of-origin genetic data for salmon. The potential for data bias was noted by NMFS in June 2013, because it appeared that vessels selected for observer coverage were taking shorter trips than vessels not selected for observer coverage. This could introduce bias if the information collected from observed trips does not represent the fishing activities of all fishing trips. In June 2014, NMFS evaluated a full year of fishing under the restructured Observer Program and analysis of trip length for vessels in the trip selection pool delivering to tenders did not show a systematic difference in trip length between observed and unobserved vessels. However, the small number of observed trips in 2013 for vessels delivering to tenders may be insufficient to clearly capture any differences in trip length. Analysis of observer coverage on vessels delivering to tenders in 2014 will be included in the 2014 Annual Report presented to the Council at its June 2015 meeting.

The second issue of concern with tender deliveries is that observers on catcher vessels must follow different sampling protocols when vessels deliver to a tender, as opposed to when vessels deliver to a shoreplant. The Council has specifically placed a high priority on genetic sampling of salmon intercepted in pollock fisheries. When vessels targeting GOA pollock deliver to a tender, the observer does not have the opportunity to census the offload to account for all the salmon that might have been caught, and then take systematic genetic samples. As pollock deliveries to tenders represent a significant portion of pollock deliveries in some areas of the GOA, this may create a gap in the analysis of the genetic stock composition of GOA salmon bycatch.

Allowing the deployment of observers from or on tenders will add a significant new component to the Observer Program. It will bring tenders into the Observer Program for the first time. Deploying observers from tenders requires the transfer of observers at sea, which raises safety concerns. It will impose costs and restrictions on tenders. It may result in some vessels no longer being able to tender groundfish which could, in turn, affect shoreside processors. These and other logistical and administrative aspects of deployment of observers from or on tenders will need to be addressed in a thorough analysis.

The proposal to deploy observers from or on tenders should not have any effect on the amount of observer fees collected because it will not change which landings are subject to the observer fee. It likely will increase the total number of fishing trips in partial coverage if the definition of a fishing trip would be changed so that a trip ends when a vessel delivers to a tender rather than when it returns to a port. The impact on the cost of deploying observers in the partial coverage category will depend on whether deploying observers on or from tenders increases efficiencies thereby possibly reducing costs or adds new cost components to the program due to more complex deployment logistics. These impacts would need to be to be explored in more detail in the analysis.

The Council's continued interest in analyzing a proposal to require full coverage on trawl catcher vessels fishing in the GOA has important impacts on the scope and priority of analysis of allowing the deployment of observers to catcher vessels from tenders. Moving trawl catcher vessels from partial coverage to full coverage would remove the potential for data bias associated with observed trips not representing unobserved trips. Every trip, whether it was a delivery to a tender or a shoreside processing plant, would be observed. However, full coverage on catcher vessels would not address the difficulty of collecting tissue samples from salmon in each delivery before that fish is mixed together on the tender, if such samples need to be identified with specific vessels and trips.

6.3.1.6 Electronic Monitoring

In addition to these proposed amendments to Observer Program regulations, the development of electronic monitoring (EM) in lieu of observer coverage is an initiative that will have important impacts and interactions with the Observer Program in the future. In general, the development of regulated EM options will not necessarily change the amount of the observer fee collected, but it likely will change the way observers are deployed and the distribution of the observer fee between observer coverage and EM. These issues and others will be explored in the analysis prepared for specific future regulatory amendments to implement EM.

EM is a broad term for technologies – such as vessel monitoring systems or video cameras – that can be used to passively monitor fishing operations through video surveillance, tracking, and sensors. In Alaska, NMFS and the Council have been on a path of integrating EM into fisheries monitoring programs for many years: we have implemented a variety of monitoring tools like motion-compensated flow scales and Vessel Monitoring Systems; and have integrated video monitoring into several fisheries in a compliance monitoring capacity. The use of video technology has been proposed as a potential way to supplement existing observer coverage, enhance the value of the data NMFS receives, and/or fill data gaps that could be difficult to fill with human observers.

NMFS, working with the Council, has developed two guiding documents regarding Electronic Monitoring and Electronic Reporting (EM/ER): 1) the EM/ER Strategic plan (Loefflad et al. 2014) to guide development and implementation of electronic monitoring tools in the North Pacific, and 2) an EM/ER implementation plan (NMFS 2014b) that provides information about the specific EM/ER initiatives that are currently being undertaken in Alaska.

