



## **Joint Meeting of the Groundfish Plan Teams**

### **Plan Team Report**

September 19-22, 2023

#### **BSAI Groundfish Plan Team Members:**

Steve Barbeaux	AFSC REFM (co-chair)	Kalei Shotwell	AFSC REFM (co-chair)
Diana Stram	NPFMC (coordinator)	Phil Joy	ADF&G
Steven Whitney	NMFS AKRO	Cindy Tribuzio	AFSC ABL (vice chair)
Allan Hicks	IPHC	Andrew Seitz	UAF
Lisa Hillier	WDFW	Beth Matta	AFSC REFM
Kirstin Holsman	AFSC REFM	Jane Sullivan	AFSC ABL
Andy Kingham	AFSC FMA		

#### **GOA Groundfish Plan Team Members:**

Jim Ianelli	AFSC REFM (co-chair)	Sandra Lowe	AFSC REFM
Chris Lunsford	AFSC ABL (co-chair)	Nat Nichols	ADF&G
Sara Cleaver	NPFMC (coordinator)	Jan Rumble	ADF&G
Abby Jahn	NMFS AKRO	Paul Spencer	AFSC REFM
Craig Faunce	AFSC FMA	Kristan Blackhart	NMFS OS&T
Lisa Hillier	WDFW	Ben Williams	AFSC ABL
Pete Hulson	AFSC ABL	Cecilia O’Leary	AFSC RACE

### **Introduction**

The Joint meeting for the Groundfish Plan Teams (“Teams”) began on Tuesday, September 19, 2023 at 9:00 am PST at the AFSC. Participation was both in person and offered remotely via Zoom. Roughly 75 people attended the meeting in person, with many more signed in remotely, but attendance varied throughout the meeting. All documents and presentations were posted to the Teams’ [electronic agenda](#). All presentations are also linked in the header for each agenda item in this report.

*Future meetings:* Dates for 2024 meetings are: September 17-20th, November 12-15th.

### **Council staff updates**

Diana Stram and Sara Cleaver presented relevant recent and upcoming agenda items at the Council and advisory committee meetings. They reminded the teams that there are vacancies on both Teams and the Teams recommended that a call for nominations be released after this meeting.

Cindy Tribuzio presented updates on the Data Limited Methods Working Group (WG). The WG has identified priorities (listed on slide) and plans to present some results to the Teams and SSC in September 2024. Cindy encouraged anyone interested in joining the WG to reach out to her.

## Research Priorities

Nicole Watson (NPFMC) presented the Council/SSC's new process for research priorities. Within this process, the Groundfish Plan Teams are expected to provide their review of existing research priorities that are already included within the [database](#), new priorities that are submitted to the [online portal](#) prior to the October 31st deadline, and any additional priorities that come from Team members themselves. Chris Lunsford proposed a description of how the Groundfish Plan Teams could conduct their review of the priorities, and the Teams agreed on this process. Team members will receive further direction through email after October 31.

**The Teams recommended AFSC track the progress of AFSC led projects that address any of the 8-12 priorities selected by the Council.** It is also challenging for anyone, AFSC or otherwise, to know whether there is research on any past or current priorities being planned, conducted, or completed. One team member suggested that Team members could potentially update the Teams if they know of the status of any projects related to priorities that have been submitted.

At the time of the meeting, it was still unclear how the Bering Sea FEP task forces on climate change and local knowledge, traditional knowledge, and subsistence will be reviewing research priorities.

The Teams will meet January 17, 2024 for the virtual meeting on groundfish research priorities. This is expected to be a half-day meeting. However, prior to the meeting Team members will be expected to have developed their own lists of priorities which will be distilled at the meeting into a list of 3-5 research priorities and then forwarded to the SSC for consideration. Council staff will provide the updated list of priorities in December and detailed instructions for Team members will follow shortly thereafter.

## Halibut DMRs

Michael Fey presented the Halibut discard mortality rate (DMR) estimates for in-season management of the BSAI and GOA groundfish fisheries in 2024 and 2025 as recommended by the Interagency Halibut DMR Workshop.

The Teams appreciated the presentation by Michael and the work of the Interagency Halibut DMR Workgroup. The Teams noted that there have been fewer DMR assessments conducted by observers recently and believed this may be due to fewer halibut caught and/or discarded at sea, as well as a trend of increased use of electronic monitoring (EM). It was also noted that when marine mammals are observed feeding on discards, the condition is reported as unknown. The Teams believed that the decrease in assessments needs to be monitored to ensure there are enough assessments to produce DMRs. It was reported that a recent change in practices by the fleet have resulted in a reduction in the halibut discard mortality rate, if this trend is accurate and continues the Teams would encourage the use of a two-year average instead of the four-year average to better incentivise this change in practices.

