2013 Observer Program

NMFS Annual Deployment Plan

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1.0 Purpose

This work documents the plans of the National Marine Fisheries Service (NMFS) to assign observers to collect independent information from fishing operations conducted in the North Pacific under the authority of the Fishery Management Plans (FMPs) for the Bering Sea and Aleutian Islands (BSAI), and the Gulf of Alaska (GOA), during the calendar year of 2013. The timing and content of this Annual Deployment Plan (ADP) follow the specifications of the North Pacific Fishery Management Council (Council) in their October 2010 final action motion to "restructure" the North Pacific Groundfish Observer Program (NPGOP; see NPFMC 2010). This document is focused on reporting changes to the timing, location, and magnitude of observer-derived information that are anticipated to occur as a result of observers being deployed by NMFS into fishing operations conducted on vessels and plants within the "restructured" portion of the fleet in 2013 compared to the *status quo*.

Details on the legal authority and purpose of the ADP are found in the Proposed Rule (NOAA 2012a). As indicated in the proposed rule, the ADP follows Section 313 of the MSA (16 U.S.C1862), which authorized the Council to prepare a fisheries research plan that requires observers to be deployed in the North Pacific fisheries and establishes a system of fees. The intent of the ADP is not to adjust policy, but rather focus on science driven deployment to meet NMFS data needs. Some aspects of observer deployment can be adjusted through the ADP, including the assignment of vessels to the selection pools or the allocation strategy used to deploy observers in the partial coverage category. The Council may provide NMFS input on the priority of particular data collection goals and NMFS will consider adjustments to how observers are deployed in the partial coverage category to achieve those goals. However, such adjustments to future deployment plans would best be made after a scientific evaluation of data collected under the restructured observer program had been performed by an analytic group (such as that used to help create this document). The analysis would evaluate the impact of changes in observer deployment and identify areas where improvements are needed to collect the data necessary to conserve and manage the groundfish and halibut fisheries as required to maintain a scientifically rigorous data collection program.

2.0 The 2013 Annual Deployment Plan

2.1 The current NPGOP sampling design

Since 2008 the NPGOP has employed a hierarchical (nested) sampling design consisting of five levels (Cahalan et al. 2010). At the lowest and most granular level (level 5), specimens including ageing structures (e.g., otoliths, spines, and vertebrae), and reproductive tissues (e.g., to be used for assessing gonad maturation or sex identification) are obtained from a simple random sample of individual fish. These individual fish comprise the fourth level of the design, and are used for sex/length determination[1]. Such "sex/length fish" represent a random sample of individual fish contained within the third level of the design: the species composition sample. The species and sample size for sex/length fish are determined largely by request to FMA by the Status of Stocks and Marine Assessment group scientists of the Alaska Fishery Science Center (AFSC). Species composition data result from a systematic random sample of the second level of the design, i.e., the haul (total unsorted catch). If a systematic random sample of species composition data is not possible, observers are instructed to obtain a simple random sample or opportunistic sampling of the haul. These species composition data are used to determine the relative abundances of all species captured by fishing gear, not just those retained by the vessel or plant. Generally, all hauls on a trip are sampled, however in cases where the observer cannot sample every haul, hauls are randomly selected for sampling by observers. Hauls are a component of the first level of the sampling design, the trip.

[1] In addition, auxiliary tissues for genetics and stomachs are collected from salmon and selected groundfish respectively under certain circumstances.

Randomization is a component of the NPGOP sampling design at all levels with the exception of the first level. Although the current NPGOP sampling design has trip as the first level, the deployment of observers in some instances may be based on vessels. In such instances, the vessel would constitute a new level of the sampling design above trips (since trips are nested within vessels). Consequently, this ADP is only concerned with addressing proposed changes to the first level of the NPGOP sampling design and the anticipated outcomes of those changes. Sampling that incorporates randomization is desirable at all levels of the NPGOP design since (1) sampling theory dictates that randomization at all levels allows for unbiased estimation (2) sampling is generally preferential over a census because it is more cost efficient, is less prone to bias than an imperfectly implemented census (one subject to logistical constraints), and can result in greater data quality (Cochran 1977). Nevertheless, there are cases in Alaska where a census has been implemented. For example, in the case of salmon prohibited species management in the Bering Sea walleye pollock (*Theragra chalcogramma*) fishery, NMFS has chosen the a census approach and attempted to mitigate the risk of bias resulting from an imperfect census through use of video monitoring and enforcement efforts.

2.2 Goal for 2013

This document follows the proposed plan to deploy observers as presented to the Council at their April and October 2010 meetings. Having gained control over the deployment of observers as a result of Council action, the goal of this ADP is to address the data quality concern expressed within Council's 2010 problem statement; i.e., to achieve a representative sample of fishing events, and to do this without exceeding available funds. This will in a large part be accomplished by incorporating randomization into the first tier of the NPGOP sampling design.

2.3 Deployment strata for 2013

Since the trip or vessel constitutes the highest level of the NPGOP sampling design, it is important that either complete observation or a representative sample of trips or vessels is accomplished. Achieving a representative sample of the population of fishing trips or vessels through randomization aids stock assessment scientists as well as in-season managers of fishery quotas. These benefits in turn help sustain conservation goals and economic opportunities of fishers.

There are two classes of vessels on which fishing trips are observed: 1) catcher processors (CP) and motherships (M) that characteristically take longer trips further from shore and 2) catcher vessels which need to limit their trip duration due to concerns over product quality and hold space. Trips taken on CP and M vessels belong to a class of vessels requiring "full-coverage" (all fishing trips observed; Table 1) because they discard and process fish onboard. Since catcher vessels belonging to catch share programs with "prohibited species caps" (PSC) require greater in-season data specificity, those vessels fishing under the authority of the (1) American Fisheries Act (AFA) walleye pollock fishery in the Bering Sea, (2) Amendment 80 to the BSAI FMP, and (3) the central GOA Rockfish Program (RP) as well as processing facilities receiving AFA deliveries are also placed within this full-coverage category. These entities are not considered further in this document since they are to obtain their observers using *status quo* (pay-as-you-go) methods and do not fall under random deployment.

There are also vessels and plants that because of the size of their operations would be logistically challenging to place observers on board (vessels under 40 feet length overall), have small amounts of catch (catcher vessels fishing with jig gear), or fall outside of the jurisdiction of NMFS (vessels fishing for groundfish in state Guideline Harvest Level (GHL) fisheries). For 2013, these entities constitute the "zero-coverage" category and will have zero probability of their vessels/fishing events being observed.

Two exceptions to the above full and zero coverage categories were made by the Council and are included in Council's motion and the proposed rule (NOAA 2012a). First, CP vessels (those with a CP endorsement on their Federal Fisheries Permit (FFP)) with a history of maximum daily production of 1 metric ton as determined by the Alaska Regional Offices (AKRO) Catch Accounting System (CAS) will not be required to carry full observer coverage. Second, a vessel with a history of both CP and CV activity in a single calendar year, and owners of CPs with an average daily groundfish production of less than 5,000 lbs in the most recent full calendar year from January 2003 through January 2010, are given a one-time choice to be treated as a CP with full coverage requirements or as a CV under the trip selection pool.

It is important for NMFS to document assumptions regarding the catch of vessels exempted from observer coverage. The NMFS estimates catch through the CAS. The CAS uses two types of estimators of at-sea discards depending on the type of estimation: a deterministic imputation method for groundfish discard on observed trips; and a ratio estimation procedure for groundfish discard on unobserved trips and PSC estimation (Cahalan et al. 2010)[2]. The estimation techniques used in the CAS rely on the basic assumption that catch for observed events represents unobserved events and that the underlying data reasonably conform to statistical assumptions on which ratio estimators are based. When these assumptions are violated, bias and decreased efficiency may be introduced. Current CAS methods rely on the post-stratification of observer information to decrease potential biases and increase precision of the estimates. Evaluation of these assumptions is critical towards understanding and improving the estimation techniques currently used in CAS. Random deployment will greatly improve NMFS's ability to evaluate the statistical properties of estimators and improve catch estimation procedures. The necessary catch estimation assumptions described above are identical to those used in the current program - only which operations are exempted from observer coverage and which operations receive observer coverage differ between the current and restructured observer deployments.

The remainder of this document focuses on fishing operations that are in the “partial-coverage” category: (1) CVs designated on an Federal Fisheries Permit (FFP) when directed fishing for groundfish in federally managed or parallel fisheries (defined as fisheries concurrently open for both state and Federal waters where catch comes off the federal catch limit), that do not fall under the full coverage category, (2) CVs fishing for halibut or sablefish (*Anoplopoma fimbria*) individual fishing quota (IFQ) or community development quota (CDQ), (3) shoreside or stationary floating processors not in the full coverage category, and (4) CPs meeting the previously described full coverage exemption. Within the partial coverage category, there are two deployment strata defined- the (1) “trip-selection” stratum and the (2) “vessel-selection” stratum (Table 1).

<u>2.3.1. Trip-selection stratum</u>

Vessels fishing trawl gear, vessels fishing hook-and-line and pot gear that are also greater than 57.5 feet overall, and shoreside and floating processing facilities comprise the trip-selection stratum. Approximately 60 days prior to the start of the year, registered owners will receive a letter informing them that they are required to log all intended future trips for their vessel using a supplied username and password into a web-based system (that is also accessible by telephone). This system, termed the Observer Declare and Deploy System (ODDS), was developed by NMFS to facilitate the assignment of observers to future fishing events on a trip-by-trip basis. As described in the proposed rule, ODDS works by providing vessel operators (either owners or their designated captains) with an account through which they shall enter their anticipated fishing trips. More than one trip can be entered- three if the start time of the first trip and the end time of the last trip span more than 72 hours, six if not. Anticipated target fishery is not required- only the port of departure and landing with the anticipated start and end times of the trip. Each trip must be entered at least 72 hours before anticipated departure to allow the vessels’ observer provider time to deploy an observer. If the contractor provider cannot provide an observer to the vessel, the vessel may be granted a release from coverage by NMFS and go fishing. If the provider obtains an observer for the trip, the vessel may still opt to defer a trip for up to 48 hours from the anticipated departure to account for unanticipated events such as poor weather conditions. If, however, after this

[2] CV retained catch is taken from landings reports and is not considered in this discussion.

additional 48 hour period has passed and the vessel has still not departed, that trip is cancelled by the ODDS, the observer is released from the vessel to be deployed elsewhere, and the vessel's next logged trip will require observer coverage.

Trip-selection systems have been successfully instituted elsewhere in the nation such as in the system administrated by the Northeast Groundfish Observer Program. Trip-selection systems work by having participants (potentially all) in a stratum observed for a short duration at a time. Trip selection systems reduce the potential negative influence of vessel operators' decisions to artificially manipulate which fishing events are observed by postponing the outcome of the trip selection (i.e., to be observed or not to be observed) until after the final trip details have been entered. Furthermore, the ODDS is designed so that (1) if selected for coverage, a "to be observed" trip can only be cancelled by the observer provider responsible for obtaining an observer, and (2) if a vessel does cancel a "to be observed" trip, the vessel's next logged trip status will change to "to be observed".

2.3.2 Vessel-selection stratum

Vessels fishing hook-and-line and pot gear between 40 and 57.5 feet in length overall will constitute the "vessel-selection" stratum. Approximately 60 days prior to the start of the year, registered owners will receive a letter informing them that their vessel may be selected for observer coverage during any of the calendar quarters in the upcoming year. This letter will provide details for the owner to update their vessel's registration information as well as how to obtain the required USCG safety decal. Included with this letter will be a self addressed post card where owners can indicate to NMFS if they would be willing to participate in a voluntary Electronic Monitoring (EM) study described in section 3.0. Vessel operators who would like to volunteer for the EM project must return the post card by February 1st, 2013 or NMFS will assume that the vessel owner does not want to participate in the EM program.

Vessels in the vessel-selection stratum will be randomly selected for mandatory observer coverage approximately 30 days prior to the start of each calendar quarter. Owners of selected vessels will be notified through the U.S. postal service of their selection, given contact information for their observer provider, and given a username and password. This information can be used to access a vessel-selection survey that provides a way for owners of vessels that have been selected for observer coverage in the vessel-selection stratum to verify their contact and vessel information and provides a forum for communication with NMFS. The vessel-selection survey will be available online or by phone if the vessel owner chooses. Owners will be asked to provide their intent to fish in the upcoming quarter to improve the logistical efficiency of observer assignment and deployment in this stratum[3]. In addition, the survey will provide owners of vessels with a way to provide a rationale as to why their vessel may not be able to accommodate an observer. Answers to these two questions will be needed by NMFS a minimum of two weeks prior to the vessels' first fishing trip of the quarter of selection in order to provide time for scheduling and conducting an on-site evaluation by NMFS. NMFS will assume the vessel intends to fish and can accommodate an observer in cases where they have not received a response to the vessel-selection survey from a vessel operator.

Vessel selection systems similar to that proposed for the vessel selection stratum have been successfully implemented elsewhere in the nation such as in the Northwest Groundfish Observer Program. These systems work to reduce the logistical complexities associated with having large amounts of participants. However, because the number of vessels that can be observed is likely to be low relative to the total number of vessels in the sample population and to reduce the operator's ability to manipulate fishing events (for example by not fishing at all if selected) there is a need to increase the duration of observer coverage for selected vessels. This ADP adopts the duration of a calendar quarter for selected vessels in this stratum. Therefore, selected vessels in this stratum will be responsible for carrying an observer for all of its fishing during the quarter for which they have been selected by working directly with their observer

[3] NMFS plans to query database records to ensure against discrepancies if owners declare their intent is not to fish.

provider. In this ADP, if any portion of a trip falls within a calendar quarter for which the vessel was selected the entire trip will be subject to observer coverage. The duration of coverage in this ADP will help the observer program obtain data from as many of the target fisheries, locations, and times the vessel participates in, was proposed to the Council in documents between 2010 and present, and was first presented to the Council's Observer Advisory Committee in September of 2011.

The definitions for the vessel and trip stratum were determined through an analysis conducted on 2007 and 2008 landings data using recursive binary partitioning – a technique that repetitively splits groups of the variable in question (here landed weight) by variations in a suite of potential cofactors in order to maximize their differences (NPFMC and NOAA 2011). Thus the division of these strata based on a vessel size of 57.5 feet in length overall was due to the fact that there were many vessels of length 58 feet and many vessels of length 57 feet (thus the difference between them was determined to be 57.5). Since the dynamics of vessel size in the fleet is likely to change, and alternative ways to group fishing events also likely to change, the definitions for the trip and vessel strata used here are limited to the 2013 calendar year only.

2.4 How observer effort will be allocated among strata

<u>2.4.1 At-sea sampling</u>

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

It is nearly impossible to assign observers to a specific fishery since fisheries may be defined by some or all of a combination of area (determined at *the end* of a fishing trip), fishing cooperative, gear type, and trip target (also determined *after* the trip is completed). In addition, fishers do not always fish in the areas nor realize the catch they intended to before the fishing trip began. If observers were deployed randomly onto vessels or fishing trips through stratified random selection (sampling) where every sample unit (vessels or trips) had an equal chance of being selected, then (on average) the proportion of the fisheries (and areas) observed would be proportional to the fisheries (and areas) that fishers participated in.

An immediate benefit to assigning observers to trips with equal probability (within a stratum) is the ability to estimate the 'observer deployment' effect. Since observer coverage within a time/area/gear type/target designation should be proportional to the actual fishing patterns within the same 'fishery' deviations of coverage proportions from the expected values given fishing patterns will be due to errors in reporting of trips (in ODDS) or catch (on landing reports). Regardless of the cause, identifying the magnitude of this potential problem will guide efforts to increase the effectiveness of observer deployment and catch estimation processes.

It may seem intuitive to adjust the probability of observer coverage to reflect the relative size of the fleet, either in terms of effort (trip length, vessel size) or impact to the marine resource (magnitude of catch, or catch histories for example). However in studies that have compared catch estimates resulting from sampling with probabilities proportional to size (PPS) to those obtained through equal probability sampling (as proposed here), it has been found 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; Cotter et al. 2002).

Similarly, the preferential assignment of observers into fleet sectors that are perceived to have a greater potential to impact or encounter species whose populations are of special concern (generally due to a depressed state of the population) may not result in data and hence catch estimates of higher quality or that better meet management needs. For example, constituents differ on what those species of special concern are and the suite of species of interest may vary over time. Regardless, if the population of such a special species is large, and encounter rates by fishers is common, then the bycatch amounts obtained from observers deployed with equal probability sampling will be unbiased and sampling will be robust enough to capture such events without compromising the catch estimates of other, more abundant species. If however, the bycatch rates for a special species are low, and/or fishing encounters infrequent, then it is possible that a sample may not capture the rare event or if the event is captured, the variance in the resulting catch estimate may be high.

Since the CAS estimates groundfish and PSC catch within sampling strata (vessel or trip selection strata), a change in the sampling rate within a year constitutes the creation of new sampling strata (trips that are subject to the new rate) and therefore has ramifications on catch estimation and evaluation of current estimation procedures. For example, the change in sampling rate marks a point in time that would require creation of an additional stratification of observer information and consequent estimation within that new stratum, but the CAS relies on programming algorithms to provide in-season estimates of catch that may not recognize the new stratum. Changing the programming of the CAS cannot be done quickly enough to accommodate dynamic sampling rates or employ some other procedure (i.e., sample weighting) on an in-season basis.