Both the strategic plan and the implementation plan highlight that the Council has established a high priority goal to integrate EM into the Observer Program for the fixed gear small-boat groundfish and halibut fisheries. The Council's intent is to develop EM to collect data to be used in catch estimation for this fleet. To meet this goal, the Council established a committee, the fixed gear EM workgroup, so that industry, agency, and EM service providers have a forum to cooperatively and collaboratively design, test, and develop EM approaches that are consistent with Council goals and objectives to integrate EM into the Observer Program.

The EM workgroup has developed a Cooperative Research Plan (CRP)[23] to determine whether EM technologies can be used to complement or improve existing data collection programs and whether this can be achieved in a cost-effective and sustainable manner. The CRP describes multiple research projects being conducted in 2015, which will collect information that will help inform pre-implementation decisions and future Council alternatives for integrating EM into the Observer Program. The CRP includes analytical and field work projects to address the following four elements:

- Deployment and operation testing of EM systems

[23] http://www.npfmc.org/wp-content/PDFdocuments/conservation_issues/Observer/EM/EMCRP1-21-15.pdf

- Research and development of EM technologies
- Infrastructure to support EM implementation
- Analyses to support EM implementation decision points

NMFS and the Council have asked vessels to volunteer to participate in the CRP and vessels that are participating in the EM CRP have been placed into the no selection pool while participating in the research (NMFS 2015c). As the next step in the CRP, the Council has also set an interim goal of pre-implementation in the small boat longline fleet in 2016, focusing on vessels that have trouble carrying an observer. It is not yet known how many vessels will be selected to participate in the EM CRP in 2016.

There are data quality tradeoffs associated placing vessels into the no selection pool while they are carrying EM. On one hand, placing vessels into the no selection pool is a way to encourage vessels to volunteer to carry EM equipment and participate in the ongoing research. The research is important since it will help assess the efficacy of EM (in combination with other tools) for catch accounting of retained and discarded catch, identify key decision points related to operationalizing and integrating EM systems, and develop performance standards and operational requirements in future regulations.

On the other hand, it is not yet possible to use the data being collected with EM in the catch accounting system. During CRP, NMFS is developing the infrastructure to incorporated EM data into NMFS databases and developing methods such as deriving weight estimates from EM to estimate catch. But in the meantime, putting vessels into the no selection pool, moves them out of the sampling frame and has the potential to decrease the quality of the observer information currently being used to manage the fisheries.

In 2015, 12 vessels have been selected by NMFS to participate in the EM CRP. These vessels are in the no selection pool while participating in the research. Removing 12 vessels from the small-vessel stratum is unlikely to impact NMFS's ability to estimate catch in the halibut hook-and-line fishery (Section 3.4). However, the potential for a data quality impact would increase if many more vessels were placed into no selection.

6.4 Context and intensity

The 2011 EA/RIR/IRFA considered both the context and the intensity of the action, as required by NEPA and 40 CFR 1508.27, to determine the significance of impacts of the actions analyzed. This section compares the conclusions of the 2011 EA/RIR/IRFA with NMFS's analysis of the implemented Observer Program.

Context: The 2011 EA/RIR/IRFA explained that the setting of the action is the groundfish and commercial halibut fisheries of the BSAI and GOA. Any effects of the action are limited to these areas. The effects on society within these areas are on individuals participating in the groundfish and halibut fisheries and on those who use the ocean resources. The purpose of the action is to restructure the Observer Program to improve data quality and utility, as well as mitigate disproportionate costs of observer services across various fleets. Inherent to the data quality objectives is the inclusion of specific sectors that were not required to carry observers; the less than 60 ft LOA groundfish sector and commercial halibut sector are included in the restructured Observer Program. As a result of collecting more statistically reliable observer data, management of the groundfish and halibut fisheries has improved. Additionally, NMFS expects to realize these improvements in data quality to occur at a realistic range of coverage levels resulting from variable fee revenues, effort levels, and costs.

Intensity: Listings of considerations to determine intensity of the impacts are in 40 CFR 1508.27(b) and in the NOAA Administrative Order 216-6, section 6. Each consideration is addressed below by number and in the order it appears in Federal regulations.