## SAFE Guidelines and update on scheduling (including contingency)

Chris Lunsford (AFSC) presented a review of the stock assessment definitions stemming from Agency review in 2023 and input from the SSC and Council in February 2023. He also provided an update on the AFSC contingency plans for stock assessments in light of the potential government shutdown. The AFSC contingency plans for assessments are as follows based upon the length of the shut down in business days:

<i>Shutdown period</i>	<i>Plan of action</i>
< 5 days	All assessments should be completed as planned
6 – 10 days	Evaluate the ability of full assessments to be completed, alternatively produce an update assessment
11– 20 days	Assessments intended to be full would be done as an update assessment. Update assessments would be reduced and include only an evaluation based on the recommended model from the last assessment and 2024 harvest recommendations (both will produce only executive summaries)
> 20 days	The Council should use previously published 2024 specifications to make management recommendations or consider rescheduling assessments and specifications to early 2024

Under the scenario of using only 2024 specifications to set 2024/25 specifications in December, the November Plan Team meeting would likely be a short virtual meeting with limited additional information available for it beyond the survey data available currently. If the Council chooses to delay assessments and specifications, it is possible that assessments could be available for Plan Team review in January and Council action in February 2024. The in-season implications of either scenario are being evaluated. **The Teams discussed the contingency plans for the >20 day issue and recommended that Council staff request feedback from the SSC and Council in October as to which plan is preferable.** The Teams requested Council staff consider the ability to obtain feedback from federal SSC membership prior to a government shutdown so that guidance received from the SSC in October would comprise the full membership.

*Stock Assessment definitions and guidelines:* Chris reviewed the background on 2017 and 2023 efforts on stock prioritization and the resulting assessment products and timelines as well as the revised stock assessment guidelines. There are five categories of assessment types (two are new and indicated by \*): Operational full assessment, operational update assessment\*, harvest projection, catch report\* and research assessment. The teams did not discuss research assessments. Of the four assessments for management purposes, the teams discussed the distinction between a full assessment which considers all data, new model configurations and/or a new modeling program and requires extensive review as compared to an update assessment (new product) which incorporates new data but minimal changes and a reduced workload and review burden. The Teams noted that while plans for a full assessment are determined internally after the December Council meeting, an updated assessment may be elevated to a full assessment on a case-by-case basis at the author’s discretion.

For harvest projections these will be done as indicated in the stock assessment schedule and were formerly known as partial assessments. The catch report is a new assessment type and contains information only on OFL, ABC and recent catch as well as a link to the most recent assessment. The catch reports will be compiled by Council staff and reviewed by the assessment author prior to the

November Plan Team and incorporated into the final SAFE. Diana Stram provided a draft ‘Catch Report’ for feedback from the team and authors on the information and format of these reports.

For assessment schedules, Chris clarified that for the Tiers 4/5 2-year and 4-year cycles the SSC requested full or update model runs of the REMA model during year 2 for the 2-year cycle and during year 3 for the 4-year cycle. This results in the 2-year assessments being conducted annually, and the 4-year assessments being conducted bi-annually as the analytical workload for these assessments is essentially the same for either a full or an update stock assessment (both require REMA model runs). This does not fulfill the aims of the 2023 Council stock prioritization activities, and AFSC requests that the SSC revisit this request and recommend that catch reports be provided as an alternative (see below).

Year	1-year cycle		2-year cycle			4-year cycle		
	Tiers 1-3	Tiers 4-6	Tiers 1-3	Tiers 4-5	Tier 6	Tiers 1-3	Tiers 4-5	Tier 6
1	full/update	full/update	full/update	full/update	full/update	full/update	full/update	full/update
2	full/update	full/update	harv proj	catch rep	catch rep	harv proj	catch rep	catch rep
3	full/update	full/update	full/update	full/update	full/update	harv proj	catch rep	catch rep
4	full/update	full/update	Harv proj	catch rep	catch rep	harv proj	catch rep	catch rep

Note: harv proj – harvest projection; catch rep – catch report

The Teams appreciated the update and concurred with the plans as outlined. The Teams did not have further recommendations.

### [Ecosystem and Socioeconomic Profiles \(ESP\) update](#)

Kalei Shotwell provided an overview of the ESP process, progress, decisions, and report summary along with an update of the current and next year ESP schedules. Several projects continue and are planned regarding statistical importance methods, report reproducibility, data modernization, and climate readiness. The ESP teams plan to begin the new Request For Information (RFI) process in winter 2024 to organize ESP contributions. A summary of the National ESP Initiative workshops was also provided.

