SCIENTIFIC AND STATISTICAL COMMITTEE
DRAFT REPORT TO THE
NORTH PACIFIC FISHERY MANAGEMENT COUNCIL
November 30th – December 4th, 2020

The SSC met from November 30th to December 4th remotely.

Members present were:

Anne Hollowed, Co-Chair *NOAA Fisheries—AFSC*	Sherri Dressel, Co-Chair *Alaska Dept. of Fish and Game*	Alison Whitman, Vice Chair *Oregon Dept. of Fish and Wildlife*
Chris Anderson *University of Washington*	Amy Bishop *University of Alaska Fairbanks*	Curry Cunningham *University of Alaska Fairbanks*
Mike Downs *Wislow Research*	Jason Gasper *NOAA Fisheries–Alaska Region*	Dana Hanselman *NOAA Fisheries—AFSC*
Brad Harris *Alaska Pacific University*	George Hunt *University of Washington*	Gordon Kruse *University of Alaska Fairbanks*
Franz Mueter *University of Alaska Fairbanks*	Andrew Munro *Alaska Dept. of Fish and Game*	Kate Reedy *Idaho State University Pocatello*
Matt Reimer *University of California, Davis*	Ian Stewart *Intl. Pacific Halibut Commission*	Tien-Shui Tsou *Washington Dept. of Fish and Wildlife*

General SSC Comments

The SSC recognizes the outstanding service of Drs. Gordon Kruse and Kate Reedy. Gordon served as a participating alternate member on the SSC from 1987-1989 and as a member on the SSC from 1990-1992 and from 2002 to 2020. He served as vice-chair (2003-2004), chair (2005-2006), and co-chair (2018-2019). He received the 1st ever Terry Quinn II Distinguished Scientist award from the NPFMC in 2019. Kate served on the SSC from 2011 to 2020. The SSC will miss the sage advice and careful evaluation of the scientific issues facing the NPFMC that were provided by these two SSC members. We are extremely grateful for their service and wish them well in their future research.

The SSC also recognized the passing of Dr. Richard Marasco on August 29, 2020. Dr. Marasco served on the SSC from 1979 to 2004. He was vice chair from 1981 - 1987 and chair from 1987-1991 and again from 1998 to 2004. During this time, Dr. Marasco provided leadership and critical guidance to the NPFMC on issues ranging from the development of the observer program, the Fishery Management Plans and the implementation of the AFA and MSFCMA. He mentored several members of the current SSC. The SSC extends our sympathy to his family and our gratitude for Rich's service to the SSC.

This year was particularly challenging and the SSC expresses its appreciation for the dedication and work done by agency staff, Council staff, and members of the public to support the annual harvest specification process. An impressive array of scientific products are produced that greatly contribute to the management of Gulf of Alaska (GOA), eastern Bering Sea (EBS), and Aleutian Islands (AI) fisheries.

B-1 Plan Team nominations

The SSC reviewed the nomination of Tyler Jackson to the Scallop Plan Team. The SSC finds Mr. Jackson to be well-qualified and recommends the Council approve his nomination.

General Stock Assessment Comments

Spatial Management

The SSC appreciates the JGPT's discussion of the Spatial Management Policy and its application to sablefish, BSAI blackspotted-rougheye rockfish (BS/RE), and any other stocks that have spatial management issues. In particular, the SSC discussed the JGPT's request for the SSC and Council to consider application of the Spatial Management Policy and for the Council to host a workshop in 2021 in accordance with Step 2 of the Spatial Management Policy. The SSC recognizes its role in bringing species that are facing potential conservation concerns to the Council's attention in accordance with the Spatial Management Policy.

The SSC believes that BSAI BS/RE are facing potential biological conservation concerns, and the use of the maximum subarea species catch (MSSC) does not appear to have had the intended outcome. Therefore, the SSC agrees that, for BSAI BS/RE, further discussion of potential options for management response and identification of a suite of tools that could be used to achieve conservation and management goals would be useful. **If the Council agrees, the SSC recommends reconstituting the spatial management working group to develop a white paper that addresses how the Spatial Management Policy can be used to address conservation and management concerns for BSAI BS/RE.** This would involve a careful review of how the information underpinned the current approach to setting subarea ABC and how MSSC values align with biological and ecological knowledge such as geo-spatial distributions of BS/RE, breaks in the spatial distribution, bycatch hotspots, and seasonal or environmental factors underlying distributions. This will support the identification and evaluation of a suite of possible actions (e.g., gear, time, area, triggered closures) that could be applied to enhance the efficacy of the MSSC or similar tools, as well as identifying priority areas for further research. Following the development of a white paper, the SSC recommends the Council consider a workshop with Council, SSC, and PT members, agency staff, Council advisory bodies and the public as part of Step 2 of the Spatial Management Policy.

The GPT also discussed the Spatial Management Policy with regard to sablefish. For sablefish, the SSC notes that scientific information indicates that there is considerable movement among management areas, and so, as long as ABC apportionment does not vary too greatly from estimated biomass by management area, there is no expected biological conservation concern. As the SSC's role is to focus on potential biological concerns, **the SSC is not asking for specific action on sablefish under the Spatial Management Policy from the Council.** However, if the Council wishes to explore the Spatial Management Policy for sablefish, the SSC would certainly participate and would focus on providing guidance regarding potential conservation concerns or sharing whether there is additional information that the Council may want to consider.

VAST models

The SSC had a number of recommendations regarding the application of Vector-autoregressive Spatio-temporal (VAST) models that apply across assessments. As mentioned in December 2019 and October 2020, the SSC recommends that standardized documentation (both format and content) will be very helpful for review and diagnosis of VAST model results for each species, including a description of the parameterization, model fit diagnostics, plots of spatial residuals, and all other components necessary for review. The SSC highlights the appendix on spatio-temporal analysis included with the 2020 EBS pollock SAFE chapter as an excellent example of standardized reporting of VAST model specification and

diagnostics, which may be a useful reference for other assessment authors. Also, as mentioned in October 2020, the SSC cautions against standardized model fitting (e.g., a single error distribution, set of covariates, number of knots), other than as a starting point. The species-specific biological distribution, and interaction of this distribution with covariates, may require differing error distributions to fit the data adequately. It is more important for each species to have a statistically rigorous model selection process resulting in good model fit and diagnostics than the simplicity of fitting the same approach to all species: unlike design-based estimators, the SSC suggests that one size does not fit all for VAST models. For each species, assessment documents should describe why the particular error distributions, covariates, and number of knots were chosen for that individual species.

As suggested for a number of species in December 2019 (e.g., GOA Pacific cod, AI Pacific cod, GOA Pacific ocean perch), the SSC recommends exploring VAST apportionment for those species that use a VAST estimator for surveys. The SSC noted that, if the geostatistical estimator is superior to the design-based estimator for survey trends for a particular species, then it conceptually should be best for apportionment as well.

Assessment Frequency

The SSC greatly appreciates the efforts of authors and Plan Teams. The SSC also reminds authors and Plan Teams that while authors putting in extra effort to bring full assessments in off-cycle from the established prioritization is appreciated, it does create an extra review burden at multiple levels. Therefore, the SSC requests the Plan Teams be judicious in September regarding bringing forward full assessments outside of the cycle in place.

C-3 BSAI and C-4 GOA Ecosystem Status Reports

The SSC received a review of the marine ecosystems of the Bering Sea (BS) from Elizabeth Siddon (NOAA-AFSC), the Aleutian Islands (AI) from Ivonne Ortiz (University of Washington), and the Gulf of Alaska (GOA) from Bridget Ferris (NOAA-AFSC). There were no public comments.

This year, as in the past, the Ecosystem Status Reports (ESRs) are insightful, well-written, and well-edited. They represent an enormous amount of work accomplished under very tight time constraints. All three chapters were helpful in providing a context within which to assess the stocks of commercially harvested fish in the federal waters of Alaska. As usual, the editors and authors have been responsive to the comments and suggestions provided by the SSC in 2019. The process this year, from the gathering of data to the analysis and presentation of the ESRs, has been affected by the necessary reduction in close personal interactions, whether they be in the laboratory or on a ship. The resulting deficit of new information as to the status of the marine ecosystems that the Council manages was apparent to the SSC as it conducted its review of the ESRs for 2020. **The SSC appreciates the extraordinary efforts made to provide quality ESRs under such difficult circumstances**.

The SSC noted that information from the EBS/AI ESRs were incorporated into the risk tables for 21 BSAI stock assessments (16 recommended ecosystem risk level of 1 and 5 recommended ecosystem risk level of >1). The GOA ESR information was incorporated into the risk tables for 8 stock assessments (7 recommended ecosystem risk level of 1, and sablefish (statewide) was the only assessment with an ecosystem risk level of 2). **The SSC recognizes the great amount of work staff have put into incorporating ESR information into risk tables and supports and commends the continued coordination of these efforts with ESPs (e.g., sablefish and EBS Pacific cod) and the transparency on how ecosystem data are incorporated into management decisions.**

Issues of Concern

Eastern Bering Sea

There were four issues of concern in the EBS that the SSC wished to highlight for the Council:

1) There was an unusually high Prohibited Species Catch (PSC) of herring in the 2020 A season directed pollock fishery. The 2020 PSC of herring exceeded the 2020 herring PSC limit and the Summer Herring Savings Areas (HSA) 1 and Winter HSA were therefore closed. The SSC appreciated the efforts by the pollock fleet to provide information as to why this PSC overage occurred. The pollock fishermen suggested that the increased PSC was not due to a change in spatial or temporal overlap between pollock and herring, but due to an increased abundance of herring. The authors of the report in the ESR provided suggestions for research that could help explain why this high PSC occurred and how to avoid repeating similar high PSC in the future. They suggest a re-evaluation of herring spawning migration by stock, and a re-evaluation of HSAs with respect to their effectiveness for protecting herring. It could also be valuable to retain PSC herring for genetic analysis of the stock of origin. **The SSC recommends that efforts be made to address these issues quickly and agrees that the areas of research identified could inform the hypotheses surrounding the increase in herring PSC and the degree of concern about this PSC, depending on the stock of origin.**

2) Starting in late July 2020 and continuing through at least October, communities in the Bering Strait region, and eventually along the Chukchi Sea coast began reporting increased amounts of marine debris, which was predominantly foreign in manufacture, with Russian and Korean characters being readily identifiable. This debris has a potential for disrupting local fishing efforts and increasing the potential for ingestion of plastics by marine life (both initially, or in the future, as items degrade). **The SSC suggests that the Council may want to collaborate with U.S. and international agencies to determine the origin of the debris, and work toward eliminating future debris discharges.**

3) A new indicator of ocean acidification based on aragonite saturation states suggests that seasonal bottom water corrosive conditions peaked in 2013. Modeled output from a ROMS hindcast for summer 2020 indicated a more strongly corrosive outer shelf domain compared to the 2003–2019 average. The authors concluded that these corrosive conditions likely resulted from bacterial respiration of organic carbon produced by phytoplankton that had sunk below the mixed layer. Increased corrosivity of bottom waters is of concern, particularly for crab stocks. There seems to be little that the Council can do to ameliorate this problem.