For the previously described reasons, this ADP will allocate observer effort among trips in the trip selection stratum and among vessels in the vessel selection stratum so that these two strata are sampled at the same rate, and it is the intent of NMFS to keep this value constant throughout the year. For example, each vessel has an x % chance of carrying an observer for a quarter in the vessel-selection stratum while each declared trip in the trip selection stratum has the same x % chance of carrying an observer. This allocation scheme was proposed in documents presented to the Council during 2010 (NPFMC and NOAA 2011).

2.4.2 Dockside sampling

While stock-assessment scientists and in-season managers represent the primary clients of observer data, there are other reasons to deploy observers. Regulations specify full observer coverage for AFA pollock deliveries to monitor salmon bycatch in the Bering Sea. Salmon bycatch in the AFA pollock fishery is enumerated and systematically sampled for genetic tissues following a protocol developed by Pella and Geiger (2009), and there is similar interest in using observers to perform these same tasks in the GOA. While NMFS and industry have worked cooperatively since the start of 2012, new regulations that became effective late in 2012 now require industry to set aside salmon caught as bycatch within the GOA pollock fishery at processing facilities so that the salmon can be tallied and recorded by observers (NOAA 2012b). In order to provide complete monitoring of all pollock offloads, for 2013, observers will be deployed under this ADP to shoreside and floating processors to enumerate and genetically sample salmon bycatch in GOA pollock deliveries since funds to pay for observers are limited. The NMFS and their contracted observer provider will coordinate with the plants to realize this observer coverage. This dockside sampling approach continues to be dependent on the industry retaining salmon and making them available for observer sampling. The ability of NMFS collect an unbiased genetic sample of salmon is dependent on the assumption of full retention of salmon and this will be evaluated.

2.5. Evaluation of the program goal

The evaluation of the program goals will follow the protocols used for the preparation of stock assessments in Alaska. This process utilizes the most recent full year of data (2011) for comparisons between current state (2011 data collected by NPGOP) and a future state (2011 as restructured and sampled according to this ADP). Where appropriate, formulations have been provided using the abbreviations in Table 2 to clarify our methods. We chose the R environment (R Core Development Team, 2011) as the preferred platform on which to conduct data analyses.

Five “evaluation analysis” have been conducted:

1. Cost and fishing effort information were used to simulate total annual program costs under different sampling rate scenarios to determine a final deployment rate to be used in 2013.
2. Simulations were performed to calculate the difference in observer coverage that would have been expected in a prior year of fishing in the partial coverage CV fleet between the (a) actual NPGOP sampling effort and (b) the anticipated sampling effort if that same prior year had been sampled according to this ADP. Comparisons were made at a scale that serves in-season managers (the first main client of observer data).
3. Extrapolations were used to evaluate potential differences in the amount of tissues that had been collected by the NPGOP in 2011 and those that which would be expected to have been collected had the year been sampled according to this ADP. Comparative summaries were made by data type (length or tissues) for a species to serve stock assessment authors and ecosystem scientists (the second main client of observer data).
4. Estimates were made to evaluate the cost of dockside salmon sampling in pollock offloads and its potential impact in terms of at-sea coverage rates.
5. Comparisons in terms of the number of participants, trips, and catch observed by the NPGOP in a prior year and that same year as if sampled according to this ADP were made for the entire fleet.

2.5.1 Evaluation analysis 1: Determination of the deployment rate (*r*)

The deployment rate (*r*) of observers into the 2013 at-sea partial coverage category fleet was determined through simulation of 2011 landings information. The basic components of this analysis included the amount of fishing effort conducted by the fleet, and the cost per observer day. Details on how effort was generated can be found in the Appendix 2 and Figure A3-1. Cost estimates derive from confidential contract information negotiated between NOAA's acquisition and grants office and the selected observer provider. The simulated deployment rate was determined from an evaluation of estimated annual program costs assessed against the risk of exceeding the observer program’s available funds. One simulation consisted of a random draw of unique trips within the trip-selection stratum, and unique vessel-quarter combinations in the vessel-selection stratum, each with a probability of being observed equal to r.

Total program costs from a single simulation trial (C_S) were determined by summing the number of simulated trips that would have been sampled in the trip-selection stratum and adding these costs to that of observing all trips for selected vessels in each quarter (c_{QV}), or

$$C_S = \sum_{i=1}^{n} c_i + \sum_{Q=1}^{4}\sum_{v=1}^{V} c_{QV}$$

where *S* indexes the simulated draw of landings (equivalent of trips) made by CVs in 2011 that would belong to the trip-selection stratum and all trips of selected vessels in a quarter that made landings in 2011 that would belong to the vessel-selection stratum. Prior to the establishment of a final contract agreement between an observer provider and NMFS (observer contract), the cost (*c*) of a trip (*n*) was originally explored as a function of the base cost rate (*B*, \$ day^{-1}) estimated to occur from a contract between NMFS and an observer provider (observer contract) added to a random draw of incidental costs (I, \$ day^{-1}) for a trip that has been determined from past invoice data and multiplied for each day (*d*) so that

$$c_i = (B + I_i) \times d_i$$

and

$$c_{QV} = \sum_{i=1}^{N_{QV}} (B + I_i) \times d_i \ .$$

Upon achievement of the observer contract, these formulations were changed to use the actual contracted values for B, and incidental costs were not included. Instead, incidental costs in simulations were accounted for by reducing the total available funds for the deployment of observers for the upcoming year by the total "not-to-exceed" incidental travel costs for the entire year from the observer contract. Reducing the remaining budget further by the amount of money calculated for dockside deployment in section 2.5.4 resulted in an available "at-sea" budget for the deployment of observers.

Two-thousand values of C_S constituted a set of simulations. The distribution of C_S values from a set was evaluated against the desired outcome that between 88 and 92% of C_S values were at or below the at-sea budget. If the desired outcome was not achieved, the initial rate of sampling was adjusted, another set of simulations was generated, and the evaluation was conducted again. This entire process was repeated until a set of simulations achieved the desired outcome. Based on this evaluation, the deployment rate was 13.03968, or 13.0. The histogram of C_S values from the final set of simulated trials is depicted in Figure 1 and the process for simulating costs and rates is depicted in Figure A3-2.

2.5.2 Evaluation analysis 2: Anticipated changes to CV coverage

Having established a deployment rate, this next analysis was performed to evaluate the questions:

- How much and where is at-sea coverage expected to be realized in 2013 as a result of this deployment plan?
- How does it compare to current levels in the partial coverage category of the CV fleet?

Any examination of changes in CV at-sea observer data needs to be done at scales relevant to the main clients of the observer program. Stock assessment scientists use data from biological tissues such as otoliths and observer length-frequency samples to generate age-length keys to estimate catch-at-age. Some authors examine their catch data at spatial and temporal scales equivalent to the FMP area/year stratum, while others aggregate catch, length and age compositions at the season/NMFS Area scale (e.g., Dorn et al. 2011, Thompson and Lauth 2011). In contrast, the CAS estimation procedures for CVs generally use a post-stratification procedure (with the exception of census salmon) to match observed discard rates with landing information. The definition of post strata depend on whether groundfish or PSC is being estimated (Cahalan et al 2010). The coarsest resolution used in defining post-strata for observer information is at the FMP area, gear, and target; whereas the finest resolution is specific to a vessel's observed trip.

Weighing the ease of calculation, the need for specificity by clients of observer data and the need for a clear interpretation of results, past and anticipated future observed and unobserved fishing effort was examined at the gear/FMP area/target/week scale. A data set was generated that equates to landings made in 2011 in what would constitute the partial coverage category for the CV fleet in 2013. Trips were enumerated for the criteria described above and used to generate heat maps and histograms. Heat maps simultaneously depict the number of trips in a week (column) and gear/FMP area/target (row) combination (i.e. a heatmap cell), and the number of observed trips in a cell. Three heat maps were generated for comparison. In the first map, the cell colors depict the proportion of trips in a cell that were observed in 2011 (Figure 2). In the second map, cell colors depict the proportion of trips in a cell expected to be observed (that is, the *average* number of observed trips in that cell from the final set of 2000 simulations; Figure 3). The third map depicts the difference in the relative coverage values from Figures 2 and 3, expressed as Figure 2 color relative coverage values minus Figure 3 color relative coverage values (Figure 4). While there is variation in the amount of observer coverage in each heat map cell in Figure 3, this variance is not depicted.

Compared to heat maps that express data in a graphical table format and are good at identifying the distribution of values of interest with respect to time and space, histograms depict the relative frequency and distribution of different values of interest. As an alternative way to depict the information provided in

Figure 4, histograms were generated from the trip and relative observer coverage data in Figures 2 and 3 for each FMP/gear type/Target. These plots depict the difference in the distribution of current and anticipated observer coverage rates by hook and line gear (Figure 5), pot gear (Figure 6) and trawl gear (Figure 7). A graphical representation of the process through which the deployment rate is set and these figures were created is depicted in Figure A3-2.

From Figures 2 through 7, the following conclusions can be made.

- Observer coverage in the current deployment system was heavily skewed into BSAI trawl cod fishery during weeks 4-17 and in the GOA trawl cod fishery during weeks 39-41.
- Observer coverage anticipated from this ADP would be expected to result in a greater number of gear/FMP area/target/week combinations that had at least some observer data within them than was realized in 2011 even though future deployment is anticipated to occur at a lower rate based on trips than current deployment rules based on days. This is especially true for the hook and line fleet, of which a large number are under 60 feet in length and fish halibut.
- The median coverage rate anticipated under this ADP is greater than that of the current program in seven of seven FMP area/target combinations for hook and line gear, three of four combinations for pot gear, and 7 of 12 combinations for trawl gear. For pot gear, median values of coverage declined between current and future simulations in the BSAI sablefish fishery. For similar comparisons made for trawl gear, median values of coverage declined for BSAI cod and GOA arrowtooth, and median values were similar for GOA cod and GOA pollock.

2.5.3 Evaluation Analysis 3: Anticipated changes to the number of lengths and specimens

Since the specimens collected by observers are used by stock assessment scientists, it is important to gauge the potential impact that changes in the deployment of observers will have on the amount of tissues collected. Each year, FMA solicits requests for changes in their observer training manual from other groups including stock assessors within the AFSC and the number of specimens collected annually can change based on their responses. Perhaps the most important sources of change with respect to the number of specimens observers collect are the fish length and specimen tables (e.g., pgs 13-25 to 13-34, NMFS 2010). These tables dictate the type, the amount, and from what species observers collect lengths and specimens from each haul based on the predominant species in that haul, and what FMP the vessel is fishing. Out of necessity, in order to determine the number of specimens we would anticipate to be collected from this deployment plan, the decision was made to calculate tissue accumulation rates where applicable assuming that the rates in the future would be identical to those in the past (that is, the table of instructions to observers did not change). In practice, NMFS may adjust these sampling rates to address potential shortfalls for stock assessment.

There are three potential sources of length and tissue information: those collected at-sea on a CV, those collected at-sea on at CP or M, and those collected from CV deliveries dockside. Within each of these sources, the current (i.e. 2011 actual data) and the future (2011 data based on the 2013 deployment methods) number of lengths and specimens needed to be obtained and calculated respectfully. Since separate calculations needed to be made for each potential source of length and tissue data, data summaries from this exercise were made at the FMP area/source/species level of aggregation. For a workflow diagram of length and tissue analyses the reader is referred to Figure A3-3.

The simplest calculation was the enumeration of lengths and tissues from the 2011 observer database NORPAC that provided a baseline from which to evaluate future changes.

Future length measurements and biological specimens from dockside sources were calculated by enumerating only those lengths and specimens collected from within the BSAI AFA fishery, and adding these values to the number of reported Chinook (a.k.a. King) salmon (*Oncorhynchus tshawytscha*) and non-Chinook salmon landed in 2011 from the GOA[4] that had been multiplied by 0.1 and 0.3 respectfully since these sampling rates represent those currently used by the NPGOP for salmon tissue collections following the instructions to observers that originated from AFSC genetic scientists at the Auke Bay Laboratories (NMFS 2010).

Since the reporting timeframe for CP and M data is the day, future lengths and specimens from this sector of the fleet were calculated by summing the number of lengths and specimens collected by observers (*x*) from within this fleet (both from those entities that required full coverage, *G*, and those that required partial coverage, *P*), dividing these values by the number of observed days (*d*) to yield a "tissue accumulation rate" (per day), and multiplying this rate by the expected change in number of CP and M days expected to be observed in 2013 (that is, total days (*D*) minus the observed (*O*) days). This value was then be added to the number of length measurements and biological specimens collected from this fleet by NPGOP. Alternatively these calculations can be expressed as:

$$x_{CP13} = \left[\frac{x_G + x_{P_o}}{d_G + d_{P_o}} \times \left(D - (d_G + d_{P_o})\right)\right] + x_G + x_{P_o}$$

where

$$D = d_{P_U} + d_G + d_{P_o} = d_{P_U} + d_O.$$

Creating estimates of future length and specimen counts from within the CV sector of the fleet was a challenging aspect of this evaluation. Using similar expansion logic to that used above, the anticipated number of lengths and specimens for 2013 was calculated from the expansion of an accumulation rate (here for each FMP area/target/species combination) that had been derived using existing information. However, unlike the CP and M sector of the fleet that report catch in terms of days, the CV fleet reports fishing effort and catch in units of trips (*n*). Therefore, for the CV fleet, the number of anticipated future tissues and lengths (*x*) for each species was determined by multiplying a "tissue accumulation rate" determined from NPGOP sampling in the 2011 partial coverage category by the number of anticipated observed trips to occur in a FMP area/target. Therefore, the mean estimated number of lengths and specimens for a species can be expressed as:

$$\bar{x}_{CV13} = x_J + round\,\frac{A}{n_S}$$

where

$$A = \left[\left(\frac{x_{Y_O}}{n_{Y_O}}\right) \times S\right],$$

and *J* represents the 2011 sector of the fleet that has full coverage due to cooperative membership (and would remain under full coverage in 2013), Y_O is the 2011 partial coverage CV fleet, *S* represents a simulated number of observed trips from the 2011 landings data that would be classified as belonging to the 2013 partial coverage category using the rate defined in section 2.5.1 and n_S is the number of simulated draws of trips (chosen to be 2000 here- Table 2). Similarly the 0.025 and the 0.975 quantiles of *A* added to x_J yielded the upper and lower confidence bounds for the estimates of $\bar{x}_{CV13}$.

Summaries of the actual and anticipated future lengths and specimens to result from this ADP are presented in Tables 3 and 4 for the BSAI and GOA respectfully.

[4] as reported by the Alaska Fisheries Information Network (AKFIN)

Since it is difficult to gain a broad program-wide understanding of the potential impacts of a restructured observer program from summary tables, for each FMP area/species, relative differences in the total amount of each tissue type (lengths, ageing structures, maturities, and stomachs) were calculated from:

$$\Delta_{\mathrm{x}} = \frac{x_e - x_O}{x_O}$$

so that the estimated (*e*) number of tissues to have been collected in 2011 using 2013 ADP sampling procedures is compared to those actually collected in 2011 (*O*). Plots of Δ_x were made with respect to values of *x* realized in 2011 to determine whether patterns were evident among species within an FMP (Figure 8). As anticipated, the magnitude of changes in lengths and tissues was negatively related to the values of *x* realized in 2011. In other words, those species that saw large numbers of lengths and ages collected in 2011 are anticipated to experience the least relative change from those values as a result of the restructured program and *vise versa*. Most of these differences are the result of changes in dockside observer deployment strategies. For example, a large relative increase in GOA Chinook salmon lengths would be offset by a relatively large decrease in GOA pollock and cod ageing structures (otoliths). However while a decrease in total maturity and stomach samples would also be anticipated for GOA pollock, similar values for cod are expected to increase (Figure 8). The at-sea collection rates that are included in the instructions to 2013 observers are likely to be adjusted to account for these differences.

2.5.4 Evaluation Analysis 4: Anticipated cost of dockside sampling for GOA salmon genetics

Tracking the bycatch of salmon in the pollock fishery has been an ongoing concern for NMFS and the Council. Bycatch of Chinook salmon in the GOA pollock fishery has historically accounted for the greatest proportion of Chinook salmon taken in the GOA groundfish fisheries (NMFS 2012). To address these concerns, the Council took action in June of 2011 which capped the Chinook bycatch in 2012 in the GOA, and NMFS is working with industry to collect salmon tissues from this bycatch (NOAA 2012b).