Team members commented on the timeline and suggested an offset for stock assessment authors on an annual cycle and when authors are working on a full assessment. Kalei agreed with maintaining an offset of ESP reviews and considering ESP assignments based on whether authors are working on updates or full assessments. At this stage, the ESP authors are only able to conduct a few ESPs annually. Kalei noted that it would be helpful to have more people involved in developing additional ESPs, especially those recommended by the SSC. If people are interested in getting involved they can reach out to Kalei.

Team members appreciated the process improvements for ESPs and the inclusion of climate data. **The Team recommended that the climate information be presented at the Council’s Climate Change Taskforce meeting as a potential on-ramp scheduled for early November in coordination with recommendations from the SSC.** The Team noted that both the R package and stock assessment summary templates developed by the ESP team are helpful to Team members and the National ESP network. Additionally, the Teams highlighted an opportunity for product sharing between the survey team and ESP teams.

## **Ecosystem Status Report (ESR) climate update**

Bridget Ferris provided an overview of the Ecosystem Status Report (climate and physical information) for the EBS, AI, and GOA. This year's presentation highlighted a return to cooler, more moderate conditions across the North Pacific in 2023 after recent, multiyear extreme climate events. However, the Teams noted that the new sea surface temperature (SST) baseline of 1991–2020 versus the previous baseline of 1980-2010 includes several recent marine heat wave (MHW) events. This means that the average temperature is now warmer than previously reported and higher SST temperatures are required to constitute extreme anomalies. Cooler La Nina conditions in the North Pacific are transitioning to warming conditions with the upcoming El Nino, but climate indices are currently not aligned as would be expected during El Nino. The authors suggested that this could be due to a time lag within the indices or that this El Nino is developing differently from those in the past. Relative to SST and sea ice extent data, the Teams suggest that a consistent baseline be used year to year to aid in comparisons, and if different baselines are used, to explicitly note them as such.

In 2023, EBS conditions were characterized by average SST with brief and infrequent MHWs, delayed sea ice formation, and average cold pool extent. The cold pool tongue was shifted more inshore than in recent years with the coldest bottom temperatures observed in the inner domain since 2013 and very cold water observed south of St. Matthew for the first time since 2015. Redistribution of fish and crab stocks is not expected based on the current cold pool location. AI conditions were characterized by record high SST and weakening eddy kinetic energy, resulting in reduced flow through passes. The GOA is currently experiencing the 4<sup>th</sup> consecutive year with no persistent MHW events. Brief summer MHWs in 2023 likely resulted from a lack of storms and increased stratification within the water column. New for this year, the authors presented a method for forecasting northern GOA SST based on Sitka air temperature anomaly data.

The Teams again acknowledge the immense effort of the ESR authors to collate and synthesize a broad array of environmental indices into a succinct summary that is useful for management advice. The Teams support continued presentation of the ESR to the Teams and appreciate the author's concise presentation format.

### **ESR CIE review**

Ivonne Ortiz presented the ESR CIE review. The presentation reviewed the CIE objectives to revisit the goals and the process of the ESR. Recommendations resulting from the CIE will be addressed over the next 2-3 years. Key benefits / items identified by the reviewers were the risk tables inclusion in the stock assessments, and their discussion with stock assessment authors. The ESR team aims to improve TAC advice, strengthen and formalize risk tables, streamline and automate the report, synthesize information and use synthesis tools, and increase web presence.

The Teams requested clarification on potential refinements to the ecosystem section of the risk table based on the ESR CIE review. The ESR authors noted that different pieces of information from the ESR could inform the population dynamics section of the risk table instead of just the ecosystem section. The Teams requested clarification on terminology used in the submitted table of CIE recommendations on the ESRs and a revised table was reposted in response to this request. The Teams encouraged the ESR authors to put ESR data on AKFIN where possible to improve accessibility in the future.