4) Starting in January 2019, and persisting into 2020, elevated numbers of North Pacific gray whales (*Eschrichtius robustus*) died along the west coast of North America, resulting in the declaration of an Unusual Mortality Event (UME). These deaths apparently occurred on the return migration of the whales to Alaska from their breeding grounds along the coast of Baja California, Mexico; reports suggest that they may have died of starvation. Gray whales feed in the northern Bering and Chukchi seas and are benthic feeders (e.g., amphipods, crab larvae). The 2019 mortality events may reflect 2018 feeding conditions in the Bering Sea, conditions experienced during migrations to the south, or a lack of available prey to complete the return migration to the Bering Sea in 2019 (Siddon and Zador, 2019). The 2019 gray whale UME may also reflect a population approaching carrying capacity. Moore et al. first suggested that gray whales might be reaching the carrying capacity of their NBS and Chukchi Sea foraging grounds. At that time, there were an estimated 26,635 gray whales (Moore et al., 2001). The estimated population as of 2019 was 27,000 (Calambokidis, in: Paris, 2019). The carrying capacity, as estimated in 2002, was between 19,830 and 28,470 individuals (Wade and Perryman, 2002). Thus, the deaths of emaciated individuals in 2019, might have been expected. There is little the Council can do to address these mortalities. A survey of the amphipod beds in the NBS and the southern Chukchi Sea could provide information on the condition of food resources compared to what was there in the 1970s and 1980s.

Aleutian Islands

Information on ecosystem patterns from the Aleutian Islands was particularly limited in 2020 due to pandemic restrictions, with only physical oceanography and human dimensions data being updated through the current year. Two items in the Aleutian Islands' ESR were of particular concern to the SSC: the death of an individual in Dutch Harbor/Unalaska from the ingestion of shellfish contaminated by Harmful Algal Bloom (HAB) toxins, and the closure of the fish processing plant on Adak. Both affect the safety and well-being of the people of the Aleutians.

1) The HABs in Unalaska Bay put at risk those people from Dutch Harbor/Unalaska who augment their food supplies by gathering wild foods from the sea. If the toxins become sufficiently concentrated, they may affect fish processing to the extent that fresh sea water is used for holding fish or crab, or for processing. At present it seems unlikely that the toxins are sufficiently concentrated to impact the safety of consuming fish caught in the eastern Aleutian Islands, but it may be worth examining vulnerability to HABs in the waters of Adak. This is particularly relevant given the possible HAB-related mortalities of a variety of fauna at the Kamchatka Peninsula reported in summer 2020.

2) The closing of the seafood processing plant on Adak removes a major source of employment and external infusions of financial resources to the community. Destabilization of that community would have consequences beyond the immediate impacts of the loss of employment. If the Adak community fails, a port of importance to all who fish the waters of the central and western Aleutians would potentially be lost. Not only would repair and refueling opportunities potentially be lost, but also the availability of vessels that might respond to an emergency.

Gulf of Alaska

Since 2020 was a scheduled 'off' year for the GOA trawl surveys, there was less data loss relative to the EBS and AI. Data loss that did occur was partially mitigated through multi-organization collaborations and integration of data sources (e.g., seabird breeding success and diet). A few items in the GOA ESR to note for the Council are:

1) The commercial harvest of salmon was low across most of the GOA, and was the lowest in SEAK since 1976. The poor catches of salmon resulted in numerous requests for the State of Alaska to declare salmon fishery disasters. The poor catches are of social and economic concern. The low returns in SEAK were primarily driven by low chum and sockeye returns. Low adult returns were likely the result of high juvenile mortality in 2017 (and years since then for certain species), but the mechanism driving that trend (e.g., environment, predation) is still uncertain. Juvenile abundance since 2017 has been increasing, suggesting harvests will increase in coming years**. The SSC supports additional research on the survival and growth of salmon during the first marine year and on survival during their later marine stages**.

2) There was a consistent presence of HABs in Kachemak Bay and around Kodiak Island in the WGOA in 2020. Bivalves in Kachemak Bay had levels of paralytic shellfish poisoning toxins (PSP, saxitoxins) approaching but remaining under the regulatory limit for human consumption. Around Kodiak, several high toxicity samples were collected that exceeded the regulatory limit. In the EGOA, HABs were above the regulatory limit at over half of the monitored sites. This was slightly lower than in 2019, likely due to the rainy summer. The SSC commends the highly collaborative efforts to provide data to the HAB network from tribal organizations (Southeast Alaska Tribal Ocean Research, communities (Kachemak Bay National Estuarine Research Reserve's Community Monitoring Program), and NOAA researchers, and supports continued efforts to monitor these toxins across all ecoregions, as it poses a considerable concern for human health. **The SSC suggests exploring if data exist on HABs in planktivorous forage fish or upper trophic level animals for inclusion in future ESRs.**

3) The desertion of two additional kittiwake colonies in 2020 in the Kodiak region is a matter of concern. It may be an indication that forage fish have become scarce in that area.

Ecosystem Trends

Eastern Bering Sea

Indicators for the prey field (zooplankton and forage fish), seabirds, marine mammals, and holistic ecosystem indicators were missing for 2020 due to the COVID-19 pandemic. Data loss was partially mitigated by participation of citizen scientists, communities, and tribal governments who contributed observations and data. For example, when USFWS seabird monitoring was cancelled, coastal community members, tribal governments, and state/university partners provided information on seabird dynamics, which were then synthesized with help from the USFWS. **The SSC commends and greatly appreciates these efforts and supports development of similar activities that incorporate local and traditional knowledge (LK/TK) and collaborations where possible**.

The combined climate section and the combined seabird section were both excellent and much easier to digest. **The SSC greatly appreciates these efforts to streamline the ESR without losing important information**.

The use of data on seabirds, salmon and ice conditions to infer zooplankton abundance showed the power of annually gathering multiple, interrelated indices on ecosystem conditions.

The 2019-2020 daily mean sea ice extent was within one standard deviation of the long-term mean. Sea ice cover exceeded the median extent in February and March of 2020, but had reduced thickness and retreated quickly. The cold pool extent and temperatures (as output from the ROMS hindcast model) were average. **The SSC suggests that the use of the ROMS model for predicting specific indices in 2020, such as the extent of the cold pool or measures of mean bottom temperatures, be validated with appropriate comparisons of hindcasts with data available from the bottom trawl surveys**.

Both the northern Bering Sea (NBS) and the southeastern Bering Sea (SEBS) have been in a persistent stanza of warm surface waters that has been greater in magnitude and duration than that of the early 2000s. A new metric of sea surface temperature (SST) that indicates when a marine heatwave (MHW) has occurred shows that the threshold for defining a MHW has been persistently exceeded in both the SEBS and NBS for much of the last five years. To date, this warming has not resulted in a major die off of a commercially important species in the EBS. However, there have been considerable re-distributions of stocks in the SEBS and NBS. Projections are for delayed sea ice formation, and moderately warm conditions over the shelf in 2021. **The SSC urges the Council to seek comprehensive annual surveys of the NBS and collaborations with Russia to ascertain the implications of changing climate on the distribution and health of commercially important stocks.**

Information on primary production indicates that the spring bloom was early in 2020 in the SEBS, and that chlorophyll-a biomass was below average in 2020 in the NBS.

The use of the remotely controlled saildrones was superb and provided essential data on pollock distribution and abundance. The SSC suggests that these data be also used to extract information on the distribution and abundance of euphausiids, if possible.

Aleutian Islands

Multi-year Trends through 2019/2020
Several biological indicators were updated through 2019 and were discussed in terms of multi-year trends. Extended periods of above average SST corresponded with a decreasing trend in large diatom abundance and copepod size, increased bioenergetics costs, and declining groundfish condition over the period from 2010-2019. With average, or close-to-average, climate conditions throughout 2020 (e.g., cooler to moderate sea surface temperatures, fewer marine heatwave days), there was a return to more favorable conditions for the biological components of the Aleutian Islands ecosystem. However, groundfish condition continues to decline, particularly in the western Aleutians. Increases in the biomass of Kamchatka pink salmon, POP, and other rockfish may have created greater competition for available prey. The continued decline in a

variety of components of the Western Aleutians marine ecosystem is cause for concern. Steller sea lions, some seabird species, and some groundfish species have experienced population declines, reproductive failures, and diminished body condition (mass/length). **The SSC suggests a holistic approach may be needed to understand and manage this region given its remoteness**.

Gulf of Alaska

Key updates were given on the MHWs in the GOA, with new contributions providing spatial differentiation between the western GOA (WGOA) and eastern GOA (EGOA). The previous MHW ended in December 2019 in the GOA, with near-normal SSTs in 2020 persisting near the long-term mean through the summer (WGOA) and through fall (EGOA). In the WGOA, sea surface temperatures oscillated around the MHW threshold throughout the summer and have exceeded this threshold since September 2020 (to date). Residual heat remains at depth. In contrast, in the EGOA MHW conditions have not yet been met in 2020. There, near-normal temperatures persisted through the summer, followed by elevated temperatures in the fall (the EGOA had not exceeded the MHW threshold as of Oct. 30th).

In both WGOA and EGOA, chlorophyll-a data indicate early peak bloom and average biomass of phytoplankton. Data from the WGOA and EGOA on zooplankton, though limited in spatial scale, suggest near long-term average biomass and densities respectively. In addition to southwest wind trajectories that result in the retention of larval pollock, the early bloom in the WGOA was a favorable indicator for age-1 walleye pollock recruitment in 2020.

Overall, there were average to positive trends in forage fish conditions in 2020, and the 2020 zooplankton data support the assumption that forage fish likely had adequate feeding conditions. However, piscivorous Pacific cod and arrowtooth flounder populations are still reduced following the 2014 MHW. The 2018 year class of age-2 walleye pollock, which was abundant at age-1 in 2019, was not observed in the winter 2020 WGOA acoustic survey, raising the possibility that the absence of these fish may be another impact from the 2019 MHW. La Niña conditions currently persist and are predicted for winter 2020-21 and into spring 2021, with moderate to cooler temperatures forecasted across the GOA.