The amount of observer time and money required to sample pollock offloads in the GOA for salmon genetics was estimated in several steps. First, the total amount of salmon (*W*) in each GOA pollock offload (*L*) each day (*d*) during 2011 was enumerated. Next, the sum of the number of Chinook salmon (*K*) divided by 10 and the number of chum salmon (*H*) divided by 30 will be used as a proxy for the number of genetic samples taken in each offload (x_l) following the instructions to observers that originated from AFSC genetic scientists at the Auke Bay Laboratories (NMFS 2010). Using the time-per-task values from prior analyses of observer duties at-sea as a guide (MRAG 2004), the number of total salmon was multiplied by 0.008 and the number of genetic samples multiplied by 0.17 to determine the observer workload in units of hours per offload. The mean value ($\bar{t}$) among offloads was then multiplied against the number of GOA pollock landings made each day to yield the daily observer workload. Next this daily observer workload was divided by a 12 hour day, rounded, and a value of one added to yield the number of observers required for this day (f_d). This calculation is presented in this way under the assumption that partial days would be billed to NMFS by the observer contractor as a full day. Multiplying the contract value of an observer day by the number of observers required for each GOA pollock offload day and summing yielded the total cost of this task. Expressed mathematically these calculations read as:

$$total\ cost = \sum_{d=1}^{D} f_d \times \$cost\ of\ observer\ day$$

where

$$f_d = \left[round\,\frac{(L_d \times \bar{t})}{12} \right] + 1$$

and

$$\bar{t} = \frac{\sum_{l=1}^{L}(W_l \times 0.008) + (x_l \times 0.17)}{L}$$

and

$$x_l = \frac{K_l}{10} + \frac{H_l}{30}.$$

To evaluate the impact of this task on the at-sea deployment rate, the total cost of the task defined above was converted into at-sea days by dividing by the contract estimate of an at-sea day to yield the number of potential at-sea days. Dividing f_d by the estimated at-sea fishing effort days for the 2013 partial coverage fleet yielded the "cost" of GOA dockside observer deployment in terms of the at-sea deployment rate. The dockside work effort (days) in this ADP represented less than a third of a percent of the total 2013 at-sea partial-coverage category fleet effort. For a workflow diagram the reader is referred to Figure A3-4.

2.5.5 Evaluation Analysis 5: Summary of total observer deployment in the fleet

Up until now, the evaluation analyses of restructure have dealt with individual aspects of the program. Here, evaluations between the actual 2011 observer data, and that expected had 2011 been sampled under this ADP was conducted with respect to three metrics for the entire fleet. The first of these metrics is the number of vessels, which is a proxy for the number of fishery participants "in the program." The second metric is the number of days, which equates not only to fishing effort, but also to costs. Finally, the total catch was evaluated since this metric equates to resource use and impact by the fleet.

Data for fleet evaluations come from multiple sources. For a workflow diagram of how total fleet comparisons were generated, the reader is referred to Figure A3-5. Table 5 contains the output from these comparisons. Comparisons of 2011 actual observer coverage to that expected had 2011 been sampled according to this ADP reveal that the restructured program would have reduced the number of vessels without any chance of observer coverage and increased the number of vessels in the partial coverage category with little change in the full coverage category. Consequently, the sampling rate for the partial coverage fleet according to this ADP is reduced compared to that achieved in 2011. However, since CPs are all within the 2013 ADP full-coverage category and these vessels fish disproportionately greater days and catch compared to CVs, when partial and full coverage fleets are combined, sampling under this ADP would have resulted in a small net increase in observer coverage in terms of total vessels, days, and catch compared to 2011 actual values.

2.6 Methods to evaluate the 2013 Observer program in 2013

In the Council's June 2012 meeting, NMFS proposed that in June of each year they would deliver a report on how participants in the fleet adjusted to the new ADP, and termed this the "ADP performance report." While a complete list of elements to be included in this future document is beyond the scope of this ADP, we will include how NMFS will be tracking key performance metrics. To address the second portion of this ADP's objective (do not run out of funds), the NFMS needs to track ongoing expenses against available funds. Following the example used in the Northeast Groundfish Observer Program, the relative cumulative days fished in the partial coverage stratum (normalized so it sums to 1) in the most recent past year will be plotted against the relative cumulative cost of observer deployment in the current year derived from (a) the number of days and cost per day in the ODDS, and (b) the number of days in debriefed status within NORPAC. While (a) represents anticipated costs to NMFS in near real time, (b) represents actual billable costs to NMFS, but will be delayed by up to 90 days since this is the maximum deployment for an observer prior to debriefing. In addition, the rates of observer coverage in terms of trips for the partial coverage category portion of the fleet from *e*Landings reports will be compared to those declared in ODDS and those for which NORPAC data exists. Deviations from expected values of coverage given ODDS deployment rates will be interpreted as the combination of both random error (unintentional) and intentional forces (e.g., the observer effect). Comparisons between these deviations among various fisheries, ports, and times of year will be used to gain insight as to which of these forces are responsible for observed patterns, and will be used to recommend targeted outreach, education, and enforcement activities to portions of the fleet. This "deploy and evaluate" approach represents an iterative improvement of the deployment efficiency of observers by NMFS.

3.0 Innovation for 2013

This 2013 NPGOP EM project strategy and design incorporates many of the lessons learned from past studies in Alaska and elsewhere- for example those summarized before the Pacific Fisheries Management Council at their April 2012 meeting (Appendix 1; Environmental Defense Fund 2012). Many (if not all) of these studies would not have been possible without close cooperation from the fishing industry (industry). It is obvious that building a strong working relationship with the industry is essential to the future success of an EM program in the North Pacific.

The objective of EM deployment in 2013 is to evaluate the efficacy of EM to identify species and the disposition of those species covered by the full retention requirements for Demersal Shelf rockfish in the hook-and-line fishery operating out of southeastern Alaska (NMFS reporting area 649 and 650) and, if funding permits the Central Gulf of Alaska (NMFS reporting area 630). Towards this end, a contract was developed by NMFS for a business to construct, deploy, and maintain a video based EM system on vessels in the vessel-selection stratum. Vessel operators whose vessels are within the vessel-selection stratum and have indicated they would like to volunteer for the EM program will be included in the list of vessels that will be randomly selected from to determine EM deployment to occur in each calendar quarter. However, given financial limitations, to meet OAC intent, and improve logistical efficiencies, EM systems will not be deployed until the second calendar quarter (April 1st) and will only be deployed on vessels with a history of fishing from the ports of Homer, Petersburg, Sitka, and (if funding permits) Kodiak. The number of vessels that will receive EM within any given quarter will be equal to the number of EM units available. This will be determined upon finalization of a test video that will guide final development of an EM system that will be deployed and from which the final cost will be determined. . Vessels selected for an EM system will be notified through the U.S. Postal Service 30 days prior to the start of the calendar quarter. The letter will contain instructions and contact information for the EM contractor to get the system installed prior to the first fishing trip of the calendar quarter. Following system installation, the EM contractor will provide detailed instructions and training on how to operate and maintain the EM system to ensure the camera system continues to deliver clear footage throughout a trip. Upon completion of all fishing trips for the calendar quarter the EM system will be removed, hard drives replaced and prepared for integration onto another vessel. Video data will be analyzed by NMFS after retrieval to evaluate operators' ability to maintain the EM system and results will be reported to the Council.

The assignment of EM systems to vessels will not preclude their observation by human observers. The deployment of EM units onto vessels that carry and do not carry human observers will allow NMFS to evaluate if the presence of an observer influences catch and discard rates. Furthermore, to address concerns over misreporting, dockside monitoring will be incorporated into the study design. For trips that carry a human observer and EM, data from four sources can be compared: at-sea counts of rockfish from cameras, at-sea counts from observers, dockside counts from the at-sea observer who follows the catch dockside, and dockside counts from industry (i.e. landing) reports. Although not simple to accomplish, the FMA has successfully embarked on this type of study and data comparison in the past (Faunce 2011).

Almost all EM applications in recent years have focused on the use of cameras. The use of alternative EM units to cameras that are less expensive may provide an opportunity for broader coverage throughout the fleet. The NMFS intends to develop non-camera systems that would collect set and haul positions, skipper estimates of discard and catch per set using a paper log or an electronic logbook that is currently in development. In addition, non-camera systems may include passive monitoring techniques such as GPS and sensors such as data loggers to determine fishing effort and location. Development of these systems will be entirely dependent upon funding that has yet been identified.

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6.0 Tables.

Table 1. Coverage strata for the 2013 ADP. Table is organized by vessel type for non-CDQ fisheries (A), and by target for CDQ fisheries (B).

	Zero Coverage	Partial-Vessel Selection	Partial-Trip Selection	Full Coverage
		A. Non-CDQ Fisheries		
Vessel type				
CV	Jig gear State GHL fisheries <40'LOA	between 40' and 57.5' LOA	>57.5' and not in RP or AFA	BS AFA Pollock vessels CGOA RP
CP	none	none	Vessels meeting CP exemption criteria	All non-exempted CPs[5]
M	none	none	none	All
		B. CDQ Fishery		
Target				
Halibut	none	Hook and line	Hook and line	None
Sablefish	none	Hook and line	Hook and line	None
Sablefish	none	Pot	Pot	None
Pollock	none	none	none	All trawl gear and motherships
Other groundfish	none	Pot	Pot	All trawl and hook-and-line

[5] Includes jig gear.

Table 2. Symbols used in calculations in the order they appear.

Symbol	Definition
r	Rate (selection probability in simulations).
N	Trips.
N_{CV13}	N trips taken in the CV partial coverage fleet according to 2013 (ADP) definitions.
S	Simulated trips sampled from $\boldsymbol{N_{CV13}}$.
c_i	Cost for trip i.
Q	Calendar quarter.
V	Vessel, v=1,...V vessels.
B	Base cost rate (\$ day^{-1}) from contract between NMFS and the selected observer provider(s).
I	A random draw from a distribution of CV invoice incidental costs (\$ day^{-1}).
D	Calendar days.
N_{QV}	N trips taken in vessel v in quarter Q.
CV13	Catcher vessel data defined by 2013 observer deployment rules.
X	Number of biological tissues. In 2.5.3- Includes lengths, ageing structures (otoliths, spines and vertebrae), sexual maturity assessments, and stomachs. In 2.5.4 includes only lengths and genetic samples).
CP13	Catcher processor/Mothership data defined by 2013 observer deployment rules.
G	2011 full coverage CP and M sector of the fleet.
P	2011 partial coverage CP and M sector of the fleet.
O	Observed in 2011.
U	Unobserved in 2011.
J	2011 full coverage CV sector of the fleet due to membership in cooperatives.
Y	2011 partial coverage CV sector of the fleet.
A	Simulated number of tissues for a species/FMP area/target.
Δ	Change in, difference between.
e	Estimated value using 2013 (ADP) definitions.
W	Number of salmon.
L	Number of GOA pollock offloads.
K	Number of king salmon.
H	Number of chum salmon.
T	Observer working time ($hours^{-1}$)
F	Number of observers.

Table 3. Summary of length and tissues collected from species by observers in 2011 (labeled as actual) and those estimated to be collected if 2011 had been sampled according to this ADP (labeled as future) from the Bering Sea and Aleutian Islands. For catcher vessel data, the mean and upper and lower 95% bounds are provided.

Species	Actual Lengths	Future Lengths	Lower 95% L	Upper 95% L	Actual ageing	Future ageing	Lower 95% A	Upper 95% A	Actual Maturities	Future Maturities	Lower 95% M	Upper 95% M	Actual Stomachs	Future Stomachs	Lower 95% S	Upper 95% S
ALASKA PLAICE	14,328	14,335	14,335	14,335	686	686	686	686	-	-	-	-	-	-	-	-
ALASKA SKATE	28,766	35,292	35,255	35,332	-	-	-	-	-	-	-	-	-	-	-	-
ALEUTIAN SKATE	2,552	3,300	3,287	3,314	-	-	-	-	-	-	-	-	-	-	-	-
ANGULATUS TANNER	676	402	272	544	-	-	-	-	-	-	-	-	-	-	-	-
ARROWTOOTH FLOUNDER	887	893	893	893	5	5	5	5	346	346	346	346	307	307	307	307
ATKA MACKEREL	20,351	20,361	20,361	20,361	1,976	1,977	1,977	1,977	-	-	-	-	-	-	-	-
BAIRDI TANNER CRAB	24,277	21,212	20,639	21,804	-	-	-	-	-	-	-	-	-	-	-	-
BERING SKATE	3,626	4,681	4,681	4,682	-	-	-	-	-	-	-	-	-	-	-	-
BIG SKATE	217	249	246	251	-	-	-	-	-	-	-	-	-	-	-	-
BIGMOUTH SCULPIN	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
BLUE KING CRAB	234	300	300	300	-	-	-	-	-	-	-	-	-	-	-	-
BROWN KING CRAB	10,816	9,578	8,347	10,918	-	-	-	-	-	-	-	-	-	-	-	-
BUTTER SOLE	21	21	21	21	-	-	-	-	-	-	-	-	-	-	-	-
CHINOOK SALMON	2,634	2,635	2,635	2,636	-	-	-	-	-	-	-	-	-	-	-	-
CHUM SALMON	6,792	6,802	6,802	6,802	-	-	-	-	-	-	-	-	-	-	-	-
COHO SALMON	36	37	37	37	-	-	-	-	-	-	-	-	-	-	-	-
COMMANDER SKATE	521	671	671	671	-	-	-	-	-	-	-	-	-	-	-	-
COUESI KING CRAB	534	331	243	427	-	-	-	-	-	-	-	-	-	-	-	-
DARK ROCKFISH	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
DEEPSEA SKATE	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
DUSKY ROCKFISH	1,197	1,198	1,198	1,198	36	36	36	36	-	-	-	-	-	-	-	-
FLATHEAD SOLE	16,192	16,304	16,303	16,306	877	882	882	882	-	-	-	-	-	-	-	-
GIANT GRENADIER	2,799	3,389	3,342	3,440	-	-	-	-	-	-	-	-	-	-	-	-
GREAT SCULPIN	3,476	3,489	3,488	3,489	-	-	-	-	-	-	-	-	-	-	-	-
HYBRID TANNER CRAB	25	26	26	26	-	-	-	-	-	-	-	-	-	-	-	-
KAMCHATKA FLOUNDER	373	373	373	373	-	-	-	-	-	-	-	-	-	-	-	-
LONGNOSE SKATE	12	14	14	15	-	-	-	-	-	-	-	-	-	-	-	-
LYRE CRAB UNIDENTIFIED	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
MUD SKATE	497	551	551	551	-	-	-	-	-	-	-	-	-	-	-	-
NORTHERN ROCK SOLE	48,778	48,747	48,739	48,754	2,151	2,152	2,152	2,152	-	-	-	-	-	-	-	-
NORTHERN ROCKFISH	1,596	1,600	1,600	1,600	469	470	470	470	-	-	-	-	-	-	-	-
OCTOPUS UNIDENTIFIED	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
OPILIO TANNER CRAB	20,343	22,547	22,449	22,649	-	-	-	-	-	-	-	-	-	-	-	-
PACIFIC COD	180,900	206,743	205,100	208,398	2,438	2,130	2,113	2,147	1,281	1,134	1,127	1,141	319	316	316	317
PACIFIC HALIBUT	52,908	54,574	54,276	54,885	-	-	-	-	-	-	-	-	-	-	-	-
PACIFIC OCEAN PERCH	12,109	12,115	12,115	12,115	2,809	2,810	2,810	2,810	-	-	-	-	-	-	-	-
PACIFIC SLEEPER SHARK	9	10	10	10	-	-	-	-	-	-	-	-	-	-	-	-
PARALOMIS MULTISPINA	2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
PINK SALMON	189	189	189	189	-	-	-	-	-	-	-	-	-	-	-	-
PLAIN SCULPIN	7,064	7,067	7,067	7,068	-	-	-	-	-	-	-	-	-	-	-	-
POLLOCK	345,971	345,658	345,644	345,672	6,608	6,600	6,599	6,600	4,570	4,567	4,567	4,567	1,673	1,674	1,674	1,674
RED KING CRAB	2,098	2,472	2,471	2,473	-	-	-	-	-	-	-	-	-	-	-	-
REX SOLE	27	27	27	27	-	-	-	-	-	-	-	-	-	-	-	-
ROCK SOLE UNIDENTIFIED	1,362	1,363	1,363	1,363	26	26	26	26	-	-	-	-	-	-	-	-
ROUGHEYE ROCKFISH	849	1,029	1,025	1,033	177	196	195	197	-	-	-	-	-	-	-	-
ROUGHTAIL SKATE	12	16	16	16	-	-	-	-	-	-	-	-	-	-	-	-
SABLEFISH (BLACKCOD)	13,443	10,577	9,046	12,285	1,919	1,512	1,315	1,726	-	-	-	-	-	-	-	-
SALMON SHARK	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
SHORTRAKER ROCKFISH	1,158	1,502	1,464	1,543	312	397	386	409	-	-	-	-	-	-	-	-
SHORTSPINE THORNYHEAD	1,893	2,239	2,239	2,239	528	619	619	619	-	-	-	-	-	-	-	-
SOCKEYE SALMON	26	26	26	26	-	-	-	-	-	-	-	-	-	-	-	-
SOUTHERN ROCK SOLE	119	119	119	119	5	5	5	5	-	-	-	-	-	-	-	-
SPINY DOGFISH SHARK	2	3	3	3	-	-	-	-	-	-	-	-	-	-	-	-
SQUID UNIDENTIFIED	5,775	5,776	5,776	5,776	-	-	-	-	-	-	-	-	-	-	-	-
TANNERI TANNER	338	213	156	277	-	-	-	-	-	-	-	-	-	-	-	-
TURBOT (GREENLAND)	7,110	8,359	8,359	8,359	410	465	465	465	-	-	-	-	-	-	-	-
WARTY SCULPIN	18	18	18	18	-	-	-	-	-	-	-	-	-	-	-	-
WHITEBLOTCHED SKATE	1,575	3,222	2,700	3,768	-	-	-	-	-	-	-	-	-	-	-	-
WHITEBROW SKATE	122	156	156	156	-	-	-	-	-	-	-	-	-	-	-	-
YELLOW IRISH LORD	8	8	8	8	-	-	-	-	-	-	-	-	-	-	-	-
YELLOWFIN SOLE	124,293	124,424	124,424	124,424	5,533	5,538	5,538	5,538	-	-	-	-	-	-	-	-
Grand Total	**971,946**	**1,007,256**	**1,000,918**	**1,013,992**	**26,965**	**26,506**	**26,279**	**26,750**	**6,197**	**6,047**	**6,040**	**6,054**	**2,299**	**2,297**	**2,297**	**2,298**

Table 4. Summary of length and tissues collected from species by observers in 2011 (labeled as actual) and those estimated to be collected if 2011 had been sampled according to this ADP (labeled as future) in the Gulf of Alaska. Format follows Table 2.