### **Rockfish genetic stock structure**

Wes Larson presented recent work on the genetic stock structure of commercially important rockfish species. There is the potential for high diversity in rockfish populations and understanding the genetic structure could improve rockfish management. When analyzing genetic structure for the different groups of rockfish (pelagic, slope, and demersal), the author found high genetic structure in the pelagic, schooling, and nearshore rockfish (black, northern, POP, and dark rockfish; exception no structure in dusky). Demersal and offshore rockfish demonstrated no genetic structure (shortspine thornyhead, shorttraker, rougheye/black spotted; potential exception yelloweye). Some of the possible explanations for these differences could be differences in habitats (homogeneous or diverse/complex) and larval connectivity. The author focused on POP where they found multiple genetic forms of POP within the same regions. Wes indicated he would like to do more research into the different POP forms and explore ways to integrate genetic information into management. In response to a question from a Team member, the author noted that observed genetic differences are very high for rockfish and were not due to samples collected in different years because many cohorts are represented in the adult samples. The Teams noted that it would be useful to indicate the year in which samples were collected.

### **EBS krill index**

Mike Levine provided an update to the EBS krill index using saildrone data as a proxy for the missing 2020 data point. The EBS krill index is used in the ESPs and ESRs and filling in the missing 2020 data point is valuable. The Teams asked if mean size across years could be used to inform the model uncertainty, but were informed that the data are limited as krill sampling is a low priority across surveys, not just saildrone research. The Teams asked if there was any indication of seasonality in the backscatter data, could the survey be missing krill due to lack of availability? Mike responded that while it's possible, it is unclear. Krill are relatively long-lived (2-3 years), so seasonality is likely less of an issue.

### **Draft 2024 Annual Deployment Plan (ADP)**

Craig Faunce and Geoff Mayhew presented the draft 2024 Annual Deployment Plan and the Partial Coverage Cost Efficiencies Analysis. In 2019, the Council identified development cost efficiencies in the partial coverage component of the Observer Program as one of its highest priorities moving forward. The draft 2024 ADP explores alternative ways that monitoring resources (observers and EM) could be deployed in a cost-effective manner while improving data quality and scientific utility for stock assessment, catch accounting, and other fishery management purposes. The analytical team sought feedback from the Teams on: 1) the use of interspersions as a metric, 2) the use of the Fixed FMP stratification method, and 3) other scientific concerns.

In terms of information that supports assessments, the Teams continued to be concerned by the decline in biological and composition sampling due to the increase in EM. Geoff stated that with the new allocation method, they would be collecting significantly more biological data collections except for those in GOA pollock due to the decrease in shoreside observer coverage rates in that stratum.

Overall, the Teams supported the inclusion of the interspersions metric and acknowledged the impressive quality of this work. The Team supports future efforts to include species groupings such as flatfish, rockfish, or sharks (or other species that may be more susceptible to data gaps) since they may be more patchily distributed instead of "GOA trawl". Geoff indicated that he could try to post-stratify in the annual report and the Teams noted that this would be helpful.

## Longline survey

Kevin Siwicke provided a presentation on the 2023 AFSC longline survey. The update included information on the survey methods and a summary of data collected on the survey including standard catch, length, otoliths, temperature, and whale depredation, along with special project collections of sablefish eyes, dogfish spines, and genetic samples. Relative population numbers (RPNs) for specific stocks were also presented. A summary of a special project comparing hook and line and slinky pot gear was also provided. This project is designed to develop a baseline of sablefish catch rates, bycatch composition, and gear size-selectivity.

The Teams asked for clarification on the slinky pot experiment regarding any issues with closed escape rings, pot fullness versus hook saturation, and sablefish getting stuck in the escape ring. Several Team members involved with slinky pot experiments replied that it is challenging to conduct an escape ring experiment from the longline survey platform, extreme catches may be better represented by the pots due to hook saturation, and that some larger sablefish did get stuck in the pot. They noted that fish swimming out of the pot from the escape rings or getting stuck may have an impact on killer whale depredation. The Teams also asked about the influence of hook competition on shortspine thornyhead given the survey estimates have dropped over the same recent years of high sablefish recruitment. Kevin noted that the estimates may be conservative but the impact is difficult to determine given that the baits left fishing are not consistently down from year to year. The Teams also asked if sablefish survey estimates could be split out by the depth where shortspine thornyhead are located and if there was any shift in depth distribution for shortspine thornyhead. Kevin replied that the information existed but was not readily available; however, Kevin and a Team member noted that the random effects model for shortspine thornyhead takes depth into account and that an additional observational error term was added to the model last year.

The Teams asked if there was a ranking of species that were appropriate for using the longline survey estimates, after sablefish. Kevin suggested that any stocks in deep water should at least consider looking at the data and that they should talk with the sablefish survey team before use so they know how to use the data appropriately for their stock. The Teams suggested comparing sablefish Bering Sea survey and fishery length compositions as there is not a lot of data in the fishery in this area.

The Teams thanked the sablefish survey team for their excellent timeliness and data delivery efficiencies this year and appreciates the early data availability on multiple platforms.