The presence of chub mackerel in the diets of seabirds at Middleton Island is of considerable interest. The SSC encourages the authors to evaluate whether the consumption of chub mackerel has increased over time and whether there are other indicators that suggest they are becoming more numerous. In addition, it would be useful to evaluate the role of the small pelagic species in the GOA ecosystem, and whether they are projected to be an important prey species under a warming climate.

New methods for assessing body condition of groundfish show that trends in body condition vary across species. For example the body condition of large walleye pollock, arrowtooth flounder, and dusky rockfish has been below average since 2015. The body condition of northern rockfish and possibly Pacific ocean perch has been above average but trending downward since 2015. Whereas, the residual body condition of Pacific cod and southern rock sole have been trending upward over the same time. Prior to 2011, condition indexes of these GOA species varied from survey to survey, cycling between negative and positive residuals with no clear temporal trend.

Marine mammal and seabird populations appear to be partially recovering across the GOA, though seabird reproductive success data is limited due to COVID-19 disruptions. Survival of humpback whales in the EGOA (Glacier Bay) has returned to pre-2014 MHW levels. This appears to correspond to good foraging from 2018-2020 when mature spawning herring showed strong recruitment in ocean-influenced populations. The abundance of the Prince William Sound herring spawning stocks increased slightly from 2019 but remain low, and humpback whales in the WGOA also remain less abundant than before the 2014 MHW. Seabird diets indicated continued diversification since the 2014 MHW, with noticeable reductions of capelin in recent years and increases in hexagrammidae.

No new data were provided on Steller sea lion populations in 2020. In 2019, non-pups in the central and WGOA had declined from the 2017 counts, but following COVID-19 cancellations, SSL surveys have been

postponed in the GOA until 2022 to focus on the Aleutian Islands in 2021. **The SSC suggests exploring other long-term datasets on sea lion reproduction from the WGOA that might be able to provide information on non-pup and pup numbers during this gap (e.g., pup production and attendance at Chiswell Island from 1998-present, Alaska SeaLife Center).**

There were no updates for Fisheries or Human Dimensions indicators in 2020; the SSC looks forward to seeing these indicators updated in 2021.

Editorial Comments- all regions

1) **SSC appreciates the efforts made to standardize and stabilize the formats and methods applied to the ESRs.** The ESRs for the EBS and GOA are already well aligned, and it would be good to put the AI ESR into a similar format, where possible. Standardized methodologies across ESRs would not have to be re-reviewed annually and changes to methods could be introduced in such a way that they could be quickly identified as new and then be evaluated. The SSC also continues to encourage the editors of the ESRs to work to reduce redundancy.

2) It would be useful to determine which of the sections of the ESRs are of greatest use to the intended audience.

3) **The SSC recommends that the ESR authors pursue the systematic and consistent incorporation of LK and TK as relevant to ESR.** As noted before, we recognize that the systematic, methodologically sound, and culturally appropriate collection of all forms of LK and TK is beyond the purview of the ESR authors, but see the benefits of the ESRs incorporating these types of data when available. As demonstrated in the EBS ESR, in light of recent disruptions to surveys due to the pandemic, established protocols for incorporation of LK and TK can be useful for avoiding data gaps.

4) In addition to the ESR Chapters, the SSC is pleased to see the continued development of the “In Brief" for the EBS and GOA, the addition of a new “In Brief” for the Aleutian Islands, and updated storymaps. We also look forward to seeing the new videos being developed. These resources are essential for efficiently and clearly communicating the main ecosystem patterns to stakeholders and the public, and the **SSC supports their continued development**.

5) The SSC suggests that the use of terms like “normal” is somewhat problematic given that what is “normal” seems to be changing rapidly. Some extremes are becoming normal. Regarding climate issues in particular, and perhaps for other areas in general, it might be better to use “average” and to indicate the years for which the average is calculated. It could also be appropriate to give departures from “average” in terms of standard deviations.

6) The MHW index provides a relative value for each season in each year in comparison to a long-term mean. However, it is likely the absolute value that drives ecosystem responses to heat waves via metabolic rates. In this regard, it would be useful if the authors can provide an index that captures the relative metabolic stress. Additionally, the MHW does not seem to be reflected in the stability index. Is this because the index is averaged over 10 years? If so, this index may not be very sensitive to major perturbations of the ecosystem.

7) How meaningful is the index of mean lifespan of the community if so many species, and especially long-lived species such as rockfish, are excluded?

8) The absolute takes of seabirds in some years, and for some species, are of conservation concern. While a standardized index, such as birds caught per line or net set may be useful for some management purposes, the number of dead birds are more useful from a conservation and ecosystem perspective.

9) There have been suggestions that fluctuations in seabird bycatch possibly reflect prey availability; however, patterns differ among species or species groups. This may be an interesting area to investigate as

the time series get longer and the methods of bycatch reduction stabilize. It may also be possible to relate seabird bycatch to die-off events, which also likely reflect a lack of available prey.

10) In the description of fishing and human dimension indicators, it would seem useful to separate landings and price. Ex-vessel value may be what is of concern to economists or the industry, but when the two are multiplied together, the underlying driver behind the final number - whether the amount of fish has gone up or if the price has gone up - is unknown.

11) Regarding the human dimension indicator of population and population change by community, the SSC recommends that the analysts consider flagging those communities that are currently directly engaged in the harvesting and/or processing sectors of federally managed fisheries.

12) The addition of new data on HABs is excellent. Should there also be an effort to report on other pollutants and heavy metals?

13) The SSC reiterates that authors who wish to include figures make certain that these figures are readable when reduced to page or half-page size. This has been an issue of concern for a number of years. Perhaps the editors can scan contributions from authors when they are first submitted and return them to the authors if the included figures are unreadable. Fonts within figures are a particular problem; and figures that show long-term trends might benefit from zooming in on more recent years to show current trends.

C-3 BSAI and C-4 GOA specifications and SAFE Report

Jim Ianelli (NOAA-AFSC) presented the Joint Groundfish Plan Team (JGPT) report from the November 2020 JGPT meeting. Dan Goethel (NOAA-AFSC) presented the sablefish stock assessment and Diana Stram (NPFMC) presented on sablefish apportionment and the NPFMC's Spatial Management Policy.

Grant Thompson (NOAA-AFSC) gave an overview of the November 2020 BSAI GPT meetings and on recommendations for BSAI groundfish OFLs and ABCs. Dr. Ianelli (NOAA-AFSC) presented the EBS pollock stock assessment, along with Alex De Robertis (NOAA-AFSC), who presented on the 2020 Unmanned Surface Vehicle (USV) pollock survey, and Dr. Thompson presented the BS and AI Pacific cod assessments.

The SSC received a presentation by Dr. Ianelli (NOAA-AFSC) on the November 2020 GOA GPT meeting and on GOA groundfish OFL and ABC recommendations. Steve Barbeaux (NOAA-AFSC) presented the GOA Pacific cod stock assessment. Martin Dorn (NOAA-AFSC) provided additional clarifications on GOA pollock.

The SSC reviewed the SAFE chapters and 2020 OFLs with respect to status determinations for GOA and BSAI groundfish. **The SSC-approved models indicated that no stocks were subject to overfishing in 2019. Also, in reviewing the status of stocks with reliable biomass reference points (all Tier 3 and above stocks and rex sole), the SSC concurs that these stocks are not overfished or approaching an overfished condition. The SSC notes that for multiple stocks in the GOA, no assessment was conducted in 2020 and harvest specifications for 2021 were rolled over. These include: GOA deepwater flatfish complex, GOA rex sole, GOA shortraker rockfish, GOA other rockfish complex, GOA skates, GOA Atka mackerel, and GOA octopus.**

To streamline and simplify the SSC report, recommended ABC/OFLs and area apportionments are summarized exclusively in Table 1 (BSAI) and Table 2 (GOA). Recommendations that differ from GPT(s) are marked in **bold**.

Table 1. SSC recommendations for BSAI groundfish OFLs and ABCs for 2021 and 2022 are shown with the 2020 OFL, ABC, TAC, and catch amounts in metric tons (2020 catches through November 7th, 2020, from AKR Catch Accounting System including CDQ). Recommendations are marked in **bold** where SSC recommendations differ from those of the BSAI Plan Team. **The sablefish OFL is duplicated in this table and in Table 2 (and added into the totals for both), because the SSC recommends that it be Alaska-wide.**

		2020			Catch as of	Final 2021			Final 2022		
Species	**Area**	**OFL**	**ABC**	**TAC**	**11/7/2020**	**OFL**	**ABC**	**TAC**	**OFL**	**ABC**	**TAC**
Pollock	EBS	4,085,000	2,043,000	1,425,000	1,364,949	2,594,000	1,626,000		2,366,000	1,484,000	
	AI	66,973	55,120	19,000	2,971	61,856	51,241		61,308	50,789	
	Bogoslof	183,080	137,310	75	8	113,479	85,109		113,479	85,109	
Pacific cod	BS	191,386	155,873	141,799	136,185	**147,949**	**123,805**		**128,340**	**106,852**	
	AI	27,400	20,600	13,796	5,321	27,400	20,600		27,400	20,600	
Sablefish	AK	50,481	22,009	n/a	n/a	60,426	**29,588**		70,710	**36,955**	
	BSAI	n/a	n/a	3,900	6,307	n/a	n/a		n/a	n/a	
	BS	n/a	2,174	1,861	5,184	n/a	**3,396**		n/a	**4,863**	
	AI	n/a	2,952	2,039	1,123	n/a	**4,717**		n/a	**6,860**	
Yellowfin sole	BSAI	287,307	260,918	150,700	128,320	341,571	313,477		374,982	344,140	
Greenland turbot	BSAI	11,319	9,625	5,300	2,312	8,568	7,326		7,181	6,139	
	BS	n/a	8,403	5,125	1,639		6,176			5,175	
	AI	n/a	1,222	175	673		1,150			964	
Arrowtooth flounder	BSAI	84,057	71,618	10,000	10,265	90,873	77,349		94,368	80,323	
Kamchatka flounder	BSAI	11,495	9,708	6,800	7,279	10,630	8,982		10,843	9,163	
Northern rock sole	BSAI	157,300	153,300	47,100	25,762	145,180	140,306		213,783	206,605	
Flathead sole	BSAI	82,810	68,134	19,500	9,001	75,863	62,567		77,763	64,119	
Alaska plaice	BSAI	37,600	31,600	17,000	19,954	37,924	31,657		36,928	30,815	
Other flatfish	BSAI	21,824	16,368	4,000	4,113	22,919	17,189		22,919	17,189	
Pacific Ocean perch	BSAI	58,956	48,846	42,875	36,303	44,376	37,173		42,384	35,503	
	BS	n/a	14,168	14,168	8,895		10,782			10,298	
	EAI	n/a	11,063	10,613	9,557		8,419			8,041	
	CAI	n/a	8,144	8,094	7,966		6,198			5,919	
	WAI	n/a	15,471	10,000	9,885		11,774			11,245	
Northern rockfish	BSAI	19,751	16,243	10,000	8,362	18,917	15,557		18,221	14,984	
Blackspotted/ Rougheye Rockfish	BSAI	861	708	349	458	576	482		595	500	
	EBS/EAI	n/a	444	85	125	n/a	313		n/a	324	
	CAI/WAI	n/a	264	264	333	n/a	169		n/a	176	
Shortraker rockfish	BSAI	722	541	375	214	722	541		722	541	
Other rockfish	BSAI	1,793	1,345	1,088	996	1,751	1,313		1,751	1,313	
	BS	n/a	956	700	293		919			919	
	AI	n/a	388	388	703		394			394	
Atka mackerel	BSAI	81,200	70,100	59,305	57,506	85,580	73,590		79,660	68,220	
	EAI/BS	n/a	24,535	24,535	22,926		25,760			23,880	
	CAI	n/a	14,721	14,721	14,588		15,450			14,330	
	WAI	n/a	30,844	20,049	19,992		32,380			30,010	
Skates	BSAI	49,792	41,543	16,313	17,221	49,297	41,257		47,372	39,598	
Sculpins	BSAI	67,817	50,863	5,300	4,805	N/A	N/A		N/A	N/A	
Sharks	BSAI	689	517	150	179	689	517		689	517	
Octopuses	BSAI	4,769	3,576	275	682	4,769	3,576		4,769	3,576	
Total	BSAI	5,584,382	3,294,590	2,003,900	1,855,780	3,945,315	2,747,727		3,802,167	2,719,274	