Species	Actual Lengths	Future Lengths	Lower 95% L	Upper 95% L	Actual ageing	Future ageing	Lower 95% A	Upper 95% A	Actual Maturities	Future Maturities	Lower 95% M	Upper 95% M	Actual Stomachs	Future Stomachs	Lower 95% S	Upper 95% S
ALASKA SKATE	154	174	167	183	-	-	-	-	-	-	-	-	-	-	-	-
ALEUTIAN SKATE	835	1,003	991	1,016	-	-	-	-	-	-	-	-	-	-	-	-
ARROWTOOTH FLOUNDER	11,315	11,068	10,611	11,533	8	6	6	6	-	-	-	-	-	-	-	-
ATKA MACKEREL	473	653	653	653	96	133	133	133	-	-	-	-	-	-	-	-
BAIRDI TANNER CRAB	767	888	852	928	-	-	-	-	-	-	-	-	-	-	-	-
BERING SKATE	459	603	589	618	-	-	-	-	-	-	-	-	-	-	-	-
BIG SKATE	660	777	748	810	-	-	-	-	-	-	-	-	-	-	-	-
BLUE KING CRAB	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
BROWN KING CRAB	6	6	6	6	-	-	-	-	-	-	-	-	-	-	-	-
BUTTER SOLE	113	73	72	75	15	-	-	-	-	-	-	-	-	-	-	-
CHINOOK SALMON	300	1,448	1,446	1,450	-	-	-	-	-	-	-	-	-	-	-	-
COMMANDER SKATE	6	7	7	7	-	-	-	-	-	-	-	-	-	-	-	-
COUESI KING CRAB	5	6	5	6	-	-	-	-	-	-	-	-	-	-	-	-
DARK ROCKFISH	39	54	54	54	2	3	3	3	-	-	-	-	-	-	-	-
DOVER SOLE	190	184	180	189	25	23	23	23	-	-	-	-	-	-	-	-
DUSKY ROCKFISH	3,550	4,162	4,158	4,168	837	977	973	983	-	-	-	-	-	-	-	-
ENGLISH SOLE	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
FLATHEAD SOLE	2,849	2,161	1,993	2,345	453	253	240	267	-	-	-	-	-	-	-	-
GIANT GRENADIER	3,118	4,931	4,524	5,367	-	-	-	-	-	-	-	-	-	-	-	-
LONGNOSE SKATE	416	531	516	548	-	-	-	-	-	-	-	-	-	-	-	-
LONGSPINE THORNYHEAD ROCKFISH	2	3	3	3	2	3	3	3	-	-	-	-	-	-	-	-
NORTHERN ROCK SOLE	647	521	368	703	65	35	23	50	-	-	-	-	-	-	-	-
NORTHERN ROCKFISH	5,121	6,091	6,088	6,094	1,271	1,528	1,525	1,531	-	-	-	-	-	-	-	-
OCTOPUS UNIDENTIFIED	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
OPILIO TANNER CRAB	2	1	1	2	-	-	-	-	-	-	-	-	-	-	-	-
PACIFIC COD	43,734	34,514	32,641	36,439	3,705	356	340	373	33	34	32	36	27	28	26	29
PACIFIC HALIBUT	9,900	11,179	10,569	11,813	-	-	-	-	-	-	-	-	-	-	-	-
PACIFIC OCEAN PERCH	9,800	11,246	11,138	11,398	2,224	2,581	2,554	2,620	-	-	-	-	-	-	-	-
PACIFIC SLEEPER SHARK	1	1	1	1	-	-	-	-	-	-	-	-	-	-	-	-
POLLOCK	20,742	6,648	5,741	7,588	3,964	1,114	958	1,273	24	18	15	20	25	18	15	21
REDSTRIPE ROCKFISH	16	16	16	16	5	5	5	5	-	-	-	-	-	-	-	-
REX SOLE	3,874	4,257	4,224	4,300	462	356	355	358	-	-	-	-	-	-	-	-
ROCK SOLE UNIDENTIFIED	50	13	13	14	16	1	1	1	-	-	-	-	-	-	-	-
ROUGHEYE ROCKFISH	993	1,716	1,601	1,840	328	681	624	743	-	-	-	-	-	-	-	-
ROUGHTAIL SKATE	2	3	3	4	-	-	-	-	-	-	-	-	-	-	-	-
SABLEFISH (BLACKCOD)	14,827	25,292	22,944	27,824	2,038	3,159	2,873	3,461	-	-	-	-	-	-	-	-
SALMON SHARK	2	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
SHORTRAKER ROCKFISH	1,012	1,752	1,611	1,901	380	708	651	771	-	-	-	-	-	-	-	-
SHORTSPINE THORNYHEAD	1,719	1,717	1,699	1,737	405	432	427	437	-	-	-	-	-	-	-	-
SOUTHERN ROCK SOLE	758	472	360	604	99	19	14	24	-	-	-	-	-	-	-	-
SPINY DOGFISH SHARK	6	9	8	11	-	-	-	-	-	-	-	-	-	-	-	-
TANNERI TANNER	50	71	63	80	-	-	-	-	-	-	-	-	-	-	-	-
YELLOW IRISH LORD	164	137	89	195	-	-	-	-	-	-	-	-	-	-	-	-
NON-CHINOOK SALMON	52	85	83	87	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	**138,733**	**134,478**	**126,841**	**142,615**	**16,400**	**12,373**	**11,731**	**13,065**	**57**	**52**	**47**	**56**	**52**	**46**	**41**	**50**

Table 5. Comparisons between the number of vessels, days and Catch (metric tons, MT) realized and observed in 2011 (A.), 2011 as-restructured (2011 sampled according to this ADP, B), and the differences between them (C, or B minus A.). Data are summarized by the zero, partial and full-coverage portions of the fleet. Note the definitions of these fleet components changes between A and B.

Coverage Category	Vessels	Days	Catch (MT)
A. Actual 2011			
	2011 Actual		
Zero	1,383	35,577	102,464.60
Partial	187	11,890	163,070.54
Full	171	22,188	1,814,487.90
	2011 Observed		
Partial	147	3,416	53,888.46
Full	167	20,258	1,733,079.44
	2011 Proportion observed		
Partial	0.79	0.29	0.33
Full	0.98	0.91	0.96
Combined	**0.18**	**0.34**	**0.86**
B. Restructured 2011			
	Restructured 2011		
Zero	949	15,594	28,583.43
Partial	787	31,803	237,826.40
Full	168	22,070	1,813,190.50
	Restructued 2011 observed		
Partial	345	4,134	30,917.43
Full	168	22,070	1,813,190.50
	Proportion observed- Restructure		
Partial	0.44	0.13	0.13
Full	1.00	1.00	1.00
Combined	**0.27**	**0.38**	**0.89**
C. Change from Actual 2011			
	Change from 2011 Actual		
Zero	(434)	(19,983)	(73,881.17)
Partial	600	19,913	74,755.86
Full	(3)	(118)	(1,297.40)
	Change from 2011 observed		
Partial	198	718	(22,971.03)
Full	1	1,812	80,111.06
	Change in proportion observed		
Partial	(0.35)	(0.16)	(0.20)
Full	0.02	0.09	0.04
Combined	**0.09**	**0.04**	**0.03**

7.0 Figures

Figure 1. Histogram of 2000 simulated total annual program costs for a deployment rate of 0.13 The dashed black line is the at-sea budget that 50% of the simulated at-sea program costs were at or below, the red line is the actual at-sea deployment budget, the blue dashed line is the at-sea budget that 90% of the simulated at-sea program costs were at or below, and the dashed yellow line is the at-sea budget that 95% of the simulated at-sea program costs were at or below. Actual program costs are not depicted.

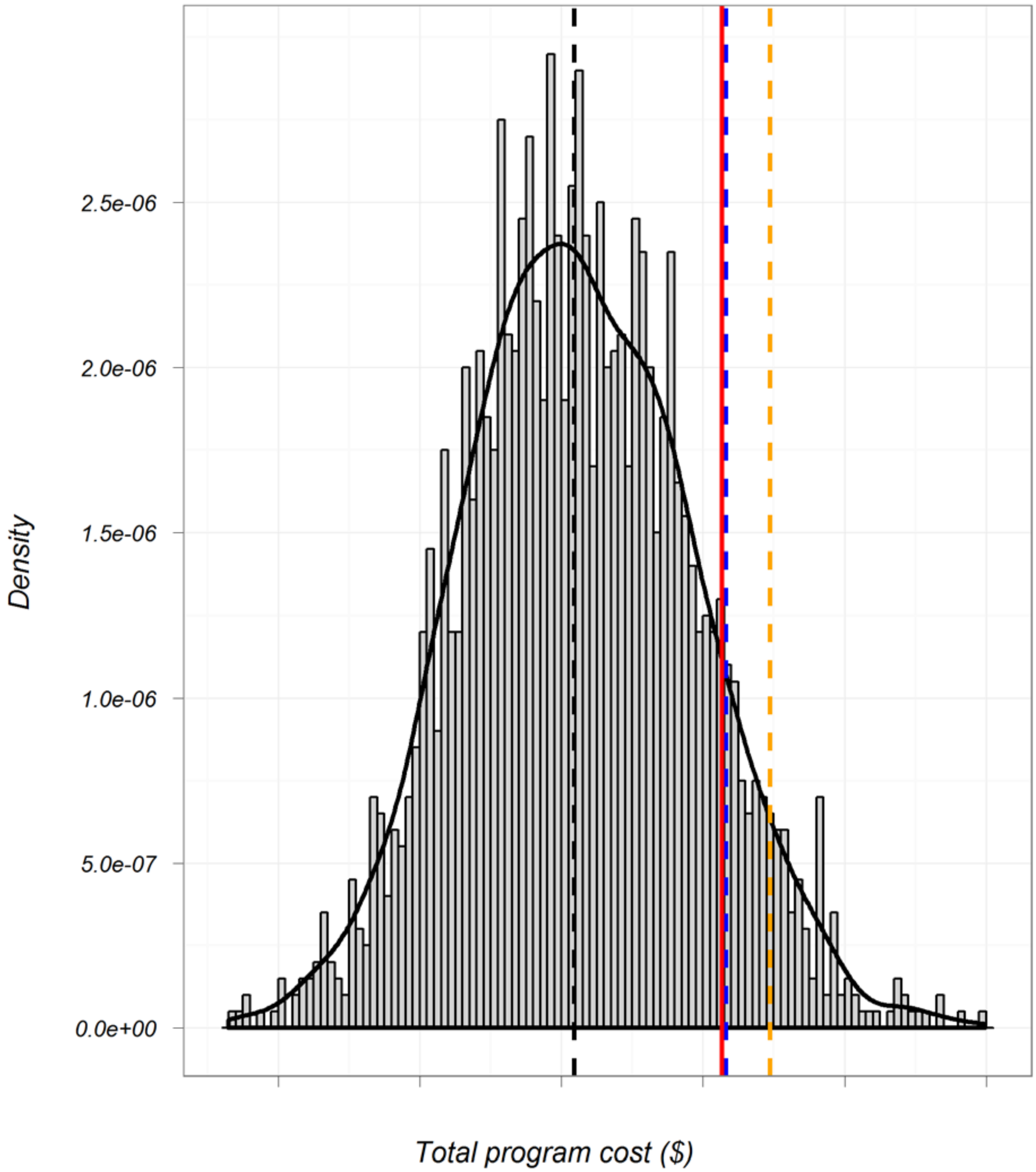


Figure 2. Heat map depiction of the number of trips (cell values) and the relative proportion of cell values that were observed in the 2011 NPGOP fleet for vessels that would constitute "trip-selection" and "vessel-selection" strata in the 2013 restructured program (colors). Row values indicate combinations of gear type (space) FMP (space) Target. Gear abbreviations: HAL=Hook-and-line gear, POT=Pot gear, TRW=Trawl gear. FMP abbreviations: BSAI=Bering Sea and Aleutian Islands, GOA=Gulf of Alaska. Target Abbreviations: ATH=Arrowtooth flounder, COD=Pacific Cod, DWF=Deep water flatfish, HAL=Pacific halibut, FSL=Flathead sole, OTH=Other, POL=Walleye pollock, REX=Rex sole, RCK=Rockfish, SBL=Sablefish, SWF=Shallow-water flatfish.

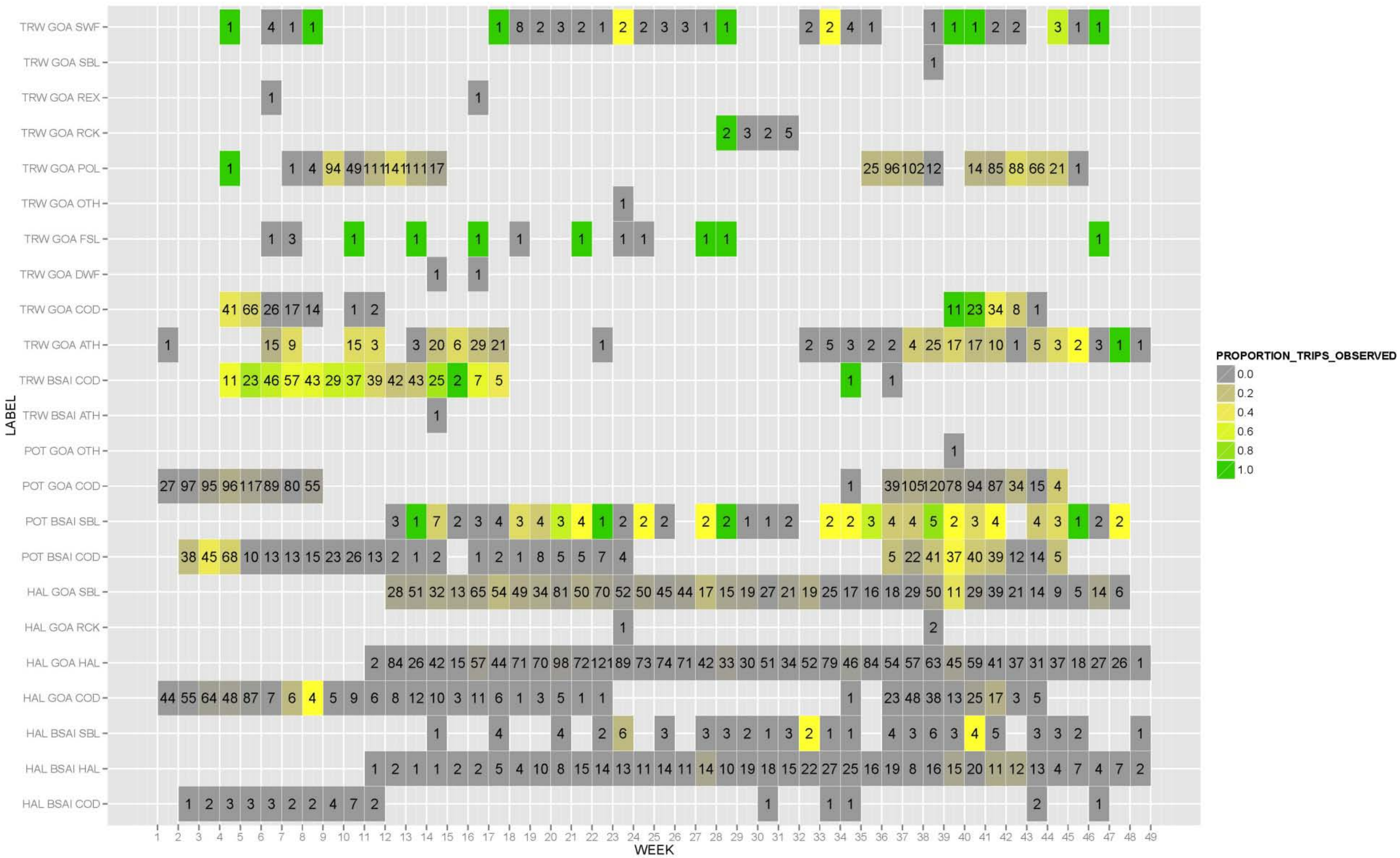


Figure 3. Heat map depiction of the number of realized trips in 2011 (cell values) and those that would have been expected to be observed had the 2011 NPGOP fleet for vessels that would constitute “trip-selection” and “vessel-selection” strata in the 2013 restructured program been observed according to this ADP (colors). Note: although format and abbreviations follow Figure 2, legend values and colors are unique to this figure.