- The 2011 EA/RIR/IRFA anticipated that Alternative 3 would have no adverse impacts on marine resources, including sustainability of target and non-target species, damage to ocean or coastal habitat or essential fish habitat, effects on biodiversity and ecosystem function, and marine mammals. To the extent that more statistically reliable data is collected because NMFS is able to direct observer coverage based on science, management, and data needs, Alternative 3 could result in a beneficial impact on marine resources. Authorizing NMFS to deploy observers on sectors that do not currently have observer coverage requirements would also be expected to have a beneficial impact on the management of marine resources. Under Alternative 3, the Council included all of the sectors in both the GOA and BSAI that are determined to need 100% or more observer coverage, which focuses the action on those fisheries in which the coverage gaps, data quality, and disproportionate cost concerns are most acute. The fisheries not included in the restructured Observer Program will continue to be required to have 100% or 200% observer coverage at all times, under the current model in which vessels and processors contract directly with observer providers.
- No public health and safety impacts were identified for Alternative 3 because this action will not change the location or intensity of fishing activity and it is expected to have no impact on any unique area including essential fish habitat or ecologically critical areas.
- The 2011 EA/RIR/IRFA did not expect Alternative 3 to change the location or intensity of fishing activities. Thus, it concluded that the restructured Observer Program would not affect unique characteristics of the geographic area (the BSAI and GOA) such as historic or cultural resources, or ecologically critical areas.
- In the NEPA context, the human environment refers to the natural and physical environment and the relationship of people with that environment. Economic and social impacts are interrelated with the natural environmental effects. The restructured Observer Program was not expected to affect the natural or physical environment and as such was not controversial in terms of effects to the natural and physical environment. This restructured Observer Program may be socially and economically controversial to the current and future participants in the fishery in that differences of opinion exist between components of the fishing industry, observer providers, and observers, on issues of cost equity, perceived inequities of observer deployment, the level of potential bias in observer data under the status quo, funding, and the need for action.
- Replacing the pay-as-you-go funding mechanism with a system based on fees, in which NMFS controls observer deployment, did not entail possible effects on the human environment that are highly uncertain or involve unique or unknown risks. Alternative 3 was intended to improve the utility of observer data by improving the ability of NMFS to deploy observers when and where necessary to improve data quality and reduce bias introduced by industry control over observer coverage for fishing operations with 100% coverage requirements. Because the action addresses the Observer Program design and does not change the harvest quotas or fishing practices, the 2011 EA anticipated that there will be no risk to the human environment under Alternative 3.
- The 2011 EA/RIR/IRFA did not expect this action to establish a precedent for future actions with significant effects. This action may influence future adjustments to the ex-vessel value fee percentage for observer coverage in sectors included in the restructured program. However, these future actions would not likely produce effects beyond those considered in the EA since the EA analyzed the effects of collecting the maximum fee amount authorized by section 313 of the Magnuson-Stevens Act on all groundfish and halibut sectors.

- The 2011 EA/RIR/IRFA did not expect the action to have any significant individual or cumulative effect on the environment and this action is not related to other actions with cumulatively significant impacts.
- The 2011 EA/RIR/IRFA concluded that to the extent that Federal managers would receive better data under the restructured Observer Program by which to manage the groundfish and halibut fisheries and other marine resources, there may be indirect beneficial impacts to the marine environment under Alternative 3.
- There are no known effects on districts, sites, highways, structures, or objects listed or eligible for listing in the National Register of Historic Places, nor would the action cause loss or destruction of any significant scientific, cultural, or historical resources. This consideration is not applicable to this action.
- NEPA requires NMFS to determine the degree to which an action may affect threatened or endangered species under the ESA. There are no known interactions between implementation of the restructured Observer Program and any ESA-listed species in addition to those previously identified in other analyses. To the extent that the statistical reliability of data are improved because NMFS is able to direct observer coverage based on science, management and data needs, the 2011 EA/RIR/IRFA concluded that the restructured Observer Program could result in an insignificant beneficial impact on marine resources, including endangered or threatened species, marine mammals, and critical habitat of these species.
- This action poses no known violation of Federal, State, or local laws or requirements for the protection of the environment.
- No introduction or spread of non-indigenous species is expected as a result of this action. This consideration is not applicable to this action.