Sources: 2020 OFLs and ABCs are from harvest specifications adopted by the Council in December 2019; 2020 catches through November 7, 2020 from AKR Catch Accounting.

Table 2. SSC recommendations for GOA groundfish OFLs and ABCs for 2021 and 2022, shown with 2020 OFL, ABC, TAC, and catch amounts in metric tons (2020 catches through November 12th, 2020 from AKR Catch Accounting System). SSC recommendations that differed from those of the GOA Plan Team are shown in **bold**.

		2020			Catch	SSC Rec 2021		SSC Rec 2022	
Species	Area	OFL	ABC	TAC	11/12/2020	OFL	ABC	OFL	ABC
Pollock	State GHL	n/a	2,712	-		n/a	2,643	n/a	2,298
	W (610)	n/a	19,175	19,175	19,005	n/a	18,477	n/a	16,067
	C (620)	n/a	54,456	54,456	55,395	n/a	54,870	n/a	47,714
	C (630)	n/a	26,597	26,597	25,538	n/a	24,320	n/a	21,149
	WYAK	n/a	5,554	5,554	5,180	n/a	5,412	n/a	4,706
	Subtotal	140,674	108,494	105,782	105,118	123,455	105,722	106,767	91,934
	EYAK/SEO	13,531	10,148	10,148	-	13,531	10,148	13,531	10,148
	Total	154,205	118,642	115,930	105,118	136,986	115,870	120,298	102,082
Pacific Cod	W	n/a	4,942	2,076	235	n/a	7,986	n/a	12,892
	C	n/a	8,458	3,806	3,474	n/a	13,656	n/a	22,045
	E	n/a	1,221	549	271	n/a	1,985	n/a	3,204
	Total	17,794	14,621	6,431	3,980	28,977	23,627	46,587	38,141
Sablefish	W	n/a	2,278	1,942	1,424	n/a	**3,224**	n/a	**4,165**
	C	n/a	7,560	6,445	5,846	n/a	**9,527**	n/a	**11,111**
	WYAK	n/a	2,521	2,343	1,789	n/a	**3,451**	n/a	**4,009**
	SEO	n/a	4,524	3,663	3,036	n/a	**5,273**	n/a	**5,946**
	GOA	n/a	n/a	14,393	12,095	n/a	n/a	n/a	n/a
	AK	50,481	22,009	n/a	n/a	60,426	**29,588**	70,710	**36,955**
Shallow-Water Flatfish	W	n/a	23,849	13,250	22	n/a	24,151	n/a	24,460
	C	n/a	27,732	27,732	4,210	n/a	28,082	n/a	28,442
	WYAK	n/a	2,773	2,773	1	n/a	2,808	n/a	2,844
	EYAK/SEO	n/a	1,109	1,109	1	n/a	1,123	n/a	1,137
	Total	68,010	55,463	44,864	4,234	68,841	56,164	69,691	56,883
Deep-Water Flatfish	W	n/a	226	226	1	n/a	225	n/a	225
	C	n/a	1,948	1,948	99	n/a	1,914	n/a	1,914
	WYAK	n/a	2,105	2,105	3	n/a	2,068	n/a	2,068
	EYAK/SEO	n/a	1,751	1,751	4	n/a	1,719	n/a	1,719
	Total	7,163	6,030	6,030	107	7,040	5,926	7,040	5,926
Rex Sole	W	n/a	2,901	2,901	36	n/a	3,013	n/a	3,013
	C	n/a	8,579	8,579	1,202	n/a	8,912	n/a	8,912
	WYAK	n/a	1,174	1,174	1	n/a	1,206	n/a	1,206
	EYAK/SEO	n/a	2,224	2,224	-	n/a	2,285	n/a	2,285
	Total	18,127	14,878	14,878	1,239	18,779	15,416	18,779	15,416
Arrowtooth Flounder	W	n/a	31,455	14,500	288	n/a	32,377	n/a	31,479
	C	n/a	68,669	68,669	20,811	n/a	69,072	n/a	67,154
	WYAK	n/a	10,242	6,900	46	n/a	8,380	n/a	8,147
	EYAK/SEO	n/a	17,694	6,900	32	n/a	17,141	n/a	16,665
	Total	153,017	128,060	96,969	21,177	151,723	126,970	147,515	123,445
Flathead Sole	W	n/a	13,783	8,650	100	n/a	14,209	n/a	14,380
	C	n/a	20,201	15,400	1,817	n/a	20,826	n/a	21,076
	WYAK	n/a	2,354	2,354	-	n/a	2,427	n/a	2,456
	EYAK/SEO	n/a	1,858	1,858	-	n/a	1,915	n/a	1,939
	Total	46,572	38,196	28,262	1,917	47,982	39,377	48,534	39,851

Table 2. cont.

Species	Area	2020 OFL	2020 ABC	2020 TAC	Catch 11/12/2020	SSC Rec 2021 OFL	SSC Rec 2021 ABC	SSC Rec 2022 OFL	SSC Rec 2022 ABC
Pacific ocean perch	W	n/a	1,437	1,437	1,335	n/a	1,643	n/a	1,572
	C	n/a	23,678	23,678	21,971	n/a	27,429	n/a	26,234
	WYAK	n/a	1,470	1,470	1,466	n/a	1,705	n/a	1,631
	W/C/WYAK	31,567	26,585	26,585	24,772	36,563	30,777	34,974	29,437
	SEO	5,525	4,653	4,653	-	6,414	5,400	6,136	5,165
	Total	37,092	31,238	31,238	24,772	42,977	36,177	41,110	34,602
Northern Rockfish	W	n/a	1,133	1,133	769	n/a	2,023	n/a	1,926
	C	n/a	3,178	3,178	1,616	n/a	3,334	n/a	3,173
	E	n/a	1	-	-	n/a	1	n/a	1
	Total	5,143	4,312	4,311	2,385	6,396	5,358	6,088	5,100
Shortraker Rockfish	W	n/a	52	52	6	n/a	52	n/a	52
	C	n/a	284	284	186	n/a	284	n/a	284
	E	n/a	372	372	301	n/a	372	n/a	372
	Total	944	708	708	493	944	708	944	708
Dusky Rockfish	W	n/a	776	776	231	n/a	**270**	n/a	**265**
	C	n/a	2,746	2,746	1,879	n/a	**4,548**	n/a	**4,469**
	WYAK	n/a	115	115	83	n/a	**468**	n/a	**460**
	EYAK/SEO	n/a	39	39	2	n/a	**103**	n/a	**101**
	Total	4,492	3,676	3,676	2,195	8,655	**5,389**	8,423	**5,295**
Rougheye and Blackspotted Rockfish	W	n/a	168	168	4	n/a	168	n/a	170
	C	n/a	455	455	183	n/a	456	n/a	459
	E	n/a	586	586	190	n/a	588	n/a	592
	Total	1,452	1,209	1,209	377	1,456	1,212	1,467	1,221
Demersal shelf rockfish	Total	375	238	238	104	405	257	405	257
Thornyhead Rockfish	W	n/a	326	326	50	n/a	352	n/a	352
	C	n/a	911	911	208	n/a	910	n/a	910
	E	n/a	779	779	201	n/a	691	n/a	691
	Total	2,688	2,016	2,016	459	2,604	1,953	2,604	1,953
Other Rockfish	W/C	n/a	940	940	647	n/a	940	n/a	940
	WYAK	n/a	369	369	101	n/a	369	n/a	369
	EYAK/SEO	n/a	2,744	2,744	95	n/a	2,744	n/a	2,744
	Total	5,320	4,053	4,053	843	5,320	4,053	5,320	4,053
Atka mackerel	Total	6,200	4,700	3,000	608	6,200	4,700	6,200	4,700
Big Skate	W	n/a	758	758	32	n/a	758	n/a	758
	C	n/a	1,560	1,560	815	n/a	1,560	n/a	1,560
	E	n/a	890	890	188	n/a	890	n/a	890
	Total	4,278	3,208	3,208	1,035	4,278	3,208	4,278	3,208
Longnose Skate	W	n/a	158	158	21	n/a	158	n/a	158
	C	n/a	1,875	1,875	360	n/a	1,875	n/a	1,875
	E	n/a	554	554	255	n/a	554	n/a	554
	Total	3,449	2,587	2,587	636	3,449	2,587	3,449	2,587
Other Skates	GOA-wide	1,166	875	875	494	1,166	875	1,166	875
Sculpins	GOA-wide	6,932	5,199	5,199	570	-	-	-	-
Sharks	GOA-wide	10,913	8,184	8,184	1,581	5,006	3,755	5,006	3,755
Octopuses	GOA-wide	1,307	980	980	78	1,307	980	1,307	980
TOTAL		607,120	465,956	399,239	186,497	**610,917**	**476,037**	**616,921**	**476,269**

Sources: 2020 OFLs, ABCs, and TACs are from harvest specifications adopted by the Council in December 2019, 2020 catches through November 12, 2020 from AKR Catch Accounting. Note: State waters GHL for Pacific cod fisheries are not included within the Federal TAC, but they are accounted for, as to not exceed the ABC when added together.