## GOA trawl survey

Ned Laman updated the Team on the 2023 Gulf of Alaska bottom trawl survey. Two vessels participated in the survey, the F/V ALaska Provider and the F/V Ocean Explorer.

In the summer of 2023, the Groundfish Assessment Program's Gulf-Aleutian Bottom Trawl Survey Team conducted the 23rd trawl survey of the Gulf of Alaska since 1984. Between 18 May and 6 August 2023, the survey team completed 526 trawl stations between the Islands of Four Mountains in the western Gulf and Dixon Entrance in Southeast Alaska. For the second survey year, groundfish scientists worked collaboratively with stock assessment scientists to determine where the survey team could decrease length and otolith sampling effort to reduce rising repetitive motion injuries amongst field staff while maintaining high data quality standards. This effort substantially improved the working conditions on the survey.

Ned highlighted a forthcoming update to the survey design. In 2025, there are plans to roll out a re-stratified survey which will use NMFS management zones. There is a multi-year rollout plan in order to give the stock assessment teams time to work with the data, infrastructure, and products. Beginning September 25, 2024, GAP\_PRODUCTS (a new Oracle schema for data products from all groundfish surveys) will be updated with provisional data, including 2023 data, to compare data products across

years and between new and historical sources. Team members asked if it is a complex process to put data products into FOSS. Ned stated that it is a fairly simple process but they are awaiting data from the Bering Sea survey prior to launching.

The Teams were impressed with the timeliness, quality of data, and graphics produced by the survey team. Team members also expressed gratitude for the survey team. Team members asked if the survey team can update the data repository with contact information. The survey team is working on a product section to add a contact person for each data product. Team members requested if the survey team can combine rougheye and blackspotted rockfish in the summary presentation so it is presented at the same level found in the assessment (i.e., rougheye complex).

### **Winter acoustic survey**

Denise McKelvey presented the update for the winter acoustic survey conducted in February of 2023. The survey completed acoustic-trawl surveys for pollock in the Shumagin Islands area, which included the Shumagin Islands, Pavlof Bay, and Morzhovoi Bay. In March, the acoustic-trawl survey completed the survey in the Shelikof Strait area, which included Shelikof Strait, Chirikof shelf break, and Marmot Bay. There was a question by a Team member on the location of trawl tows and how their placement was determined. The presenter reported that ideally trawls are conducted where there is strong backscatter, but they collect tows as close as practicable in the cases of trawl impediments such as wind and whales. The Teams expressed their gratitude for the immense amount of work by all involved in collecting and making these data available.

### **Summer acoustic pollock survey**

Dave McGowan provided preliminary results of the summer 2023 acoustic-trawl (AT) survey of walleye pollock in the Gulf of Alaska. The 2023 summer AT survey was scheduled for 66 days from June to mid-August however 20 days of the survey were lost due to NOAA Ship Oscar Dyson staffing issues. Fishing and other operations covered the full survey area from the Islands of Four Mountains to Yakutat Trough with reduced sample resolution creating higher uncertainty. Sampling in non-core areas was dropped but the loss of samples from these areas was determined to have minimal impact on biomass estimates and population age structure.

A DriX Uncrewed Surface Vehicle (USV) was deployed in tandem with NOAA ships to evaluate its use as a “force multiplier” for AT surveys. During leg 2 of the 2023 summer survey, the crew developed shipboard procedures to safely deploy, recover, and refuel the USV. Side-by-side testing was done to evaluate data and fish reaction to the survey vessel. The pilot testing also demonstrated that the USV could be controlled by satellite link. Data from this evaluation will be forthcoming. Future goals include reduced propeller cavitation interference and increasing the weather window for deploying and recovering the USV.

The Teams requested that information on age and length frequency be provided in numbers of fish in addition to biomass. New survey technologies were discussed in addition to cost per day for USV use (\$4-5K), vehicle capabilities, as well as the purchase of an USV (~\$22 million).

### **EBS/NBS Trawl Survey results**

The AFSC Groundfish Assessment Program completed the 41st annual bottom trawl survey of the eastern Bering Sea and the sixth modern trawl survey of the northern Bering Sea from May through August, 2023. Results of the EBS survey indicate that the Bering Sea cold pool is similar in spatial extent to 2022, but is colder, and the overall mean bottom temperature and surface temperature are slightly below the long-term mean. In general, fish biomass estimates for commercially important species are down relative to 2022, although Pacific cod, northern rock sole, and Pacific halibut show slight increases in biomass.