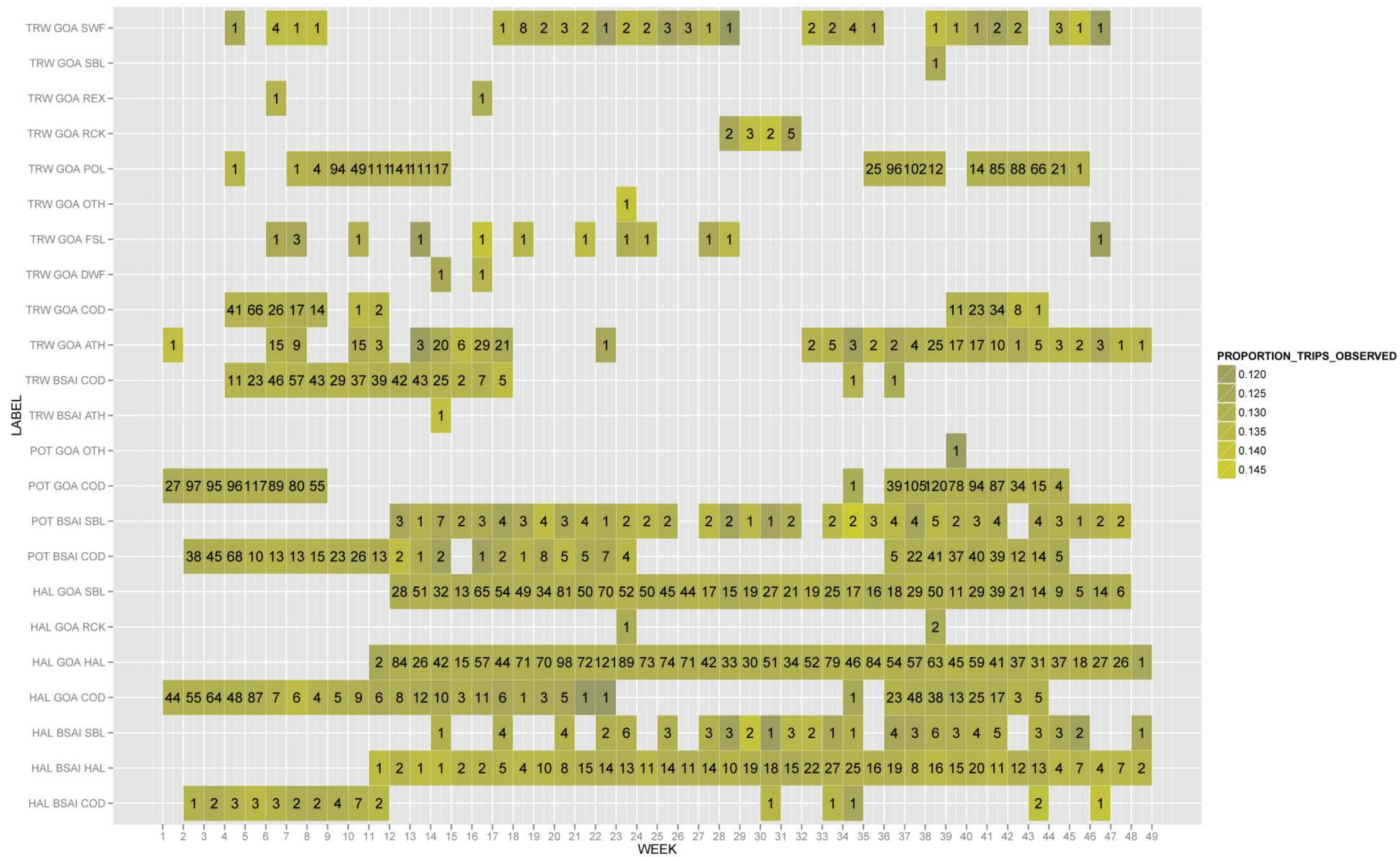


Figure 4. Heat map depiction of the differences between the coverage rates from Figure 2 minus those in Figure 3. Note: although format and abbreviations follow Figure 2, legend values and colors are unique to this figure.

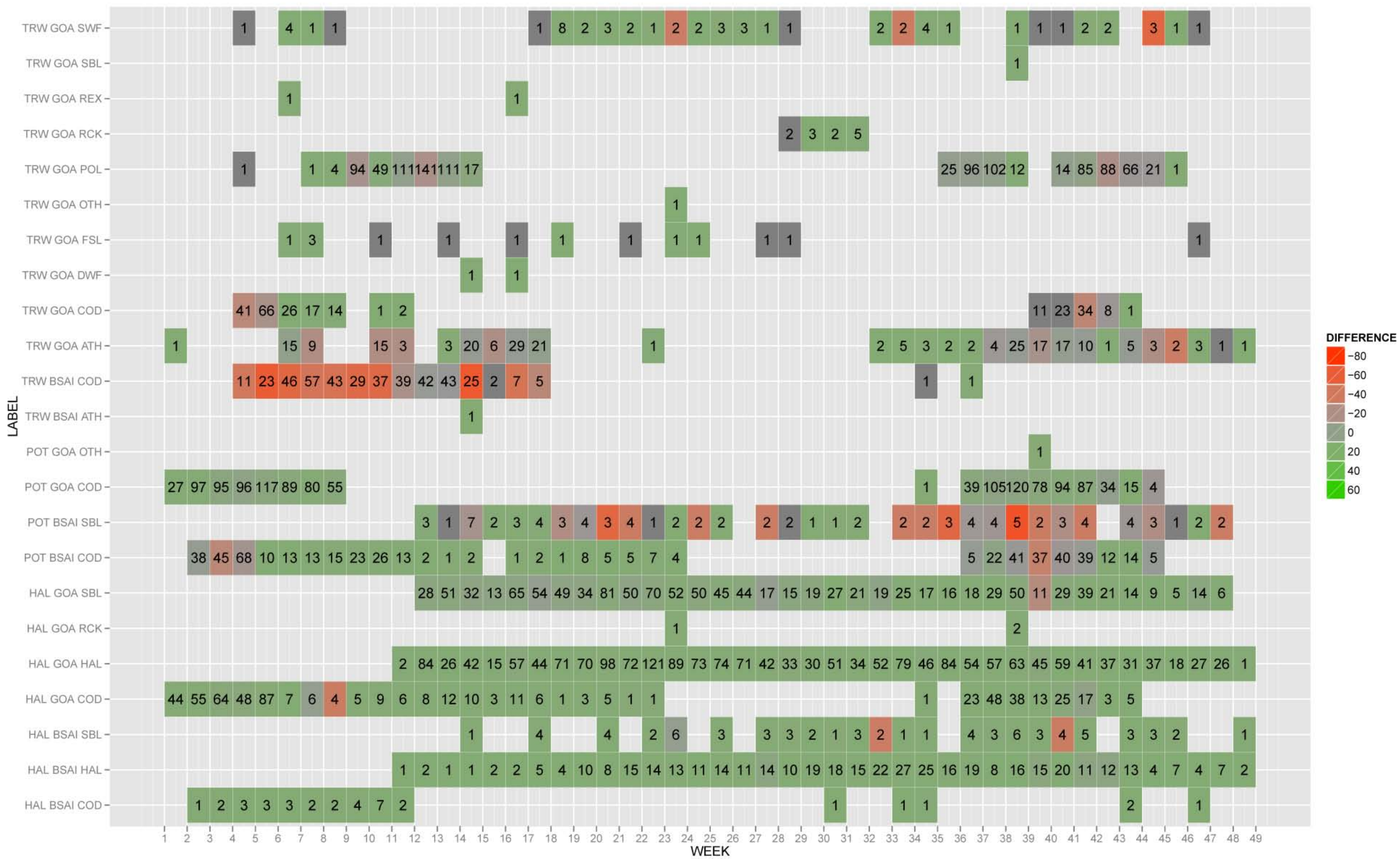


Figure 5. Histograms depicting the number of trips in each relative coverage rate depicted in Figures 2 and 3 for the 2013 partial coverage stratum CV fishing hook and line gear within each FMP (columns) and target (rows). Abbreviations follow Figure 2. Median (50 percentile) values for current (2011 NPGOP) and future (2011 as sampled according to this ADP) are depicted at horizontal dotted lines.

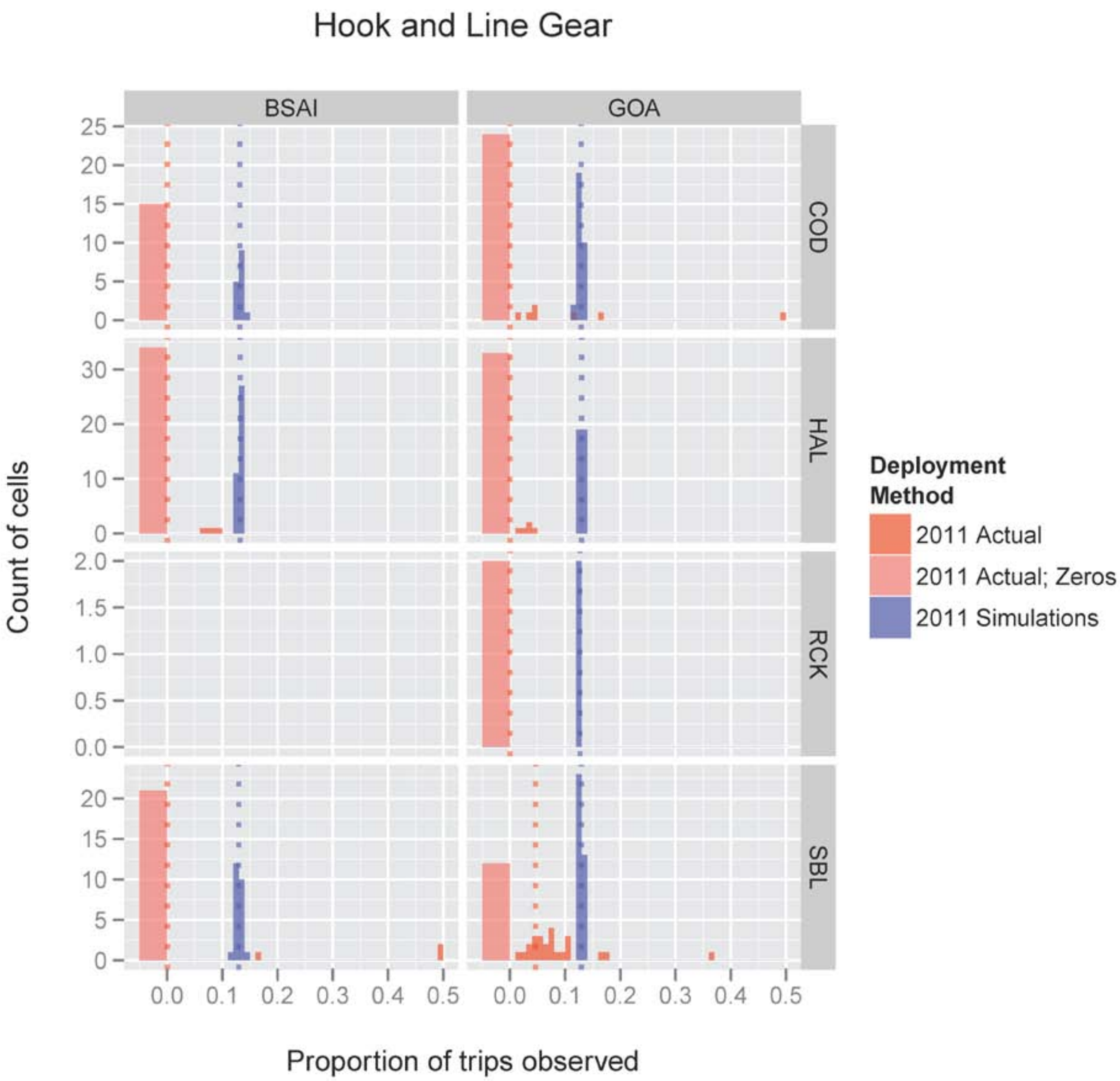


Figure 6. Histograms depicting the number of trips in each relative coverage rate depicted in Figures 2 and 3 for the 2013 partial coverage stratum CV fishing pot gear within each FMP (columns) and fisheries (rows). Format follows figure 5. Abbreviations follow Figure 2.

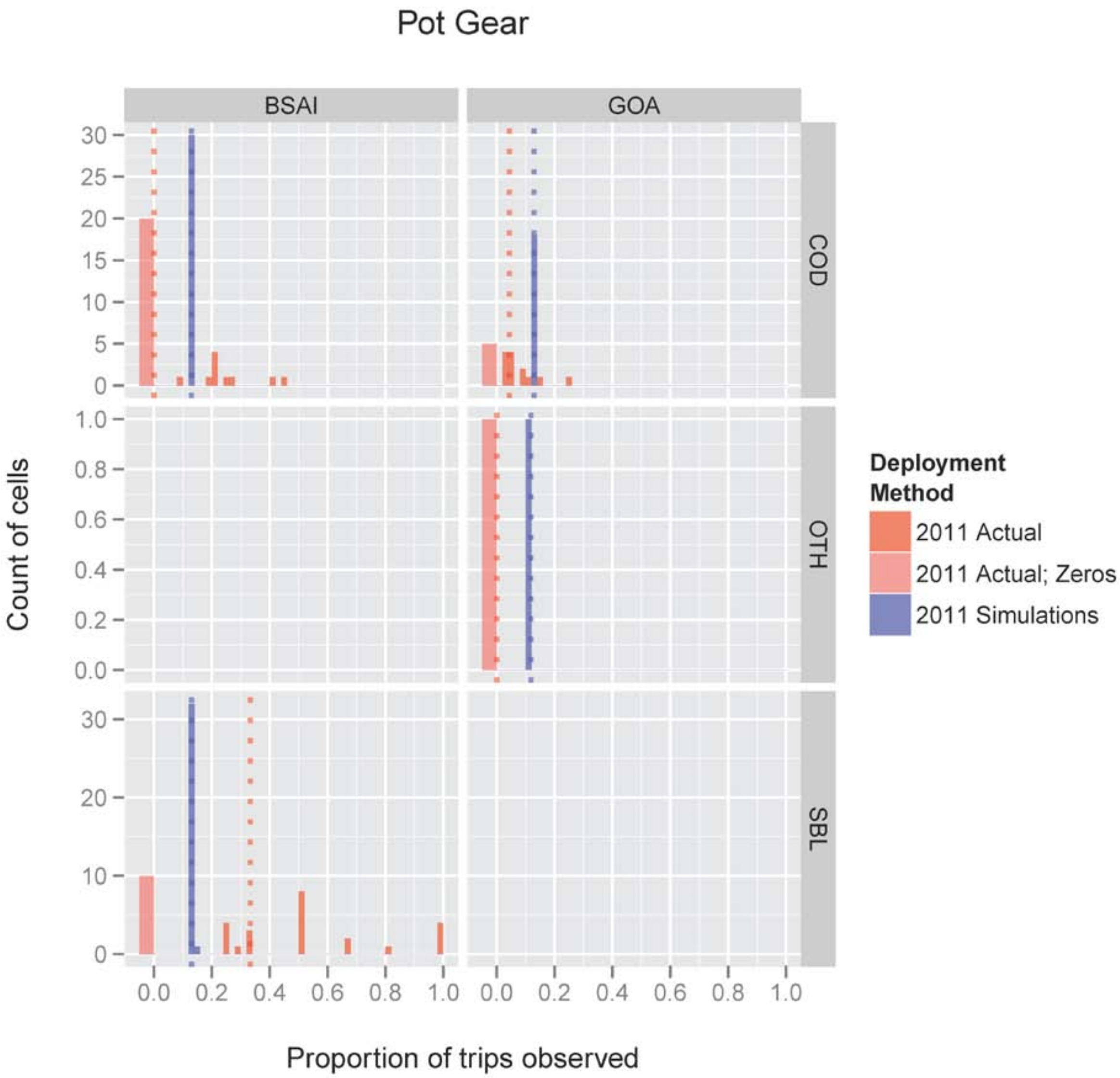


Figure 7. Histograms depicting the number of trips in each relative coverage rate depicted in Figures 2 and 3 for the 2013 partial coverage stratum CV fishing trawl gear within each FMP (columns) and fisheries (Rows). Format follows figure 5. Abbreviations follow Figure 2.