Joint Groundfish Plan Team Report

Risk Table

The SSC appreciates the JGPT summaries of risk level and whether there were recommended reductions to maximum ABC for each assessed stock. The SSC recognizes the large amount of work that the risk tables and associated evaluations require and appreciates the work of the authors, agency staff, and Plan Teams to do so. The JGPT noted that there were differences in treatment of scoring among assessments and that they did not recommend any changes to the author-recommended risk table scores this year, but instead accepted them in acknowledgement that each author identified reasonable rationales in assigning levels. The SSC acknowledges that there are significant challenges to achieve consistency in scoring across assessments and notes the risk table is a relatively new tool with just two years of use. In addition, while there is a desire for consistency in scores across assessments, differences in scoring among tiers, risk categories and assessments are expected given the specific issues considered by each assessment author. The SSC's December 2019 minutes describe the risk table assessment as a qualitative process designed to inform discussion about uncertainty that is not accounted for in the tier system or assessment. In addition, the risk scores and associated evaluations in the SAFE are intended to be informative to discussions regarding uncertainty rather than prescriptive regarding potential reductions from maximum ABC. The SSC believes that the work that has been completed on risk tables for each assessment has helped to bring clarity to the associated uncertainties for each stock assessment. The SSC also believes that a mature process should have reasonable consistency of scoring across assessments, and that scoring inconsistencies are transparent and well-defined. However, the SSC does not expect this burden to fall on authors alone. Instead, the risk tables are an evolving process and consistency among assessments will require discussion and evaluation from Plan Teams and the SSC.

In the near-term, differences in consistency are likely best resolved on a case-by-case basis. To improve this process over the long-term, the SSC will discuss these issues at a workshop during the February 2021 SSC meeting, as scheduling allows. The goal of this workshop will be to evaluate how the risk table process is working; address consistency issues with the risk table as identified by the GPTs, authors, and SSC; and to provide guidance for moving forward. The SSC appreciates hearing about the challenges the authors and JGPT have found with the risk table process. For example, authors found completing the table was challenging for stock complexes where different species within the complex experience different risks. The JPT also reported that it was difficult for authors alone to assess consistency with respect to whether "increased" concern should be evaluated relative to (1) previous assessments of the same stock/complex or (2) typical assessments with the same tier or (3) typical assessments across all tiers, conditions under which elevated risk levels should result in reduction from maxABC. It was also challenging to assess what the magnitude of reduction from maxABC is appropriate when reduction is warranted. These issues provide direction for more in depth SSC discussion in February. The SSC also supports the JGPT suggestion to ensure adequate time for a risk table discussion during the September 2021 JGPT meeting, particularly given the planned SSC workshop.

Ecosystem and Socioeconomic Profiles

With respect to the JGPT request for "the SSC to clarify how the community information should be presented in a stock-specific manner in the ecosystem and socioeconomic profiles (ESPs), or if it could be better placed in the broader context of changes being experienced by communities," the SSC is providing comments under the BSAI and GOA agenda items that include ESPs. In general, however, the SSC recommends the continued inclusion of community engagement and dependency indices at varying scales in ESPs, ESRs, and SAFEs. For ESPs specifically, changes in patterns of community engagement and dependency at the stock level have the potential to inform not only stock assessments and analyses that support fishery management, but they may also function as early indicators of larger ecosystem changes.

Sablefish

The SSC thanks the authors for their work, acknowledging the challenges of transitioning the lead assessment author during 2020, and the ongoing contributions of the entire assessment team. The NPFMC received written testimony on the sablefish assessment that can be found on the Council's agenda. The SSC received oral public testimony from the following individuals:

Alexander Stubbs (Stubbs Marine) provided information on the increased use of slinky pots in the fishery and noted these will decrease whale depredation. He was also very concerned about the management of trawl bycatch, and supported survey-based apportionment, but was concerned about a quick change in quotas and supported a phase-in approach.

Linda Behnken (Alaska Longline Fishermen's Association) was concerned about the lack of the older fish and wanting to ensure the upcoming cohorts survive and provide value to the fishery. She supported the authors' recommended ABC, and moving away from fixed apportionment; however, she was concerned about a large change and supported an apportionment scheme that reflects a half-step between fixed apportionment and the 5-year survey distribution of the stock. She also indicated the Council should direct the stock assessment team to complete the MSE process prior to identifying a new long-term apportionment scheme.

Karl Haflinger (Sea State Inc.) provided an overview of the composition of sablefish caught on trawl vessels in the Amendment 80 and AFA trawl sectors. He highlighted that sablefish CPUE in the trawl fisheries has increased in recent years, a large proportion of which are younger year classes. He did not support the authors' recommended ABC. He also indicated the risk scores should be lowered, and a larger ABC set for 2021.

Steve Martell (Sea State Inc.) indicated there was no risk to the future spawning stock biomass as a result of a change in apportionment method from fixed to the authors' recommended method, and that rolling over last year's ABC is extremely conservative in the face of the growing evidence of the past four years on the relative abundance of three above-average year-classes. He provided a detailed analysis of yield equivalence, technical concerns about the model, and comments on risk assessment versus risk management.

Jon Warrenchuk (Oceana) testified that bycatch levels in the trawl fisheries were unacceptably high and that current management and accountability measures were inadequate. He also indicated that the current sablefish harvest strategy is out of step with biological, economic, and social needs because it seeks to maximize total yield, even if that biomass yield consists of small fish that are not desired by the marketplace. He urged the SSC to set a conservative ABC.

Malcolm Milne (North Pacific Fisheries Association) supported the stock assessment authors' recommended ABC and a gradual transition from fixed apportionment to the non-exponentially weighted survey-based apportionment. He also indicated his members are greatly concerned about the levels of trawl bycatch over recent years and wanted the Council and industry to work out mitigation strategies.

Brent Paine (United Catcher Boats) indicated his vessels (eastern Bering Sea pollock) are encountering more small sablefish in recent years and that they have been working to avoid their capture, but that they are at very high abundance. He indicated the fleet must balance sablefish avoidance with also avoiding other species of concern. He testified that the authors' recommended ABC buffer of 57% is too high and would like to see a maximum ABC buffer of 35%, which accounts for recent recruitment events and increased abundance. He supported the authors' recommended apportionment method.

Mary Beth Tooley (O'Hara Corporation) noted that new data provide indications of good news for the sablefish stock, but highlighted issues with the model and continued uncertainty in projections.

She questioned the subjectivity of retaining the 2020 ABC and noted that 'rebuilding' did not seem like an appropriate term given the status of the stock in 2021.

Julie Bonney (Alaska Groundfish Databank) testified that trawlers are working hard to avoid sablefish, but noted that there are a lot of sablefish on the grounds and they are difficult to avoid. She believed the authors' recommended ABC was too conservative given the recent large recruitment events, and noted similar issues with POP due to the stock doing better under a warmer regime. She supported moving to the authors' recommended apportionment, but indicated a stair-step approach should be used.

The 2020 stock assessment included new and/or updated information for:

- updated catch from the 2019 fishery and projected fishery catches (2020-2022)
- age data from the 2019 longline survey and fixed gear fishery
- relative abundance and length data from the 2020 longline survey
- CPUE and length data from the fixed gear fishery for 2019
- length data from the trawl fisheries for 2019
- updated estimates of killer and sperm whale depredation in the fishery for 2020-2022

The SSC recognized the importance of the 2020 longline survey for informing this year's analysis and the challenges associated with completing the survey. New data for this year's assessment included notable trends of: increasing trawl catch of sablefish, primarily in the Bering Sea; increases in the longline survey index from 2019 to 2020 (32%); and increases in the fixed-gear fishery CPUE from 2018 to 2019 (20%). Age information from 2017-2019 shows a high proportion of young sablefish, dominated by the 2014 and 2016 year classes and a weaker signal indicating a 2017 year class, while the proportion and abundance of older fish has been declining rapidly.

This year's assessment was an update of the previously accepted assessment model (16.5), with no structural changes to the base case, and no alternatives presented for direct use in management. **The SSC accepts the authors' and JGPT's recommendation to use this model (16.5).** This model continues to show an increasing stock trend due to large recent recruitments in 2014, 2016 and now 2017. The authors highlighted several shortcomings of the current model including:

- Lack of fit to index data, overestimating the increasing trends in recent years
- Poor retrospective behavior in spawning biomass estimates
- Decreasing estimates of the magnitude of recent large recruitments over the previous three stock assessments.

The SSC appreciates the extensive work done in developing sensitivity analyses covering the topics of data weighting, selectivity parameterization, natural mortality, maturity, and other topics. The SSC looks forward to further development of several of these alternatives for more thorough consideration in 2021.

The authors identified a series of concerns beyond those noted above contributing to the risk table scores provided. These concerns included: recent environmental conditions leading to increased recruitment success but decreased fish condition and potentially higher mortality rates; uncertainty in the specific rate of maturation for recent year-classes of current and increasing importance to the estimated spawning biomass, and truncation of the age distribution in the population; and the potential for density-dependent stock responses to incoming recruitments that may reduce or delay their productivity. The authors assigned risk scores of 3 for the stock assessment, 3 for the population dynamics, 2 for ecosystem considerations, and 3 for fishery performance.

After holding apportionment among areas constant (also called a 'fixed' strategy) since 2013, the authors provided four alternative methods for consideration for 2021: the historical NPFMC method (a blend of survey and fishery CPUE), the fixed values applied from 2013-2019, the five year survey average (called "Non-exponential survey") recommended by the authors, and stair-step options from the fixed method to the five year survey average method. Notably, the five-year survey average differs greatly from the recent fixed apportionment in some areas: by 69% in the Bering Sea, 79% in the Aleutian Islands, by -35% in East Yakutat/Southeast, and -25% in both central and West Yakutat. These differences illustrate how much change has occurred in the stock distribution estimated by the longline survey since the fixed values were adopted. The authors also provided the whale depredation corrected ABCs accounting for projected mortality by management area, using recent estimated average mortality, scaled for the absolute level of catch.