EBS survey data and design-based data products were made available to AFSC staff, prior to the PT meeting, which is a result of streamlined processing and efforts by GAP to meet stock assessment needs. These data are normally not available until later in September. Results of the 2023 NBS survey were still being processed at the time of the meeting. The Teams expressed their gratitude for the work carried out by the group and continues to stress the importance of funding for this important activity.

### **EBS BTS Survey Modernization Plans**

Stan Kotwicki gave a presentation about survey modernization efforts in the Bering Sea, including changes to survey design necessary to adequately sample the EBS, NBS, and Slope, and changes to the sampling methods (e.g., doors, floats, mesh, bridles, etc.). Questions from the Teams were focused on leveraging expertise from comparable efforts in other regions (e.g., the ICES bottom trawl survey and the GOA bottom trawl survey). Stan noted that the EBS redesign is unique in that it involves changes to the sampling area, survey design, and sampling methods. Questions from the audience focused on gear (e.g., the potential to use pelagic instead of bottom doors) and calibration methods. Stan stated that the scope of the gear redesign and subsequent calibration is currently unknown and encouraged stakeholder participation in the upcoming October 2023 workshop. The Teams appreciated learning about these plans and look forward to keeping abreast of developments.

### **Ecosystem surveys**

Lauren Rogers presented an update on ecosystem surveys. This was a comprehensive presentation with updates from many surveys. The Teams asked about the presence of rainbow smelt in the northern Bering Sea and were informed that the species is generally not sampled well, but is relatively common in Norton Sound and is a coastal brackish water species related to eulachon. There was discussion about low abundances of large copepods in the EBS and how it may be related to the cold pool being more inshore or colder surface water, however there is no clear mechanism and at this time no available data to explore it further. The Teams asked where the ultimate destination of data products from these surveys is. Many of these surveys are one-off projects as are the data products, some are included in the ESRs/ESPs, others as manuscripts, or GitHub repositories, it varies. There is no consolidated warehouse. The Teams noted that it would improve uptake of the information if made more rapidly or centrally available.

### **Sablefish model**

Daniel Goethel presented expected updates for the 2023 sablefish model, ongoing explorations translating the sablefish model from Automatic Differentiation Model Builder (ADMB) to Template Model Builder (TMB), and preliminary results of a spatially explicit sablefish model. Authors recommended replacing the nominal CPUE index (i.e., using only hook-and-line gear data) to a standardized index (i.e., using both pot and hook-and-line gear data). The assessment impacts of changing from the nominal index to the standardized index are limited. Authors noted that updated whale depredation estimates are unlikely to be available for 2023 and intend to carry over the values used in the past years assessment. No major model changes were proposed, and the 2023 sablefish stock assessment will be considered an operational update.

Potential modeling changes that may be explored for the 2024 assessment cycle, including migrating the assessment to TMB, how best to handle CPUE data (which has become sporadically available in recent years), and ways to address alterations in the sablefish fishery dynamics that may result from a pending NPFMC motion to allow discarding of small sablefish.

The Teams supported all proposed modeling changes for the 2023 operational update assessment, including replacing the nominal CPUE index with a standardized index, and using the last assessments whale depredation values. The Teams supported exploring sensitivity runs for starting the model at age 3 versus age 2 as an option for dealing with a proposed small sablefish release motion being considered by

the Council. They also supported the plan to continue pursuing Management Strategy Evaluations via simulations from operating models.

### **Sablefish fleet changes**

Matt Cheng presented the results of his work on the implications of different approaches for modeling fleet structure (i.e., the rapid transition to pot gear) in the sablefish assessment. Last year, Matt presented work on standardizing sablefish catch-per-unit-effort (CPUE) across gear types and data sources. The current assessment combines hook-and-line (H&L) and pot data together (assumes a single fixed gear fishery), but the index that is associated with this fleet only uses H&L data. This year, Matt is working to incorporate data on pot gear removals using IPHC logbooks and observer data to develop a standardized index of abundance to be used in the 2023 stock assessment. This work addresses the SSC's request to see a model that allows for separate fleets.

There were some questions about the different selectivity parameterizations that were used, especially as relates to the “plus” group. It seems that there is an estimation interaction with the new fishery (slinky pots) being introduced around the same time as the apparent strong year-classes entering the population. That is, the long-term selectivity expectation for the gear type might be for older age classes than are currently available given the data. This could affect how catch recommendations might differ if selectivity was based on the current pattern of “young fish” relative to the estimate (or realization) when the population contains a broader distribution of ages.