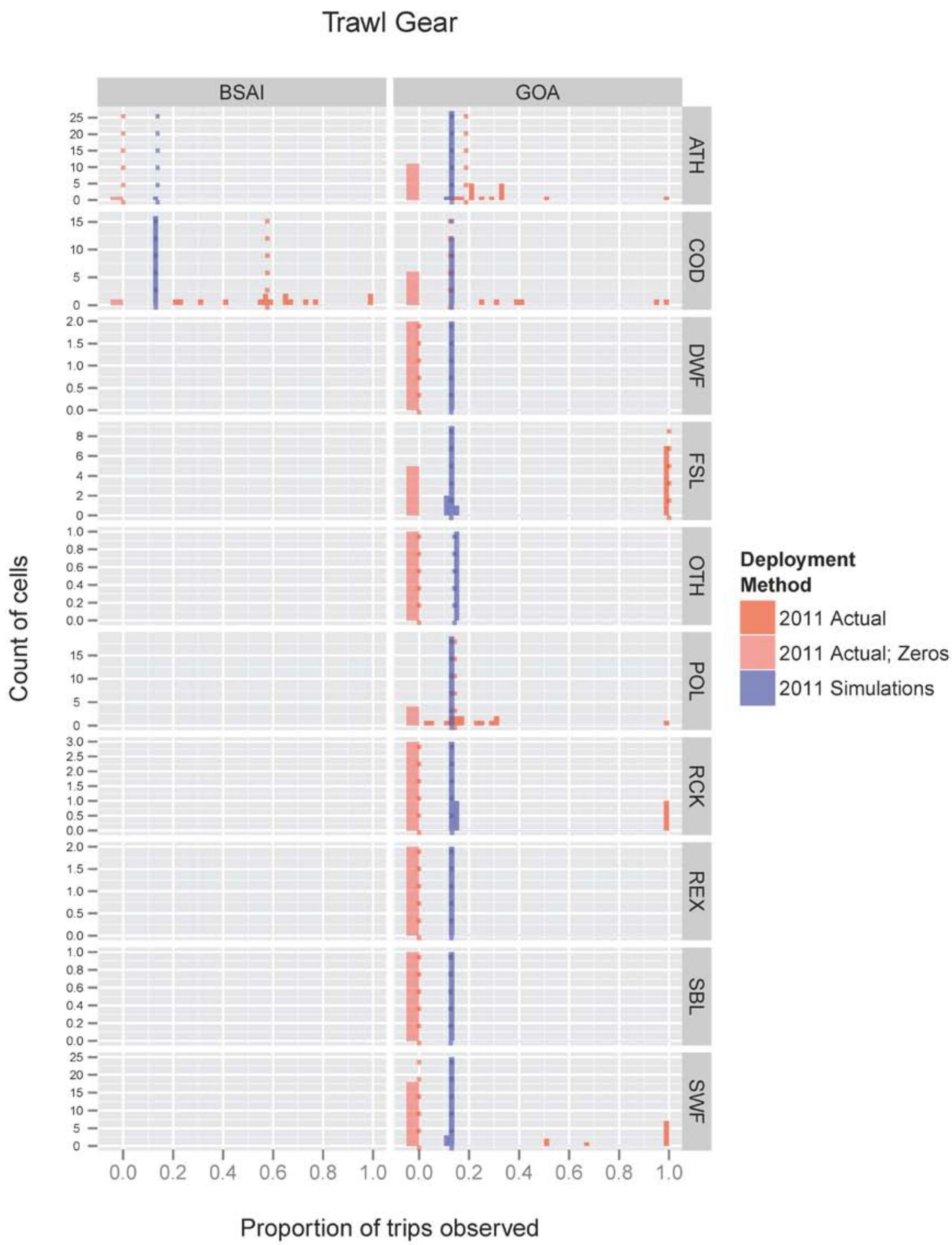
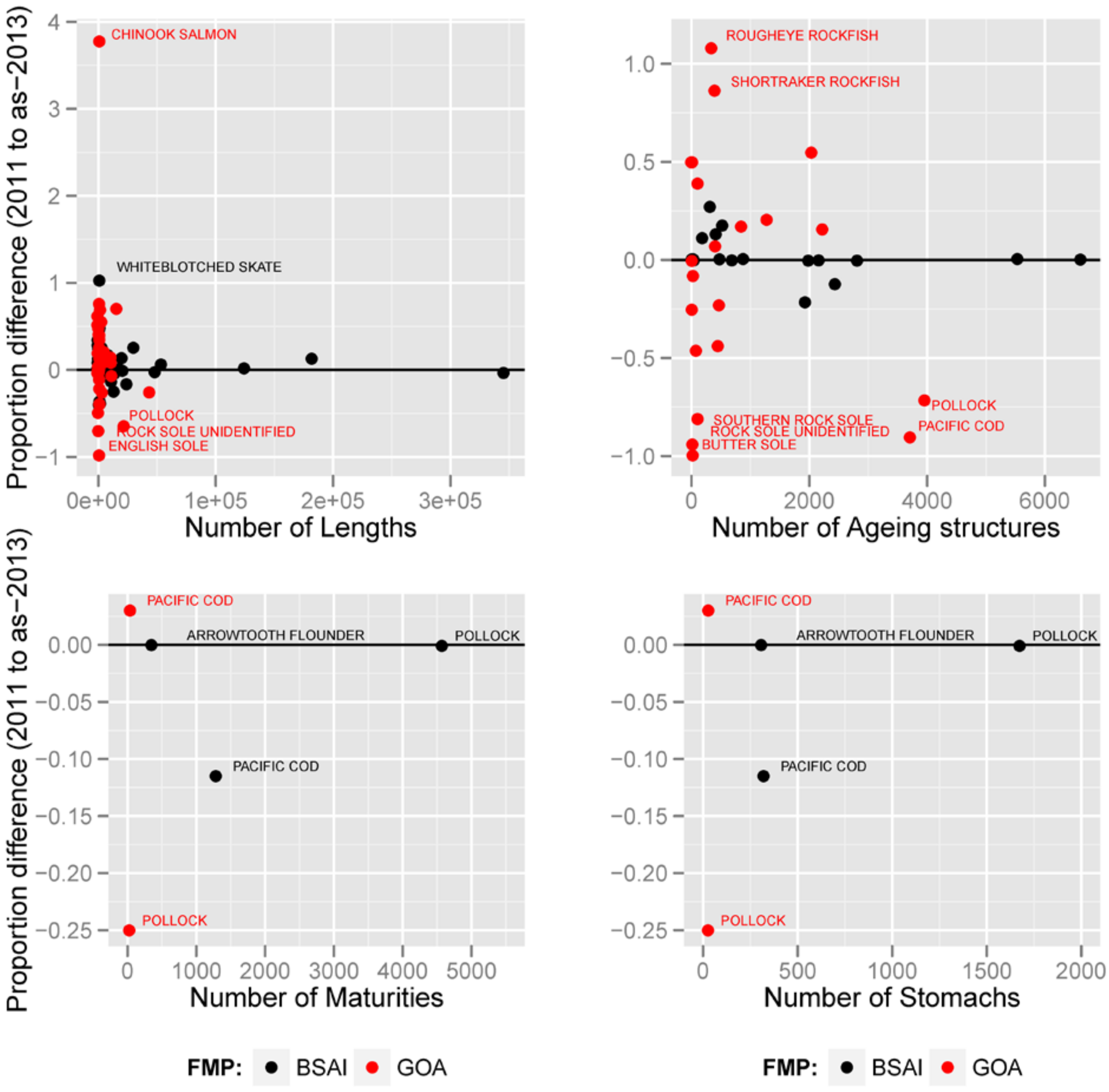


Figure 8. Difference plots between the number of lengths and tissues that were collected by NPGOP observers in 2011 compared to the number that would have been expected had 2011 been sampled according to this ADP within each FMP. Point labels are somewhat arbitrary and are depicted to reflect those species that exhibited the greatest difference values where graphic space is limited.



Appendix 1. Background information

History of the North Pacific Groundfish Observer Program (NPGOP)

Observers are people who collect independent information on the total impact of fishing operations on natural resources. The deployment of observers onto fishing vessels began in the Bering sea in 1973 and in the remainder of the North Pacific in 1975 (Wall et al. 1981, Nelson et al. 1981). Fisheries in the North Pacific were initially prosecuted exclusively by foreign and later by “joint venture” operations where a developing domestic fleet of catcher vessels delivered to foreign owned processing vessels. During the foreign and joint venture operations, foreign vessels carried fisheries observers at their expense, while domestic vessels were exempted from this “observer coverage”. As foreign vessels’ rights to fish in the U.S. Exclusive Economic Zone (EEZ) were reduced over time, it became obvious that observer coverage would be necessary for the emerging domestic fleet. At the onset of fully domestic fishery operations in 1990, the NPGOP was established as an interim observer program with rules governing observer coverage codified in regulations that stand to be amended in 2012.

In summary, the regulations established in 1990 required vessels 60-125 feet in length (overall) and all vessels fishing pot gear to carry observers at their own cost for 30% of their fishing days in a calendar quarter plus at least one trip in each fishery they participate in (termed the “30% fleet”), and vessels greater than 125 feet in length to carry an observer for 100% of their fishing days at their expense. Vessels less than 60 feet, those fishing jig gear or those fishing with trawl gear that deliver unsorted cod ends to processing vessels (termed “catcher processors” or CPs if the vessel also has catching ability and “mothership” or M if the vessel does not) were exempted from observer coverage. So too were catcher vessels that fished for Pacific halibut (*Hippoglossus stenolepis*). For shoreside processors, the rules governing observer coverage were based on the estimated tonnage processed in a calendar month: plants that processed less than 500 metric tons (t) a month are exempted from coverage, those that processed between 500 t and 1,000 t a month were required to be observed for 30% of the calendar days, and those that processed more than 1,000 t a month were required to be observed for each day in the month.

There were several shortcomings that were identified with the establishment of the NPGOP. First, decisions as to which trips were assigned an observer were made by the vessel owner/operator. Second, costs to the fleet were inequitable. Vessels required to obtain observer coverage pay the direct costs of that coverage to an observer provider. Although contracts for observer coverage were made between a vessel or plant operator and an observer provider, and costs were largely held in check through an open market for observer provider services, the cost of an “observer day” was greater than a day of fishing or processing without an observer. Since the cost of an observer day was fixed, the cost of observer coverage in terms of a day represented a disproportionately larger cost in terms of daily earnings for smaller entities than for larger ones (so-called economics of scale). In addition, since observers collect information such as bycatch (defined here as the catch of non-target species, including “prohibited species catch” (PSC) i.e. species not allowed to be caught with certain gear types, and protected species such as seabirds and marine mammals), and monitor for regulatory compliance, observer data are used by NMFS to constrain fishing operations through fishery closure or enforcement action. For all these reasons, there have been longstanding concerns that observer data may not represent the true operations of fishers. This so-called “observer effect” has been documented in the NPGOP (Faunce and Barbeaux 2011).

Towards a restructured observer program

Soon after the establishment of the domestic observer program, efforts were made by NMFS and the Council to provide NMFS control over where and when observers were deployed. Lacking that control, managers had no ability to address information needs through the directed collection of observer information. At issue was the fact that in order for NMFS to gain the control it desired, a funding mechanism needed to be established, enabling NMFS to enter into contracts with observer providers; i.e., the NPGOP would have to be “restructured”.

In 1992 the Magnuson Stevens Act was modified to allow for the establishment of a fee-collection system and a North Pacific Fisheries Observer fund. This system of fee collection was termed the “Research Plan” and was adopted by the Council in 1992 and implementation initiated by NMFS in 1994. One year later, after $5.5 M was collected to capitalize the North Pacific Fisheries Observer Fund, the Council rescinded its support for the Research Plan and NMFS returned the fees with interest the following year. In 1996 NMFS considered a joint operating agreement with the Pacific States Marine Fisheries Commission (PSMFC) envisioning that the PSFMC would serve as an observer provider, but that approach was abandoned over liability issues in 1998. In 2006 an amendment package was presented to the Council for NMFS to again levy fees and enter into direct contracts with observer provider companies. However, uncertainty on the cost implications of the Service Contract Act and Fair Labors Standards Act led the Council to delay action on the amendment package for another two years. In 2008 the Council directed NMFS to draft a discussion paper on the status of the 2006 fee obstacles. The Council drafted a problem statement at its December 2008 meeting that outlined shortcomings of the existing observer program that included: disproportionate costs to participants, lack of data on a large portion of the fleet, and the inability for NMFS and the Council to address management needs through the collection of observer information due to a lack of NMFS control over when and where observers were deployed. Addressing these shortcomings would form the basis for a proposed regulatory package implementing Amendment 86 to the FMP of BSAI and Amendment 76 to the FMP of the GOA.

At the April 2010 Council meeting, staff presented an initial review draft (EA/RIR/IRFA) for Amendments 86 and 76[6]. The rulemaking analysis described the rationale behind funding mechanisms for a restructured observer program and proposed a methodology for NMFS to procure and deploy observers to address the 2008 problem statement. Contained within this analysis were frequency histograms of fleet vessel sizes that showed large spikes at size categories just below 60 feet and 125 feet overall that suggested vessels at the maximum size for the zero and “30%” class of observer coverage were preferred in this fleet. The analysis also described the allocation of how NMFS would allocate observer coverage in the fleet under different funding scenarios as well as the acknowledgement that the first year of the program would be considered a pilot, and the requirements for moving towards a developing and optimized program were presented. Among the other data presented were a suite of tables showing the amount of funds required to enact a restructured program according to Council motion, alternatives whereby some portions of the fleet would be assessed a fee and others would not. Perhaps most surprising was that the analysis identified that collection of a 2% ex-vessel value fee (the maximum permissible by the Magnusson-Stevens Act) from all participants would not adequately fund all of the observer program coverage needs in some years, due largely to numerous catch-share programs that had been instituted since 2000 which required an observer for 100% of their operating days and in some cases two observers (termed confusingly as 200% coverage). These “full-coverage” vessels included the American Fisheries Act (AFA) which includes catcher vessels and catcher processors that fish walleye pollock (*Theragra chalcogramma*) in the BSAI, trawl catcher processors receiving certain groundfish allocations under Amendment 80, and the GOA Rockfish Program (RP) in the GOA.

In October 2010, the Council received the public review draft of the Amendment package that contained a requested suite of alternatives whereby various components of the restructured fleet (based largely on vessel size) would be exempted from paying a fee. Due to projected funding deficiencies and complex observer requirements intertwined with management of PSC caps under catch share programs, new regulations divide the fishing participants into two classes: those requiring observer coverage on all of their operation days (full-coverage), which would be kept in their current form (contracting directly with

[6] The secretarial review draft of this document can be accessed at http://www.fakr.noaa.gov/analyses/observer/A86%20and%2076%20ea_rir_irfa.ea.pdf.

observer providers at their expense); and all other entities that would constitute the "restructured" portion of the fleet and be subject to a fee (partial coverage). Vessels and plants in the full-coverage category would obtain coverage using a pay-as-you-go model and contract directly with NMFS-certified observer provider so all trips are observed and regulations governing coverage requirements are met (e.g., number and type of observers on each trip). In contrast, the partial coverage portion of the fleet would receive observers through an observer provider contracted directly with NMFS. Funding for the observer days on vessels in the partial-coverage category will be obtained through an ex-vessel fee on landings.

Small vessels present logistical challenges for the deployment of observers and NMFS concluded in the analysis that vessels sized below 39' LOA harvested less fish per trip then larger vessels. The first few years of the re-structured program will allow NMFS to better assess deployment needs on smaller vessels. The NMFS proposed an initial "zero-coverage" category to be comprised of vessels fishing hook-and-line or pot gear that are under 40 feet length overall, and all jig vessels, subject to modification in future deployment plans. In addition, consistent with existing regulations, trawl vessels delivering unsorted cod ends to motherships were to be exempt from coverage. The Council unanimously decided to move forward with the restructured observer program, and after considering exempting certain vessels from the fee, decided that all participants in the restructured fleet, whether they were slated for observer coverage or not, would be subject to a 1.25% fee to fund subsequent years of the observer program. The first years funding required start-up money from the federal government with a projected need of $3.8M. Furthermore, the Council specified that NMFS release an observer report by September 1 of each year that contains the proposed strata and coverage rates for the deployment of observers in the following calendar year (NPFMC 2010). Staff from the Fisheries Monitoring and Analysis Division (FMA), the body responsible for the training and data quality of observers in the NPGOP of the Alaska Fisheries Science Center (AFSC) organized an Observer Restructure Analysis Group (ORAnG) in July 2011 to provide analytical guidance and support towards the effective and efficient deployment of observers in the North Pacific. In April of 2012, the Council asked for an update on the progress of the observer report, which they received in June 2012. Since it is concerned with the deployment of observers, the observer report in the Council's October 2010 motion was renamed the Annual Deployment Plan (ADP).

Background to the 2013 Innovation

Compared to a human observer, electronic monitoring (EM) technologies offer a way to obtain independent fishery data onboard vessels where space is limited and/or safety is a concern. Since vessels pay for human observers on a cost-per-day basis in the current NPGOP, it has been proposed that EM technologies such as cameras offer cost-savings to fleet members, although in practice the results of such cost comparisons have been mixed (e.g. Bonney et al. 2009, Cahalan et al. 2010, Dalskov and Kindt-Larson 2009).

As expressed by the Council motion on proposed final regulations, EM is to be integrated into the restructured observer program (NPFMC, 2011). At the Council's Observer Advisory Committee (OAC) September 15-16, 2011 meeting it was concluded that the initial phase of the EM program should focus its initial efforts on IFQ vessels 40-57.5' in length that are not managed by real-time data and are not constrained by Prohibited Species Catch (PSC) (OAC, 2011).

One unforeseen limitation to EM implementation by NMFS following the recommendation of the OAC involves the definition of an IFQ vessel. IFQ is a quota management system where the right to harvest pacific halibut or sablefish is issued to a permit holder that is an *individual*. However, the OAC intent is to deploy EM on IFQ *vessels* of a certain length. Therefore, the NMFS is forced to define the EM eligible frame of vessels to those 40-57.5' in length that have an IFQ holder onboard. Unfortunately, an IFQ holder on board is unknown before a fishing trip begins, and it would be impractical to deploy and then retrieve EM equipment on a trip-by-trip basis. Since both IFQ halibut and sablefish seasons are open between March and November, and the deployment duration for vessels in the "vessel-selection" stratum of this ADP is a calendar quarter for 40-57.5 foot long vessels, IFQ vessels were defined as those in the 2013 "vessel-selection" stratum that have a history of landing IFQ in prior years during quarters 2-4.