Specifications made in 2019 (last year) used an SSC-recommended 25% stair-step from the 2019 ABC toward the maximum permissible ABC. That recommendation recognized that there were important uncertainties not captured by the assessment model, but that there was also important new information in the assessment on incoming year-classes (particularly the 2014 and 2016 cohorts) that warranted an updating of the previous ABC, albeit with a substantial buffer from the maximum permissible ABC. However, assessment results for 2021 indicate that, rather than decreased uncertainty, there are now additional sources of increased uncertainty, including: evidence of recent delayed maturation extending previous concerns regarding the partial maturity of the large year-classes entering the fishery, increased poor retrospective patterns in the assessment estimates of spawning biomass, and the sensitivity analysis provided by the assessment team (but not proposed as the basis for the assessment) suggesting that use of a more objective data-weighting method was likely to result in less weight on the compositional data, and a reduction in the increasing stock trend that better matched the trends observed in recent surveys. Further, the authors' use of the risk table indicated a range of other concerns, as noted above. There were also notable improvements to our understanding of stock status provided by the updated assessment. The updated assessment suggests a reduced chance that the 2014 and 2016 year-classes are average or lower, and these year classes are one year closer to full maturity in 2020.

For these reasons, instead of continuing with a 50% stair step toward the maximum permissible ABC, the SSC recommends repeating the same stair-step approach made last year for 2021, increasing from the 2020 ABC (22,551) by 25% of the range to the maximum permissible ABC from the assessment of 52,427 t. The SSC also recommends applying the same method for adjusting the ABCs to account for whale depredation used in recent assessments, which will modify this stair-step slightly and depends on the apportionment (see below). This equates to a coastwide ABC of approximately 29,588 t (after accounting for whale depredation and apportionment). The SSC recognizes that the stock is at $SB_{42\%}$ in 2021, placing it in the Tier 3a classification. This ABC provides a 44% buffer from the maximum permissible ABC; a substantial reduction in both the potential catch and potential rate of fishing mortality. The preliminary 2022 ABC would be a second stair step of 25%, resulting in a coastwide ABC of 36,955 t (again accounting for both whale depredation and apportionment). The SSC recommends setting the coastwide OFLs to those values projected in the 2020 assessment, a value of 60,426 t for 2021 and 70,710 t for 2022. The SSC continues to note that although the stock biomass is projected to increase due to the strong recent year-classes, these cohorts also affect the calculation of reference points. Specifically, as the 2017 year class is included in the $B_{40\%}$ calculation, that reference point will increase (to the degree the 2014 and 2016 year classes do not decrease), as has been the case with the 2014 and 2016 year-classes, which is appropriate given the increased information on the productivity of the stock.

The SSC recognizes that, given high movement rates among all areas in Alaska, sablefish apportionment represents a combination of biological issues focused on long-term conservation of the resource and management considerations regarding how the catch is allocated within the constraints of the long-term conservation goals. Although in this case apportionment has a direct effect on allocation due to differing

allocations to gear types among areas, the SSC should consider only the biological aspects of apportionment when setting the specifications, and only comment on the information needed for the Council to effectively address allocation. Previous consideration of apportionment, leading to the NPFMC method and the more recent fixed apportionment, has supported flexibility in apportionment methods, as long as area-specific fishing mortality rates are not substantially different from the overall target mortality. Although no specific biological concern is identified at present, the SSC notes that the accepted default for Alaskan stocks is to base apportionment on the survey distribution, and that current fixed apportionment now differs substantially from that of the 2020 survey, and other recent surveys. All potential apportionment approaches are likely to have at least some component informed by survey distribution, and that at present, a move toward that distribution would reduce the risk of future biological concerns by bringing exploitation rates more closely in-line with recent survey observations. The SSC notes that large changes in apportionment could result in differences in overall exploitation rates as fisheries in different areas encounter differing demographics of the sablefish stock and areas allow differing allocations among gear types. Therefore, the SSC suggests that making changes in apportionment may be best phased-in gradually. This is also in line with the goal, stated in the 2020 apportionment workshop, of providing stability to the various fisheries and areas. Finally, the SSC recognizes that the current stock dynamics are highly uncertain, as incoming large recruitments are poorly resolved in both absolute magnitude and spatial distribution.

To this end, and consistent with the logic applied for the total ABC recommendation, **the SSC recommends a 25% stair step from the current (fixed) apportionment percentages toward the non-exponential 5-year survey average proposed by the authors.** For 2021 this would equate to increases in the apportioned ABCs in all areas (up to 60% in the Aleutian Islands), but much smaller increases in those areas that have recently been apportioned a greater percentage than suggested by survey observations (only 17% in the East Yakutat area). This degree of change may be more consistent with the use of a five-year average than moving directly to that average from the *status quo* fixed method. If this stair step is continued, the 2014, 2016, and 2017 year-classes should be much better understood as the apportionment approaches the five-year survey average. However, the SSC recognizes that other apportionment methods may also address biological concerns. **Therefore, the SSC suggests that the Council provide guidance to the analysts regarding any additional objectives for apportionment (e.g., socio-economic considerations, use of fishery information, etc.) such that alternatives for future specifications (2022+) can be evaluated against these objectives in addition to both survey distribution and overall exploitation rates under different apportionment methods. However, the SSC recommends that authors consider apportionment methods that adhere to the goals of avoiding biological concerns by generally following survey estimates, while addressing the NPFMC's allocation goals. The SSC cautions against apportionment methods that differ appreciably from the surveyed distribution, as these may lead to future biological concerns.**

The SSC appreciates the information provided in June, and additional work completed subsequently, on the simulation model for comparing apportionment performance. This analysis appears to be underutilized in the current discussion of apportionment. Specifically, there are a number of apportionment methods that appear to perform similarly with regard to biological concerns. The SSC recalls that the overall uncertainty is likely understated, based on the suite of uncertainties identified previously that were not able to be included. However, **the SSC recommends that the assessment authors continue to include these simulation results in future work on apportionment.**

The SSC acknowledges the excellent continued work of the authors on the ESP. This ESP provides an extremely helpful basis for interpreting biological and stock trends and guiding future research.

The SSC adds or reiterates the following additional recommendations for future assessments:

- Consider proposing modifications to the Tier 3 HCR to better match the dynamics of sablefish. This may require simulation of episodic and highly skewed recruitment dynamics. Consideration of the potential evidence for maternal effects beyond fecundity, since fecundity is already addressed

by managing female spawning biomass. Provide evidence that maintaining a broad distribution of spawning ages has tangible long-term benefits to the stock.

- For next year's specifications, provide the yield associated with F40% for a range of apportionment methods such that the feedback from apportionment to SPR can be better understood.
- Provide an update on the status of fishery logbook information, including methods for calculating and including pot gear into the time series. The SSC requests that the authors identify specific fishery data gaps and potential approaches to address these gaps. The authors and agency staff are encouraged to work with the fishing industry to fill these gaps.
- Use the 'Francis method', or other objective data-weighting approach, as an alternative to the base case method in the next stock assessment.
- Consider time-varying selectivity approaches to accommodate shifts in the fishery from hook-and-line to pots, as well as potential shifts in availability due to apportionment and the distribution of the biomass.
- Consider including time-varying or cohort-specific maturity curves, and/or weight-at-age relationships if supported by data.
- Consider further evaluation of time-varying and/or age-specific natural mortality.
- Re-evaluate the coefficients determining the degree of whale depredation in order to determine whether the relative effect of depredation may have changed over time, and/or to update existing coefficient estimates with additional available data since the previous analysis, including the increased use of pots.
- Support further genetic work toward a better understanding of stock structure within the coastwide distribution.
- Consider what field studies are needed to better understand the potential for increased reproductive output, reduced rates of skip-spawning, and/or quality by large/old female sablefish.
- Evaluate the use of the mean vs. median recruitment estimates to better understand whether sequential reductions in large estimated recruitments may be related to the reduction in uncertainty as well as other factors. Perhaps review the material produced by the 2014 Plan Team working group on recruitment modelling for additional guidance.
- Include a summary of information available on the historical use of sablefish by coastal communities in the next ESP.

Finally, the SSC strongly supports further work by the Pacific Sablefish Transboundary Assessment Team (PSTAT) to evaluate broad patterns in sablefish productivity and the implications of a shared resource spanning multiple assessment and management units.

Grenadiers

Grenadiers were added to the Ecosystem Component of the BSAI and GOA FMPs in 2015; therefore, OFL and ABC specifications are not required for this species complex. An abbreviated SAFE report is written every four years to track trends in catch and abundance. Unofficial OFL and ABC values based on Tier 5 calculations are also provided, although they are not used for management or for determining if overfishing is occurring.

Grenadiers are primarily caught in the Greenland turbot and halibut fisheries in the Bering Sea and in the sablefish fishery in the GOA. Catch data were updated through September 2020 and indicate that grenadier catch is down in the Bering Sea and GOA, but stable in the Aleutian Islands. Recent catches of grenadiers are well below the unofficial ABC and OFL values.

GOA grenadier biomass is estimated using a random effects model applied to trawl survey data. In the AI and EBS biomass estimates for giant grenadier are calculated based on the average of the three most recent bottom trawl surveys. Updated data inputs included 2018 and 2020 AI biomass using the estimation method presented in the 2012 SAFE; NMFS longline survey Relative Population Weights (RPWs) in the GOA for 2017-2020, in the EBS for 2017 and 2019, and in the AI for 2018 and 2020; and updated GOA trawl survey biomass time series through 2019 using a random effects model.

Biomass estimates for grenadiers in the BSAI and GOA have both declined and the GOA estimate is the lowest since 1998. The AFSC longline survey index for grenadiers has decreased in all areas and it is hypothesized that it may be due to sablefish, which have increased in abundance, outcompeting grenadiers for the hooks on the longlines. Catch and biomass of grenadiers from other surveys are also down so the decline may have another explanation.

The Tier 5 definitions for OFL and ABC were used to calculate the unofficial OFLs and ABCs for grenadiers (listed below in mt).

	Unofficial	
Area	OFL	ABC
EBS	44,053	33,040
AI	38,264	28,698
BSAI total	*82,317*	*61,738*
GOA	28,830	21,623
Grand total	*111,147*	*83,361*

These unofficial ABCs for 2021 are a 12% decrease in the BSAI and a 27% decrease in the GOA from 2016.

It was noted in the SAFE report that determining ecosystem effects on grenadier stocks is difficult because of the lack of biological and habitat information and by limited knowledge of the deep slope environment inhabited by these species.

The SSC appreciates the efforts of the author to provide an abbreviated stock assessment. **The SSC supports the unofficial OFL and ABC values recommended by the authors and the BSAI GPT, which are not for management, but for monitoring purposes only.**

C-3 BSAI SAFE and Harvest Specifications for 2020/21

BSAI Groundfish Plan Team Report

The SSC appreciates the authors' and BSAI GPT's efforts to highlight concerns and issues with the risk table assessment process. This information will be incorporated into an SSC workshop on the risk table in February 2021, schedule allowing (see SSC BSAI JGPT minutes for details).