### **M prior**

Jim Thorson provided a review of phylogenetic comparative methods (PCMs) for use in fisheries assessment, including an R package ([phylosem](#)). This is a statistical estimation methodology that utilizes the phylogenetic relationships between species when considering the relationships between life-history traits such as mortality (M), growth, and longevity. Jim presented an application to several Alaska stocks, and the method has been used to develop a prior distribution for natural mortality in the EBS Pacific cod assessment. Jim also discussed the potential to use PCM to predict fecundity-at-length parameters, e.g., for rockfishes.

The Teams discussion focused on uncertainty in the estimates of natural mortality, and how they might be used to develop prior distributions. Some applications to Alaska stocks indicate similarity of natural mortality estimates between PCMs and linear models, but PCMs can result in smaller standard errors for well-studied species. An additional advantage is improved estimates of M when there is concern about aging error or missing data for older fish that would motivate using the M-estimator that is based on growth parameters (instead of longevity), which would be improved with phylogenetic information. The Teams suggested that the methods for obtaining estimates of natural mortality (outside of assessment models) deserved more attention, and the PCM methodology could be considered as a subtopic in an existing workgroup on the effect of climate on life-history traits.

### **Archival tag methods**

Jim Thorson presented an introduction to new mechanistic movement models, which predict animal movement given diffusion (residual movement), taxis (movement towards preferred habitat), and drift (movement along a specified direction, e.g., larvae following oceanographic currents).

The Teams discussed habitat covariates considered and the future of this work. It was emphasized that there may be a size limitation of fish species that can be tagged using the current PSAT technology used in this project (currently limited to sablefish, sharks, halibut, and Pacific cod in Alaska), that the PSAT equipment is expensive, and that the funding provided for some of these species through the GOA Pacific cod disaster relief funds is not available for all species. However, it was noted that the method described

by Jim can incorporate data from many different sources including the full range of tag types including the standard Floy tags, archival (i.e., temperature and depth only), or even acoustic data from moorings as seen for pollock, into a single model framework and therefore not limited in a need for PSAT data.

The AFSC is in the process of creating a unified tagging database including electronic tags. It was emphasized that the methods described by Jim is one way all of the available data can be integrated and potentially provide a wide range of products that could be used in stock and essential fish habitat assessments. Current PSAT work by the sablefish and Pacific cod tagging groups has already made contributions to the stock assessments, there is hope that these types of programs may be expanded to other species as costs are reduced and methods are better developed.

### One step ahead residuals

Cole Monnahan presented the calculation of one-step-ahead (OSA) residuals and their properties, provided examples from some North Pacific stock assessments, and proposed a protocol for AFSC authors to report and interpret them. The OSA residual method appears to be a better alternative to Pearson residuals for validating model fits to composition data due to non-normality and the correlation structure of composition data. Cole noted that calculations are available and easily implemented through the use of an [R package](#) (oneStepPredict). He recommended using residual “bubble” and QQ plots for model diagnostics. The Teams encouraged further development on the use of OSA residuals for diagnostics and noted interpretation of Pearson residual plots for composition data should be treated with caution.

### Index Likelihoods

Cole Monnahan provided a presentation on a novel way to treat index data. He first noted that lognormal distributions are widely assumed for fitting index data within stock assessments. Explorations of distributions of survey estimates via bootstrapping suggests that the distribution “shape” varied broadly over different years. Fitting annual distributions using a generalized gamma (GenGam) showed that in most years the distribution was poorly described as being log-normal. By introducing the parameters to the annual GenGam distributions within some example assessment cases Cole showed that it impacted the assessment outcomes. The Teams noted the logic and innovation of the approach and encouraged more analyses. In particular, more comparisons on the differences between VAST and design-based GenGam distributions may be instructive. The Teams also was interested in how this approach behaves for patchy, high-CV species.

### Retrospective patterns

Meaghan Bryan presented a review of comparative approaches to determine if there is a “strong” retrospective pattern in an assessment model. The present method uses a rule of thumb approach to define significance based on natural mortality. The goal of their review was to compare this to two alternative approaches to determine retrospective pattern significance 1) the “model approach”, where values outside the null distribution (centered on zero) suggest significance, and 2) the “data approach” using the mean of the observations and weights from observed data, where a  $p$  distribution that does not contain zero indicates significance. These approaches were applied across a series of individual assessments and they found that the methods do not always agree. As such they recommend using a conceptual framework of statistical and scientific significance for when to consider model adjustments or inclusion in risk tables for ABC adjustments. It is more computationally expensive than the rule of thumb, therefore the authors suggest using the alternative approaches when introducing a new model or for stocks where observed  $p$  changed dramatically between full assessments, stocks that are changing rapidly or near overfished status, or stocks that had historically large  $p$  values.