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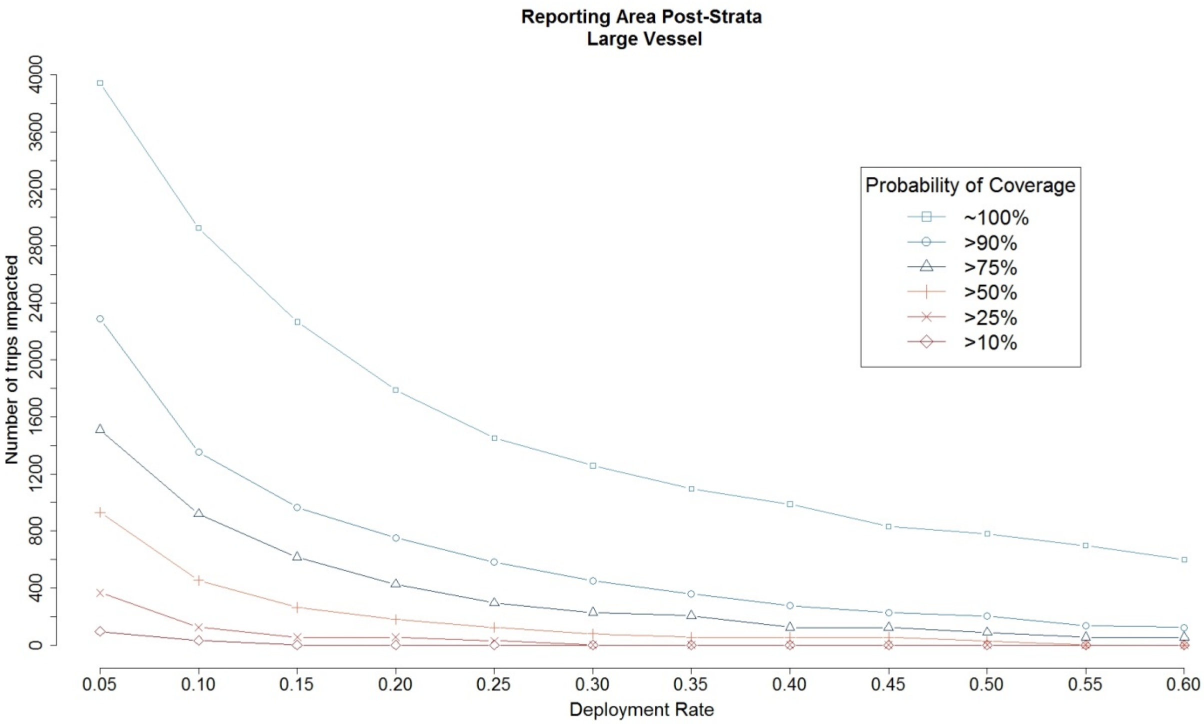
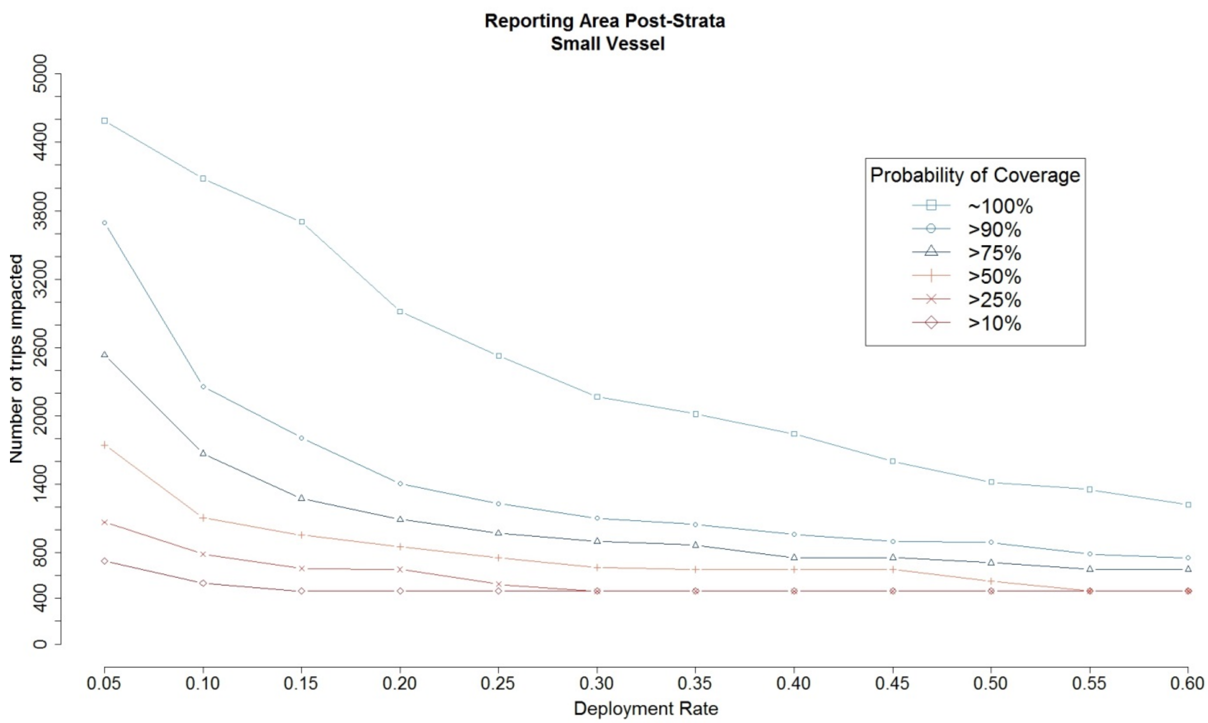
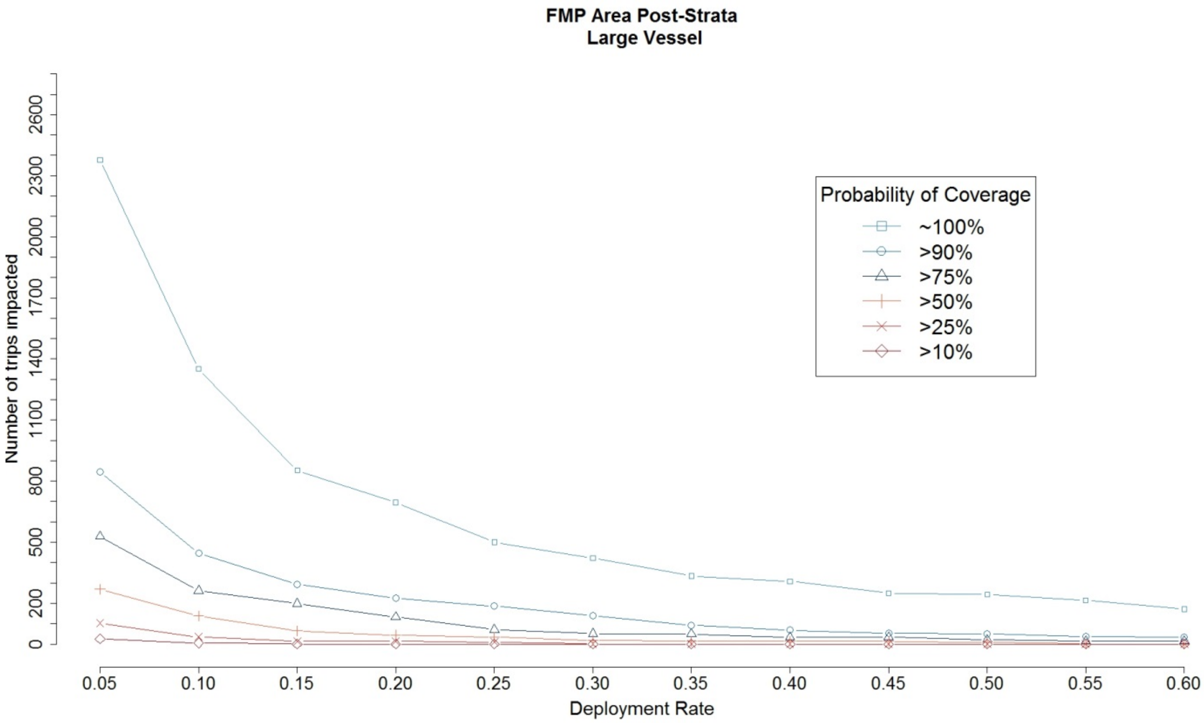
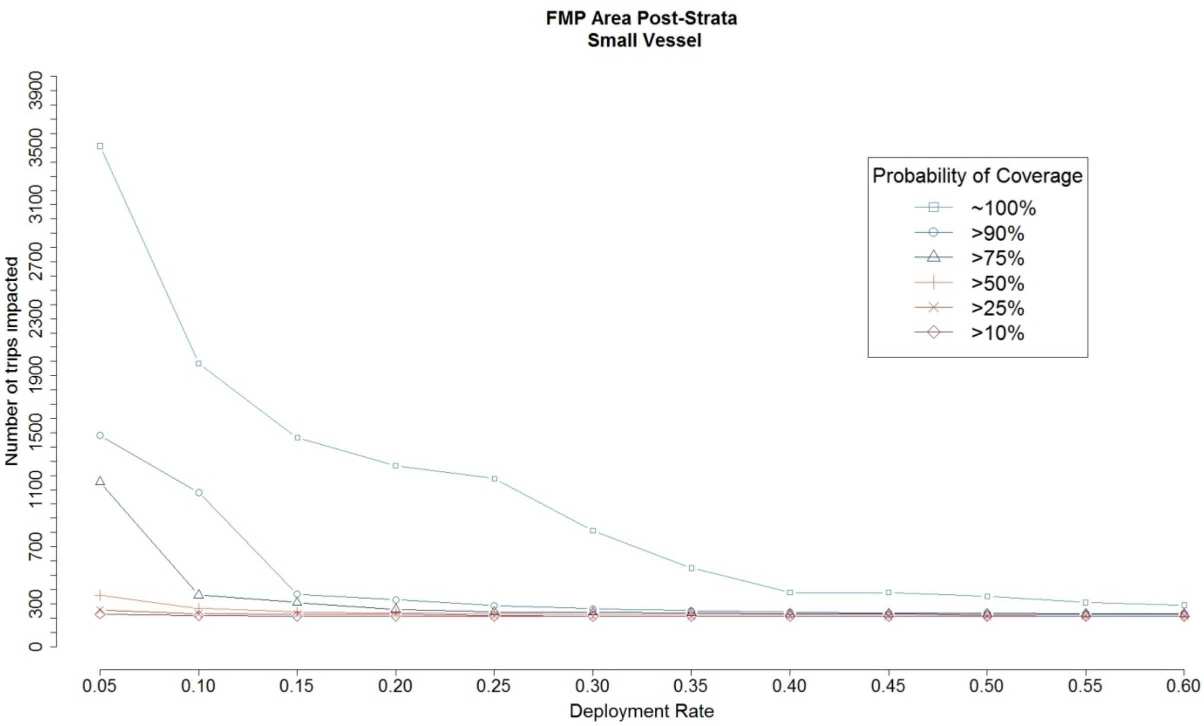
Appendix A

Graphs show potential impacts as they relate to the number of trips for which estimates were not made. The lines represent specific probability of a CAS post-strata having observer information across various deployment levels (“x” axis). The graphs are specific to large or small vessel post-strata, and priority 1 or priority 2 levels of estimation in the post-strata. In general, increasing the deployment rate results in a decrease in the number of trips belonging to post-strata where estimates could not be made. Note the small vessel post-strata does not asymptote at zero due to vessels being outside of the sample frame (e.g., jig vessels).




Reporting Area Post-Strata
Small Vessel
Number of trips impacted
0
400
800
1400
2000
2600
3200
3800
4400
5000
Probability of Coverage
~100%
>90%
>75%
>50%
>25%
>10%
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
Deployment Rate


FMP Area Post-Strata
Large Vessel
Number of trips impacted
0
200
500
800
1100
1400
1700
2000
2300
2600
Probability of Coverage
~100%
>90%
>75%
>50%
>25%
>10%
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
Deployment Rate


FMP Area Post-Strata
Small Vessel
Number of trips impacted
0
300
700
1100
1500
1900
2300
2700
3100
3500
3900
Probability of Coverage
~100%
>90%
>75%
>50%
>25%
>10%
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50
0.55
0.60
Deployment Rate