The SSC also highlights that the lack of BSAI trawl and slope surveys has increased uncertainty in biomass estimates for BSAI species. Regarding AI trawl and EBS slope surveys, results of the recent uncertainty analysis by Bryan et al. (2020) reveal that stocks that rely on biennial survey data are generally more impacted by the loss of one survey. As such, the SSC emphasizes the importance of each of these surveys,

while recognizing the survey prioritization recommendations from the SSC's October 2020 meeting in the case of insufficient funding.

BSAI Walleye Pollock

Bering Sea

Eastern Bering Sea Unmanned Surface Vehicle (USV) Acoustic Survey
The SSC received a presentation from Alex De Robertis (NOAA-AFSC) on the use of unmanned surface vehicles (USV) to conduct an abbreviated EBS Shelf acoustic survey in summer 2020, in the absence of the standard NMFS acoustic survey due to the COVID-19 pandemic. The USVs which completed this survey are wind and solar powered drones developed as part of a collaboration between NOAA-AFSC, Saildrone Inc., Simrad, and NOAA's Pacific Marine Environmental Laboratory (PMEL). The presentation highlighted that the use of USV was feasible because fish backscatter on the EBS shelf is dominated by pollock, and because of recent research, described in De Robertis et al. (2019), which shows USVs produce comparable backscatter measurements to the standard NOAA acoustic survey vessels. In summer 2020, three USVs completed the EBS shelf acoustic survey between July 4 and August 20; a time period consistent with recent hydroacoustic surveys. Key differences between the USV acoustic survey and the standard NMFS EBS acoustic shelf survey include a wider transect spacing (40 vs. 20 nmi), the absence of paired trawling which provides species identification and age and length composition information, and differences in acoustic equipment resulting in a larger acoustic dead zone. To develop a comparable design-based biomass index, pollock backscatter throughout the traditional survey area was computed using traditional methods, a correction for the acoustic dead zone was applied, backscatter was converted to biomass using the relatively strong linear relationship observed across previous years, and additional uncertainty was computed to account for the biomass-backscatter conversion.

The 2020 USV acoustic survey provided a pollock biomass estimate of 3.6 million t, representing a 44.5% increase from 2018 but with a significantly higher uncertainty.

The SSC thanks Dr. De Robertis and colleagues at partnering organizations for their efforts in developing the USV survey platform, and operationalizing this technology to complete the 2020 EBS shelf acoustic survey. **The SSC supports inclusion of the USV-derived acoustic index for eastern Bering Sea pollock in the 2020 assessment, and in the time-series of survey estimates for future assessments.**

EBS Pollock Assessment
The SSC received a presentation on the 2020 assessment for the EBS pollock stock from Dr. Jim Ianelli (NOAA-AFSC). No public testimony was provided. Data from 2020 indicated a distinct difference in fishery catch rates between the A and B-season; catch rates for the A-season were among the highest in the recent time series, while those in the B-season were the lowest in the time series. The SSC notes that this pattern in fishery catch rates was also observed last year (2019) and in 2011. Also of note in the 2020 fishery data was the lower than average pollock condition, with standardized weight at a given length among the lowest in the time series since 1997 for A-season and B-season in the NW region.

The EBS pollock stock qualifies for management under Tier 1 and is assessed using a statistical age-structured model, applied to the 1964-2020 period. For the 2020 assessment, new data included 2019 fishery catch-at-age and weight-at-age, fishery catches through 2020, and the acoustic biomass estimate from the summer 2020 USV shelf survey. Four alternative models were brought forward as part of the 2020 assessment cycle:

- **M16.2** – The SSC-selected model from 2019 with updated data.
- **M20.0** – The same model structure as M16.2, but with the addition of the 2020 USV acoustic biomass estimated as an extension of the standard design-based acoustic trawl survey (ATS) time series.

- **M20.1** – The same model structure as M16.2, but instead of the standard ATS time series, this model was fit to a survey index derived from a Vector-autoregressive Spatio-temporal (VAST) model fit to backscatter from the ATS survey and 2020 USV acoustic backscatter.
- **M20.0a** – The same model structure and data as M20.0, but estimation of the stock-recruitment relationship that ignored the 1978 year class.

The SSC supports the authors' and Plan Team's recommendation to use Model 20.0a as the basis for harvest specifications, noting that M20.1 results in a modest increase in estimates of spawning biomass over the recent 5 year period.

In response to the SSC's 2019 request, the authors reviewed the factors affecting the Tier classification for this stock (under amendment 56), with respect to the reliability of the estimated probability distribution for F_{MSY}. Specifically, the authors explored the sensitivity of the stock-recruitment relationship (SRR) for EBS pollock to four changes relative to a status quo (M20.0) configuration. These sensitivity analyses concluded that ignoring the high 1978 year class in estimation of the SRR, which is a high outlier in recruitment produced by a relatively low SSB, had relatively little impact on the overall SRR with only a slight change in steepness resulting in additional precaution. **The SSC supports the authors' conclusion** that this high recruitment event perhaps arose under a recruitment regime that differs from that under which the stock exists currently. The authors found that relaxing the prior distribution on the slope of the SRR at the origin had a large impact on the shape of the SRR, resulting in a large increase in estimated recruitment at low SSB and strong overcompensation. In sensitivity analyses exploring the impact of setting F_{MSY} equal to the $F_{35\%}$ and $F_{45\%}$ SPR rates to approximate the implicit assumption under a Tier 3 specification, the authors found that relatively minor changes in the estimated SRR resulted, aside from a mild reduction in steepness.

The authors highlight several considerations leading to a rating of Level 2 (substantially increased concerns) for environmental/ecosystem and fisheries categories in the risk table. These included the poor fishery catch rates during the 2020 B-season, low pollock condition (weight per length), overall small size of pollock in catches, and temperature conditions experienced by the 2019 year class.

The 2021 ABC and OFL specifications under Tier 1 continue to be above the 2 million t OY for combined groundfish stocks within this FMP area. However, the authors and BSAI GPT recommended a 30% reduction from the maximum permissible ABC under Tier 1, which is consistent with maxABC under the Tier 3a harvest control rule, as has been the practice in recent years. **The SSC continues to support the authors' and BSAI GPT's recommendation to specify the 2021 ABC and OFL consistent with the maximum values under Tier 3a,** given the sensitivity of the stock-recruitment relationship to prior specification, poor 2020 B-season fishery catch rates and concerns regarding pollock condition in 2020. Assuming recent harvest levels continue, the projected 2021 female spawning stock biomass would remain above B_{MSY} in both 2021 and 2022.

The SSC appreciates the inclusion of a thorough appendix describing the structure and specification for the VAST model used to standardize NMFS bottom trawl survey data from the EBS and NBS. In addition to standard diagnostic plots (i.e. Q-Q plot, residual histograms, and observed vs. predicted encounter probabilities), this appendix included plots of the distribution of spatial residuals for the encounter probability and positive catch rate components of the spatio-temporal model. **The SSC commends the authors on development of this appendix and recommends** that other assessment authors utilizing VAST models for survey index standardization follow a similar standardized format for reporting VAST model structure and specification, including figures describing model fit and spatial residual patterns.

The 2021 EBS pollock assessment includes a formal decision table, describing the probability of a range of fishery and stock performance metrics across a range of potential catch levels for 2021. The SSC appreciates the authors' efforts in developing this informative addition to the SAFE document.

The SSC continues to support:

- Ongoing genetic studies to determine the relationship between pollock in the NBS and EBS, and nearby GOA and AI regions.
- The 2019 BSAI GPT recommendation to revisit and evaluate the treatment of variance parameters within the assessment, with particular attention to those that are fixed.
- Efforts to quantify pollock movement and abundance along the US-Russia EEZ boundary.
- Geostatistical analyses of combined trawl and acoustic data to provide a single time-series, statistically accounting for the overlap between these data, for informing stock trends.

The SSC provides the following additional recommendations:

- Exploration of young-of-year pollock density and quality estimates from NMFS BASIS surveys to inform pollock recruitment.
- Consideration of whether the observed sensitivity in the SRR to prior specification should constitute an increased risk level specification within the assessment or population dynamics-related considerations. This could provide a clearer justification for the use of the Tier 3 calculation as the basis for harvest specification.
- Given the time-varying specification of fishery selectivity within the assessment model and the large change in the estimated 2021 F_{OFL} between the 2019 and 2020 assessments, the authors should provide a retrospective comparison of the selectivity assumed in projections to that estimated with the addition of new data.
- Consideration of whether risk table specifications should account for the importance of pollock as a key forage species in the EBS ecosystem to better justify the use of a Tier 3 ABC determination as a precautionary measure for this Tier 1 stock.
- Given the apparent disappearance of the second and large mode in fishery length compositions as the 2020 B-season progressed, exploration of within-season spatial variation in fishery length composition would be useful in evaluating whether these larger pollock simply moved out of the area of fishing effort, or died as a result of natural or fishing mortality.

Aleutian Islands

The previously accepted base model (15.1) was updated for 2020 to include: the 2018 survey age composition data, 2018 fishery age composition data, and updated 2019 and 2020 fishery catch estimates. There was no Aleutian Islands bottom trawl survey in 2020. A second model (15.2), which included age-specific natural mortality was again provided for comparison.

The SSC supported the authors' and BSAI GPT's recommendation to continue using model 15.1.

Results indicate the spawning biomass may be increasing, but remains far below historical peaks. The authors note several ABC considerations, including: potential interactions with other pollock stocks including migration into and out of the area, the assumption that survey catchability is equal to 1.0, high survey CVs, high levels of ageing error and the apparently anomalous 1978 year class. Despite these uncertainties, the authors assign risk levels of 1 to all categories and suggest setting the ABC to the maximum permissible value.

The SSC concurs with the authors and the BSAI GPT to use maximum ABC for 2020 and 2021 and to calculate OFLs using the standard Tier 3a approach.

The SSC provide the following additional recommendations:

- Consider the relatively high level of ageing error and whether this constitutes the basis for a higher risk level within the assessment-related considerations. Also explore avenues for improved ageing, including an evaluation of the apparent shift of the 2011 cohort into a 2012 cohort in the recent observations. Comparisons with similar shifts from the 2012 to 2013 cohorts in the EBS pollock data may be helpful.
- The bottom trawl survey age composition data appear to be largely uninformative and show little evidence of larger cohorts in the fishery data. Consider whether this has implications for the strong assumption that survey catchability is equal to 1.0, and perhaps explore other plausible values for catchability.
- Continue genetic analyses of walleye pollock including this portion of the species range in addition to the Bogoslof area, GOA and EBS in order to better understand the stock structure and potential for demographic exchange among these areas.
- In the next assessment, explore potential effects of the apparent inconsistency between the input recruitment variability (0.6) and the estimated variability (1.0).
- Following the SSC comments in 2018 and 2019, provide a basis for the time-period over which recruitment estimates are used to estimate the biological reference points for this stock.