Case-studies of EM in the North Pacific

There are few case studies where video imagery has been used to extract data for catch estimation. This statement may seem to conflict with the understanding of fishers and their representatives in the North Pacific. In the development of this ADP between 2010 and 2012, there have been frequent references to "the Canadian model" without a full appreciation of how that model works. To clarify, in British Columbia camera systems have been used as an important monitoring tool in the commercial groundfish hook and line and trap fisheries. These fisheries are 100% monitored by cameras to capture video footage of hauling that are associated to Global Positioning System (GPS) and to winch sensors on all boats to identify set and haul locations. Vessel operators are required to maintain accurate logbook records of catch and discard and have 100% dockside monitoring of piece counts and weights. Because of the difficulty in identifying rockfish species and the potential for discard mortality, fishermen are required to retain and unload all rockfish, and biological data such as length and weight are collected dockside. A random selection of video data is used to audit fisher's self-reported records of discards and retained pieces to ensure rockfish landed weight and piece count provides an accurate record of total catch. Landed weights are used to track all quota species for each vessel. It is important to stress here that the management and official catch records for this system come from the vessels' logbook and dockside reports and not from the EM system. This is an example of an EM-*audit* system that has been in place since 2006 and appears to be successfully employed (Stanley et al. 2009; Stanley et al. 2011).

In Alaska, there have been a number of case studies that have explored the potential use of cameras and video imagery in the halibut longline fishery. The first of these was a feasibility study to monitor bycatch of short-tail albatross in the GOA (Geernaert et. al. 2001). In 2002, EM video imagery was successfully used to detect and monitor streamer line deployment and endangered seabird bycatch, but additional work was needed on species identification from the video (Ames et al. 2005). Two additional studies conducted in 2002 and 2004 onboard volunteer chartered vessels examined the accuracy of fishing effort and catch composition data collected by EM relative to the traditional at-sea observer methods (Ames 2005; Ames et al. 2007). A number of improvements based on the 2002 study results were incorporated into the 2004 study design and agreement between the EM data and the observer data increased. Species identification limitations were still evident in the later study, but the studies suggest EM technology for longline fisheries may have a potential role within a monitoring program.

In 2007, Cahalan et al. (2010) conducted a study on four volunteer commercial longline halibut fishing vessels during normal fishing operations to compare bycatch (numbers of fish) resulting from an observer census, a complete review of EM video, and standard NPGOP sampling. Although both EM and observer data sources were found to have lapses in data collection, EM data lapses tended to encompass large portions or entire trips. Comparison of species identification of catch between monitoring methods indicated statistically unbiased estimates and acceptable comparability for most species except for those such as shortraker (*Sebastes borealis*) and roughgeye (*Sebastes aleutianus*) rockfish that could not be identified beyond the species grouping levels using EM. Similarly, the estimated species-specific abundance (numbers) of fish between EM and observer collected data showed few statistically significant differences. Based on the results of this limited study, it was determined that this EM design could be used as an additional tool for catch monitoring in the commercial halibut fishery. However, the authors cautioned that EM is not an alternative to observers for collecting biological samples and the potential uses of EM would first need to be tailored to monitoring requirements and management needs[7].

[7] For example, EM camera systems lack the ability to captured mean weights of discarded species, which are the basis for catch estimation and would require untested assumptions as would mixed species groups where like species cannot be identified using video imagery.

The Northeast Fisheries Science Center (NEFSC) began a multi-year pilot program in 2010 to test EM technology to collect catch and fishing effort data aboard commercial vessels. The goal of the study was to evaluate the potential of EM to monitor retained and discarded catch on a real-time basis in the Northeast groundfish sector fleet (NOAA, 2011). This study identified a number of deficiencies that would first need to be addressed before EM technology could be considered in lieu of at-sea observers in the Northeast multispecies fishery. Recommendations to improve data quality included the development of a more reliable EM system and modifications to how discarded catch was handled by the crew. The NEFSC stated that further research would also required to improve the accuracy and reliability of species identification and to reliably monitor weights of discard by species, and identified the need to analyze multiple data sources to improve their ability to validate and identify discrepancies between observer and EM collected data. Given the issues identified under the first year of this pilot project, EM was not incorporated as a monitoring strategy in the 2012 fishing year by the NEFSC.

Most recently, the Alaska Longline Fishermen's Association (ALFA) received funding through a grant from the National Fish and Wildlife Foundation for 2011 and 2012 to focus on EM integration logistics for the small vessel fixed gear fleet in southeast Alaska. ALFA have developed an approach and successfully integrated camera based EM systems on multiple vessels and fishing configurations. The final report and results will be given at the September, 2012 OAC meeting[8]. FMA staff provided initial technical review of the electronic monitoring information obtained by this study in 2011 and 2012. At the end of that time, many of the data quality issues identified by earlier studies described in this section were still present. These include lapses of EM video data, poor video quality that degraded during a trip unless camera lenses were clean periodically, and difficulty with identification of some fishes to species level[9].

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[8] Dan Falvey, personal communication.

[9] Farron Wallace and Paul McClusky, FMA staff, personal communication

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Appendix 2. Effort Calculations

Problem statement

This document outlines the rationale, process, and decisions used to estimate fishing effort (*E*) in terms of days and trips. Since it has been proposed that catcher processors and motherships will carry an observer for 100% of their trips and pay for their observers using *status quo* methods, these effort calculations are only concerned with the catcher vessel fleet. These estimates were necessary to generate potential at-sea and dockside sampling rates that could be afforded by the National Marine Fisheries Service (NMFS) as part of the 2013 Annual Deployment Plan.

Available data

Since the regulatory authority of the NMFS Observer program does not extend to State managed Guideline Harvest Level (GHL) fisheries, there is need to identify which trips occurred in each in GHL vs. non-GHL fisheries. In addition, since rules governing which trips belong in each selection stratum are based on gear and vessel size, these fields are necessary as well. Finally, these information need to be relevant to the unit of deployment, i.e, the trip.

Data for effort analyses come from several sources. The Alaska Regional Office's (AKRO) Catch Accounting System (CAS) contains the necessary tables to examine the enumeration (weight), identification (species), and disposition (retained vs. discarded) catch of Fishery Management Plan (FMP) defined groundfish and prohibited species as well as the relevant landing information such as vessel, port, date fishing began, date of landing, port of landing, gear type, management program, and NMFS statistical area in which the catch was made. In 2010 the Fisheries Monitoring and Analysis Division of the Alaska Fisheries Science Center (FMA) began to include the field linking *e*Landings to the observer records (report id) on their offload forms as part of their debriefing data requests for observers. This field is obtained from catcher vessel landing reports, and provides a link between the observer database NORPAC and the CAS, facilitating the identity as to which trips were observed for 2010 and 2011. In addition, since observer data represent independent information, decisions as to the validity of self-reported landing data can be assessed for observed trips.

Data limitations

Just as financial advisors warn their clients that "past performance does not guarantee future results", there is no guarantee that trends identified in the fishing effort of past years will adequately reflect future effort, especially if changes to the allocation of quotas occurs during the period between last available landings and observer data and the year of planned deployment.

There are limitations to broadly applying observer information to categorize the behavior and characteristics of all catcher vessel fishing operations. For example, prior to this ADP, observers were not deployed onboard catcher vessels fishing with jig or troll gear, or vessels that are less than 60' LOA. In addition, the proportion of observer coverage that occurs within each fishery (based on predominant species caught), NMFS statistical area, and gear type will greatly vary depending on the size of vessels and the type of management program they are fishing in. For example, there were three broad rules governing observer coverage requirements for catcher vessels. First, observers were to be deployed on 30% of the fishing *days* per quarter for catcher vessels 60-125' fishing hook and line or trawl gear, and 100% of fishing days per quarter for larger vessels. However, vessels over 60' LOA fishing pot gear retained 30% coverage based on *gear*. Second, any trip that a vessel fished under a cooperative management structure (e.g., AFA, RP, Amendment 80), was to be observed. Third, a vessel was required to obtain observer coverage for one trip in each fishery (defined by target species from landings) the vessel participated in each quarter. Vessel operators had control over which fishing operations were observed and not all ports vessels land catch at shore had been visited by observers.

Methods

A graphical representation of the process through which the fishing effort and trip definitions were determined is depicted in Figure A3-1. Since the electronic dockside reporting system for catcher vessels (*e*Landings) and current North Pacific Groundfish Observer Program (NPGOP) at-sea sampling and database structures were implemented in 2008, the three most recent years of information (2009-2011) were chosen as the time frame for investigation.

<u>Defining a trip</u>

Two options were examined to define a trip. The first was to concatenate a vessel's permit number and the "landing date" field on the landing report to generate a "trip label". The second was to treat each landing report (an auto-generated unique 6-digit number) as a separate trip. The first method is conservative in terms of total trips, and attempts to "correct" for the possibility that multiple landing reports are filed for the same trip while ignoring the possibility of multiple landings in a day, while the second method has the opposite assumptions. The first method is most problematic for small CDQ trips. To evaluate which definition would be appropriate for ADP evaluation analyses, the relative rates of "duplicate trips" were determined for the identifiers Program Management Code, NMFS area code, FMP area, Processor identification, and trip target separately for each trip definition by summing the number of duplicated trips and dividing by the total number of trips. Trip definitions based on landing report identification number was preferred because (1) the duplication rate was lower for this method than for the vessel and date method, (2) it is easy to match with observer records, and (3) the assumption that a report id was equivalent to a trip would at maximum, overestimate the number of true trips by 3-4%, which would in turn act as a buffer for NMFS against the risk of "over deploying", i.e. running out of observer funds due to deploying observers into trips at a rate that results in a greater number of observed trips than that afforded by available funds (last column of Table A2-1).

<u>Creation of the OBSFRAME</u>

The dataframe "DATAFRAME_OUT" was used to create a dataframe of landings information that corresponds to a sampling frame for years 2009-2011 following the proposed 2013 Annual Sampling Plan (OBSFRAME_OUT). Both DATAFRAME_OUT and OBSFRAME_OUT have an additional flag identifying whether a trip had been observed that was facilitated using the common field "landing report id" between landings source data and the observer database NORPAC. It is apparent that FMP Area and Processor ID are fields that are duplicated within a Report ID. The former of these is expected, while the latter is evidence of "split deliveries" in which a vessel made one landing, but completed two landing reports. Interestingly, when the landing report definition of a trip was applied to only those trips that would belong in a restructured observer program, duplication rates were greater than those when calculated across all CV trips (the last three rows of Table A2-1). It seems logical that larger vessels (i.e. those in the OBSFRAME_OUT) would have a greater proportion of split deliveries than vessels < 40' and those fishing jig or other gear.

<u>Calculating trip duration</u>

Accurate accounting of fishing effort in terms of days is very important because it translates effort into costs since traditionally observer providers have contracted with vessels at a "daily rate"[10]. While landing reports have the fields describing the date when gear was first put into the water during a trip (date fishing began) and the date fish were landed (date of landing), the difference between these two times may not adequately reflect trip duration because it does not contain the span of time from departure (i.e. leaving the dock) to the date fishing began. In addition, for split deliveries, it is unclear whether the vessel reported the date of landing for the first delivery or of the last and in some cases (particularly IFQ) the date fishing began may reflect the date a vessel left a dock. Finally, for the purposes of observer coverage, a trip in which fishing began and landing date were the same would not be free, yet it would be

[10] Personal communication and e-mail correspondence between Heather Weikart and Craig Faunce (both of FMA) during January-March 2012.

a “zero-day” trip if one were to simply subtract the two dates on the landing report. To help alleviate some of these issues, for any given landing report, the minimum “date fishing began” and the maximum “date of landing” were labeled as START DATE (START) and END DATE (END) respectfully and used in duration calculations.

Although limited, there exists observer data from catcher vessels that can be used to gauge the relative difference between trip duration, defined as the difference between the two dates in the landings reports and the “Embark date” and “Disembark date” reported in NORPAC. Unlike the duration on landing reports, the duration using the fields above should reflect the true duration of the trip from cast-off to tie-on of the dock. Trips used for comparisons were constrained to those that would have defined and constituted the 2013 trip-selection deployment strata that occurred during 2010 and 2011.

Time data from NORPAC fishing trips are specific to the second, whereas data from “OBSFRAME_OUT” (and ultimately *e*Landings) is specific only to the day (times default to midnight). A total of 713 and 842 trips in the OBSFRAME_OUT dataframe were recorded as observed during 2010 and 2011 respectfully (the *e*Landings report id was not required in NORPAC until 2010), from a total of 166 unique vessels during that period (147 in 2010 and 151 in 2011) ranging from 60 to 176’ in length.

Two different methods were used to calculate the duration of an OBSFRAME trip using landings source fields: (1) the difference between START and END with time removed (dates only, labeled as Tix), and (2) the same as #1 but with an additional day added (labeled as Tix round). Similarly, the duration of an OBSFRAME trip using NORPAC source fields was defined in two ways: (1) rounded durations to the nearest day (labeled as Obs) and (2) durations with an additional half day added (labeled as Obs round). Only a half day was added to NORPAC source durations because these trips had a greater specificity, and many trips that ended in the morning would not account for that day of observer coverage.

Three differences were calculated between NORPAC and *e*Landings source durations: The first was calculated from Obs – Tix, the second was Obs Round – Tix and the third was Obs round – Tix round. From these comparisons, difference values greater than zero indicated longer durations from NORPAC source data than landings source data, while negative difference values indicated the opposite condition. Difference values of zero were desired. From the distribution plots of differences, it appears that the addition of one full day to landing durations matches well with the observer durations with an additional half day (Figure A2-1). Thus trip durations from landings were adjusted to be defined as 1+(END minus START) rounded to the nearest whole day.

<u>Enumerating yearly effort</u>

The total fishing effort in terms of days was calculated by summing the total trip duration in terms of days for each unique landing report within each year that was contained within the dataframe OBSFRAME (Table A2-2).

Tables and Figures.

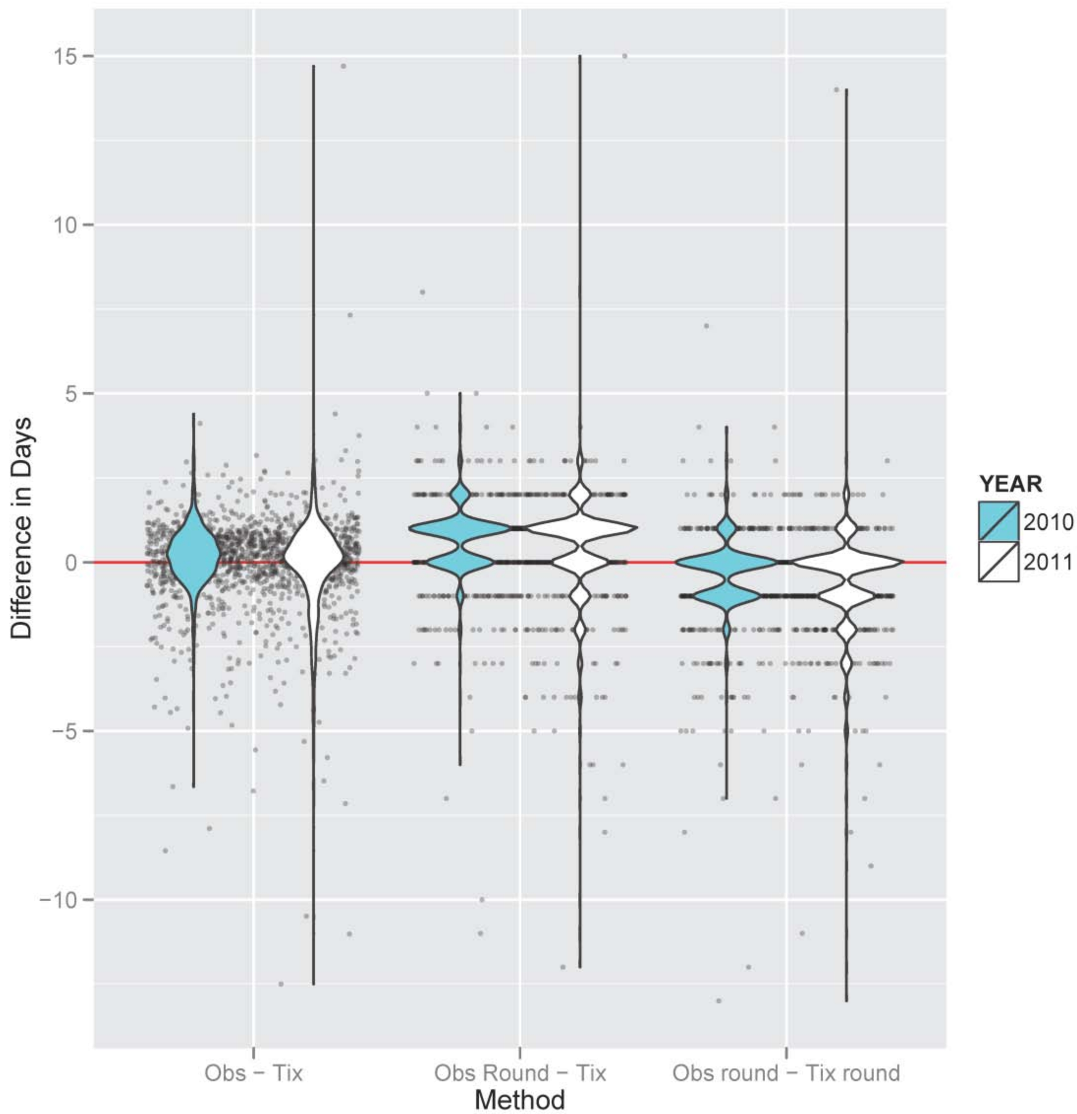
Table A2-1. Summary of duplication rate for trips defined by two methods (vessel ID + Start date or by report id). Duplication rates are expressed as the percent value from each year (2009-2011). The Report column refers to the percentage the total number of trips defined by vessel and date that had duplicate report ids. Application of the Report ID trip definition to trips that would constitute a restructured sampling frame for the CV sector of the fleet in 2011 are depicted in the last three rows of the table.