The Teams appreciated the presentation and expressed interest in further discussion of using this approach or something similar to help inform discussions of model performance. The Teams noted that presently there is not a consistent use of the rule of thumb approach but something like what Meaghan presented would be of high utility for consistency across assessments. The Teams also discussed that it would be useful to see a bit more evaluation of why the methods sometimes differ. The Teams noted that there wasn't a lot of clarity around the term "statistical and scientific significance" and suggested a more specific definition, but in general supported the decision framework. The Teams discussed that use of the alternative methods might depend on computational feasibility as the parametric bootstrapping method run-time can vary from model to model and can range from overnight to multiple days. In general, the Teams appreciated the review and supported the analyses and future exploration or use of the methods.

### **Acoustic trawl survey uncertainty**

Sam Urmy presented ongoing research to improve the uncertainty estimates in the acoustic trawl survey, which is conducted biennially and used to estimate pollock abundance and biomass in the Eastern Bering Sea. Currently, an estimate of relative error is provided from the acoustic survey that is based on a simple 1-dimensional geostatistical procedure, which typically indicates a coefficient of variation between 4 and 8%. However, this purely-spatial estimate omits a number of other uncertainties known to affect the acoustic index, and is therefore inflated to 20% in the current stock assessment model. MACE has undertaken a comprehensive uncertainty analysis based on parametric and non-parametric bootstrapping to better quantify the total uncertainty. This analysis closely follows MACE's current analysis procedures, incorporating uncertainty from instrument calibration, spatial sampling, net selectivity, biological measurements, trawl placement, acoustic target strength, age-length keys, and length-weight conversions. Of these, spatial sampling error is consistently the largest source of uncertainty, followed by target strength and acoustic calibration. Total uncertainties for pollock biomass between 2012 and 2022 were 5-11%, approximately 1.5 times the corresponding 1D geostatistical estimates on average. On the other hand, they were two to five times smaller than the 20% error assumed in the assessment. One source of remaining unaccounted uncertainty is the bottom 3 meters of the water column (i.e., the acoustic survey "dead spot"), which a Team member noted may contain up to 40% of the pollock biomass at times. The Teams appreciated the presentation and expressed interest in further discussion of applying these updated uncertainty estimates in the pollock assessment.

### **Age and length sample sizes**

Pete Hulson presented an overview of methods to calculate input sample sizes for trawl survey age and length composition data. The authors have developed two code packages which can provide Tier 1-3 stock assessment authors with updated estimates of input sample size, as well as AFSC Tech Memos. The authors note that because fishery-dependent input sample sizes are not yet available, they have not incorporated this into their own assessments yet. A post-doc is planned to begin soon to work on the fishery-dependent input sample size project. The Teams asked about availability of the results, which the authors noted could be emailed to authors. The Team also asked about a minimum sample size for a strata to which it was noted that for the species that were evaluated they were typically common at the haul level for lengths. Ages are resampled at the management area level and sample sizes were sufficient.

### **Age composition methods**

Thomas Helser presented on Fourier-transform near-infrared spectroscopy (FT-NIRS), a technology that is being investigated as an alternative method of producing fish age estimates in coordination across the nation's six NOAA Fisheries Science Centers age determination units. This highly efficient and reproducible method, which relates otolith spectral absorbance to reference age data to predict age, is expected to replace the traditional microscopic method of age determination for a significant portion of the age sample requests for selected stocks (e.g., walleye pollock and Pacific cod). Tom gave an overview

of the envisioned operational framework to generate FT-NIRS age predictions and how consistency with reference (historical) data will be maintained. Tom also walked through an example of how ages are predicted based on FT-NIRS spectra using a convolutional neural network model and how model performance will be assessed.

The Teams inquired about whether the time series would be updated whenever a model change occurred.. Tom noted that historical estimates were based on a model that was performing well and would be the same given those data. Model updates would be to improve performance with new samples because of new, previously unseen variability in the system. The Teams also inquired about the influence of covariates (e.g., length, otolith weight) relative to spectral information on the model predictions. While some covariates can be influential (and differ across species), certain spectral regions are consistently the most important predictors of age. A Team member asked whether epigenetics has been investigated as a method for age determination. Tom noted that this is being looked at in combination with FT-NIRS for lingcod, but that like FT-NIRS, epigenetics is based on reference data to build a calibration model. However, FT-NIRS is generally more efficient.