Method	Year	Mgt. Code	Area	FMP	Processor	Target	Report
Vessel + Date	**2009**	0.874	8.037	0.496	0.362	0.400	3.903
Vessel + Date	**2010**	0.635	7.042	0.419	0.237	0.370	3.961
Vessel + Date	**2011**	0.877	8.956	0.529	0.245	0.264	4.407
Report ID	**2009**	0.588	7.492	0.475	0	0.028	NA
Report ID	**2010**	0.461	6.571	0.381	0	0.046	NA
Report ID	**2011**	0.553	8.484	0.491	0	0.043	NA
Report ID (OBSFRAME)	**2009**	0.794	9.453	0.836	0	0.056	NA
Report ID (OBSFRAME)	**2010**	0.621	7.947	0.494	0	0.051	NA
Report ID (OBSFRAME)	**2011**	0.700	8.757	0.788	0	0.050	NA

Table A2-2. Total number of trip duration days calculated for each year within what would constitute the 2013 partial coverage CV sampling frame.

Year	Days
2009	30,402
2010	32,306
2011	31,803

Figure A2-1. Violin and scatter plot of differences in the duration of trips defined in three different ways (see text for details). The width of the violin plots corresponds to the amount of data, so that wider positions have more data. Similarly, the appearance of the scatter points behind each violin plot is more intense (darker in color) where more data occur.



Appendix 3. Abbreviated methods

This section depicts the workflow, including source (input) and sink (output) files used in this document. It is intended to serve as a quick reference guide to the methods used to produce the ADP and supporting appendices. Input database tables and output file names are denoted as circles, while specific processes (the task performed on the data) are depicted in boxes.

Figure A3-1. Workflow diagram of effort calculations used in Appendix 2.

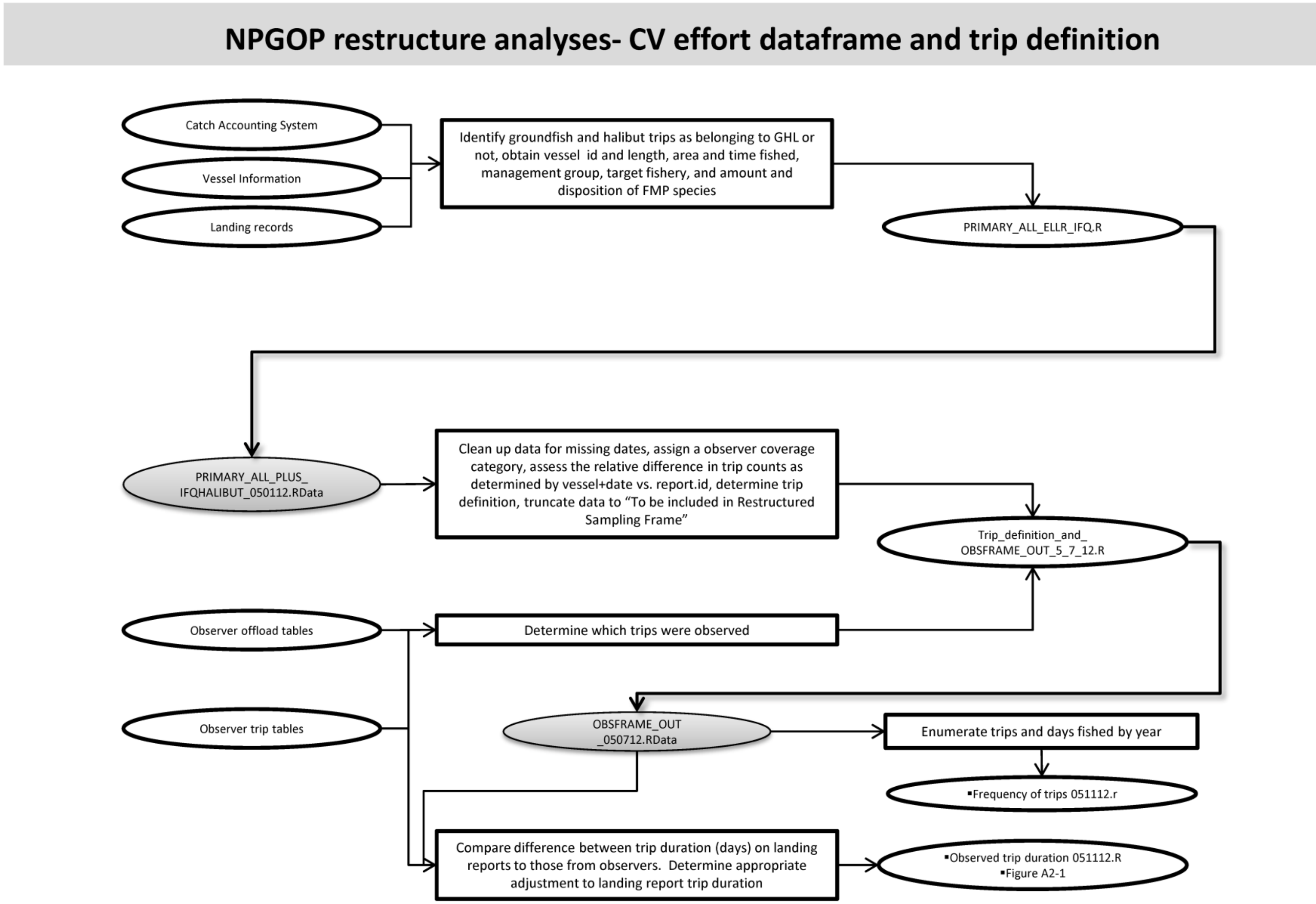


Figure A3-2. Workflow diagram of CV simulations.

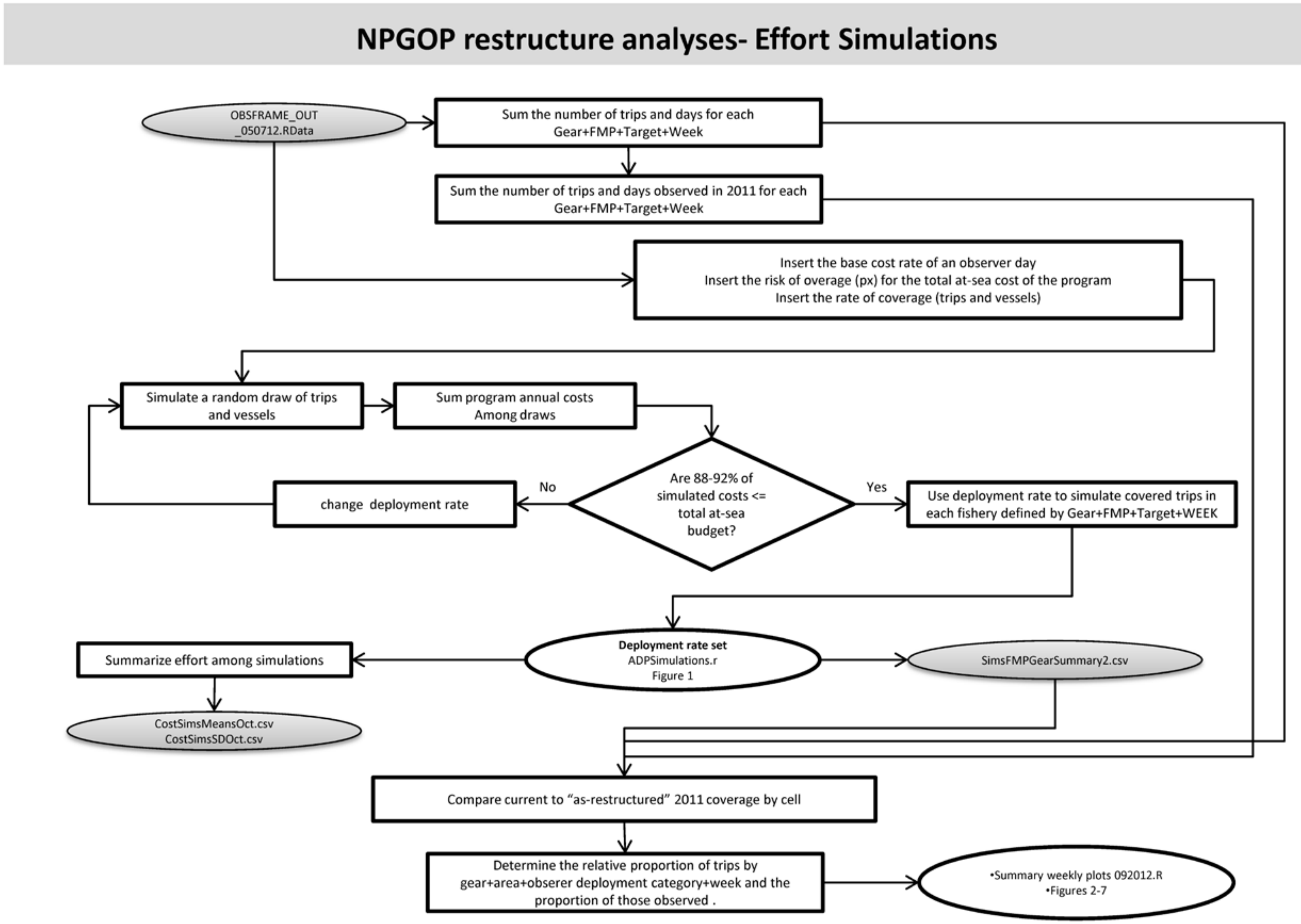


Figure A3-3. Workflow diagram of length and tissue simulations.

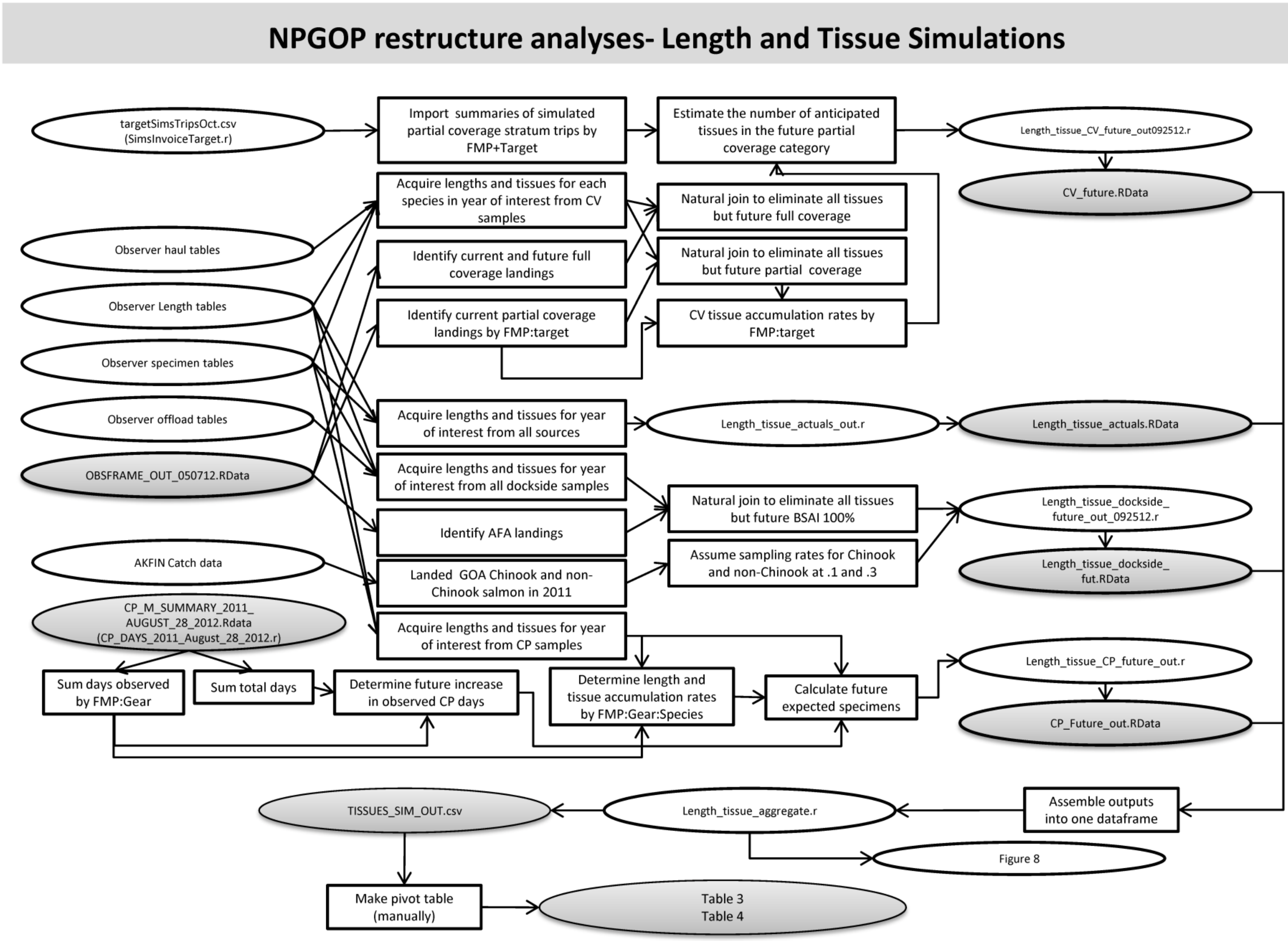


Figure A3-4. Workflow diagram of GOA salmon cost estimate.

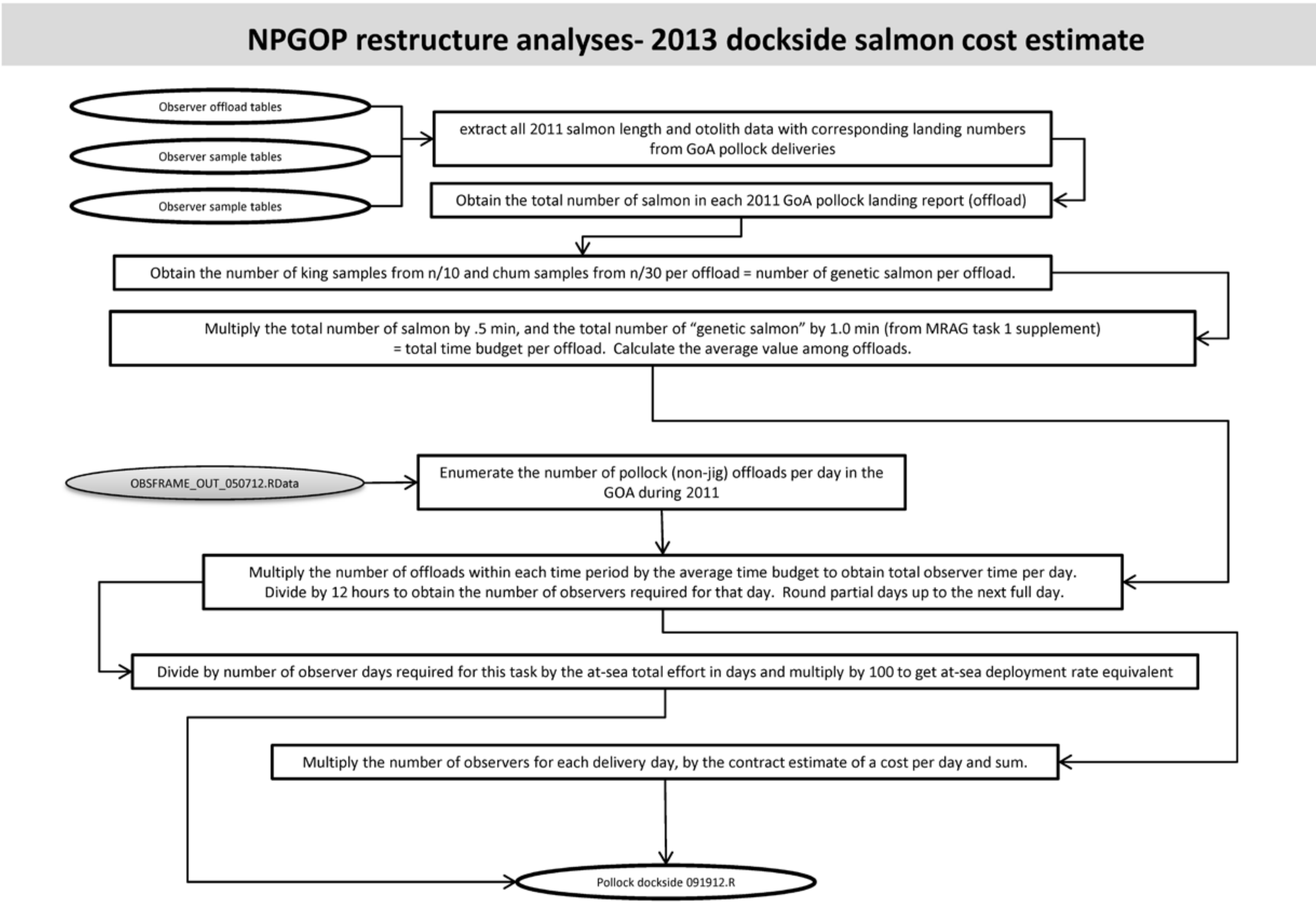


Figure A3-5. Workflow diagram of total program changes.