Bogoslof

This assessment included the results of the most recent acoustic-trawl survey conducted in February 2020, including updated biomass trend and age composition information. The authors note that this stock has been subject to a very low level of fishing mortality since 1992.

The assessment presented the results of the Tier 5 random effects smoother, as well as an age-structured model that provided a consistency check on the assumed rate of natural mortality of 0.3. The 2020 acoustic survey was down considerably from the higher indices in 2016 and 2018, and the Tier 5 estimates of biomass based on the random effects smoother followed this trend. The age-structured model results appear to track the Tier 5 biomass estimates well, and the estimated distribution for natural mortality did not suggest a point estimate appreciably different from 0.3. The SSC appreciates the authors' efforts to re-evaluate natural mortality, given newly available data. The authors noted no elevated risks in the risk table analysis (values of 1 for all categories).

The SSC supports the authors' and BSAI GPT's recommended Tier 5 estimates of the ABCs and OFLs for 2021 and 2022.

The SSC wishes to highlight the use of posterior predictive distributions in this assessment. The SSC noted that these distributions provide a very helpful diagnostic for model fit and consistency of model structure and assumptions with the observed data. While commonly employed in Bayesian analyses in other fields, such computationally demanding methods are rarely included in fisheries analyses but represent a promising avenue for development. In addition to time-series including the expanded uncertainty in the predicted values (process and observation error), histogram plots of the quantiles of the posterior distribution in which the data points lie may also aid in interpreting this information.

BSAI Pacific Cod

Bering Sea

Public Comment

There were many public comments for this year's EBS Pacific cod stock assessment. Written public comments were provided by Chad See (Freezer Longline Coalition), Alistair Dunn (Ocean Environmental Ltd), Richard Thummel (COO, Alaskan Leader Fisheries), and Oystein Lone (Captain, F/V Pacific

Sounder). Oral public testimony was provided by Gerry Merrigan (Freezer Longline Coalition), Chad Lowenberg (self), Kenny Down (self), John Gauvin (Alaska Seafood Cooperative), and Scott Hansen (Fishing Company Beauty Bay). Many complimented the stock assessment efforts both in 2020, and historically. Most testifiers commented about increases in fishery catch per unit effort (CPUE) observed in recent years across gear types and over broad areas. Several discussed that sometimes the fish quality is different in the northern Bering Sea with respect to parasite loads and that this can drive the observed spatial patterns in the fishery. Many expressed concern about potential large reductions in ABC despite increasing CPUE and that there has not been a cod ABC so low for 30 years. Many commented on recent observations of large numbers of small cod. Several recommended rolling over the current ABC to next year, and others expressed a preference for model 19.12a or selection of ensemble model AB. Another testifier commented that a significant portion of the cod stock is off bottom during the times of day that the survey samples. One testifier had been hired to provide a written scientific review of the assessment models, along with recommendations on topics recommended for inclusion in the terms of reference for a planned CIE review of this assessment.

Assessment

As always, Dr. Thompson and the co-authors diligently responded to all previous SSC comments and recommendations. The authors also developed new models to accommodate fishery CPUE into several models in response to a stakeholder request. The SSC commends the extensive and thorough work leading to this year's assessment. The authors have presented several ensembles, including: the four models the SSC requested in October (ensemble A), and a second ensemble (ensemble B), which added models including fishery CPUE as an index and allowed for dome-shaped selectivity. The author recommended ensemble (AB) was the union of these two ensembles.

In terms of the author recommended models, the BSAI GPT was concerned that the inclusion of fishery CPUE was premature at this time; specific concerns included: the way the error was treated in the model, the aggregation of gear types, and the fitting to this index in the absence of age data. However, the SSC agrees with the BSAI GPT that the compiled index and the raw data do tell a valuable story. A frequent concern with the use of fishery CPUE data is the possibility of hyperstability of the index (i.e., fishery CPUE does not drop in proportion to abundance). This can be particularly important for use of nominal CPUE data that does not control for other factors. However, spatial fishing maps suggest that cod are not particularly aggregated and that the industry is finding high catch rates in many places. Generally one would be most concerned if CPUE was suddenly dropping and/or the fishery was concentrated in a shrinking footprint. Fishery CPUE usually lags a decline in survey CPUE (e.g.,basin effect), but in this case it is steadily increasing and is at the highest levels since the 2000s. Other potential issues with fishery CPUE include technology changes, vessel and gear effects, and the effects of changing management on fishery behavior. For these reasons it is important to standardize CPUE using statistical methods. The SSC welcomes further development of fishery CPUE as a potential index whether for inclusion as a hypothesis in an ensemble or for a standalone model. However, the SSC requests the authors consider using methods like a GLM or GAM moving forward and providing results early in the process (e.g., September), to allow for sufficient review time. It would also be important to carefully consider the error that is used to weight a new fishery index, as it probably will be more precise than the survey, but not necessarily a better index of population abundance. Other new models introduced considered dome-shaped selectivity for the survey, which has previously been abandoned by the SSC and Plan Teams because of published work on the topic. If future potential ensemble members were to include dome-shaped selectivity, they might also consider lower values of catchability as an additional alternative hypothesis because both of these issues were examined in that research.

The BSAI GPT and SSC have continued to encourage efforts to provide ensemble models for Pacific cod. The authors have made tremendous progress despite recommendations shifting over time. Yet, the SSC is again unsure what constitutes a good ensemble, how to weight the ensemble, and being unsure if the added complexity is worth the cost in terms of communicating and interpreting results. Adopting an ensemble

approach right now, particularly the one that the BSAI GPT has identified, represents a big change prior to the scheduled Center for Independent Experts (CIE) review planned for 2021. This was discussed briefly in October, but the SSC recommended continued evaluation of ensembles in December. There was no new survey information in 2020. However, all the models presented in 2020 are projecting a declining spawning biomass trend, largely consistent with models evaluated in 2019.

In addition, it was noted that Pacific cod catch rates in the AFSC longline survey have been about average in terms of relative population weight from 2011 - 2019, and catch rates have recently increased in the IPHC setline survey. The series of recent low recruitments is concerning, but it is not unprecedented and there are signs of a potentially larger incoming year class (2018). Though unused in the model, fishery age compositions in recent years suggest that a similar proportion of age 3 fish have been caught through this period of low recruitment, as compared to years when there was good recruitment. The SSC reiterates the importance of including fishery age compositions in future model candidates.

Model 19.12 was the SSC-recommended model from last year and combines the NBS and EBS surveys into one index. The SSC recognized at that time that it was an increase in complexity from 16.6i,which had been previously used to set catch specifications. The SSC recommended the inclusion of 19.12a (2020 naming) last year as an alternative to time-varying catchability for the survey, which may dampen the information content of the survey time series, and does not appear to provide notable improvements in model fit to other data sources. This could lead to 'overfitting' the index, if not driven by detectable process error (i.e., the extra parameters merely follow the index, when the survey goes up the catchability goes up and when it goes down catchability goes down). The authors noted that model 19.12a has a high mean-squared residual relative to the other models. However the standard errors on the combined index are quite small and the models tend to fit the size composition data closely, which challenges the model to precisely fit the more extreme survey data points.

The SSC identified model 19.12a as a simpler version of the previously adopted 19.12, which partially addressed the BSAI GPT and SSC concerns of overparameterization. Model 19.12 also shows large annual changes in catchability, sometimes as high as 20-30% between years, with many annual catchability estimates, and the mean greater than 1. The author noted that there is no clear hypothesis or mechanism behind allowing catchability to vary every year. The SSC was concerned that time-varying catchability might be aliasing some other unmodeled process. The SSC also noted that this model showed a relatively unbiased retrospective pattern.

Based on these considerations, the SSC recommended using model 19.12a to set the OFL and ABC for 2021.

The authors presented a new method in Appendix 2.6 to consider whether risk table levels warrant a reduction in ABC, which involved computing a probability of going over OFL and assessing where in each risk level rating band the author thinks the stock falls. The only rating that was above 1 was ecosystem, and the authors also consider this to be on the low end of a 2. The rationale in that category was a mixture of positives and negatives but with many indicators looking normal or average. One of the risks in the stock assessment cited last year that appears to be at least partially resolved, is apparent spawning in the NBS with the presence of many one year old fish in the 2019 age composition. The author provided a rationale for assigning a risk level of 1 for stock assessment considerations. Part of this rationale was based on the use of the ensemble to include additional sources of uncertainty beyond those included in a single model. However, the SSC notes that this would imply an elevated risk for all assessments where structural uncertainty was identified but not included either in the base case model or through the use of an ensemble.

Based on the risk table results and the new method, the authors did not recommend any further reduction from the maxABC. Nevertheless, the ABC from the single model 19.12a was similar to the authors' recommended ABC. The SSC noted that a tier 5 ABC based on the 2019 survey biomass would be higher than any of the Tier 3 models considered. Generally speaking, the SSC views Tier 5 calculations as being

more conservative than Tier 3. **The SSC agrees with the authors and BSAI GPT for no reduction from the maximum ABC based on the risk table.**

CIE Review

The SSC supports items proposed by the BSAI GPT for inclusion in the CIE review of this assessment planned for 2021. Proposed topics include: development of a standardized fishery CPUE index using alternative statistical methods, incorporation of dome-shaped survey selectivity, discussion of models to include in an ensemble, whether to apply the sloping harvest control rule before or after ensemble averaging of SSB and other reference points, and development of movement models. The SSC also recommends consideration of suggestions offered by Alistair Dunn (public comment) about other factors that could be included in the CIE review if time is available including: inclusion of other survey information (e.g., the IPHC and sablefish surveys), and considerations about how best to include the fishery age and size composition data. Additionally, Mr. Dunn suggested that the analysis of fishery CPUE data suggested by the GPT could include development of spatiotemporal analyses of fleet-specific CPUE indices that may help inform the assessment. The SSC also encourages review of further efforts to include fishery age data in future analyses. If time allows, the CIE could comment on avenues for incorporating spatial dynamics and movement.

In addition, the SSC would like the CIE review to include an evaluation of the use of ensemble modeling in the NPFMC management system, and specifically whether the structural uncertainty and historical challenges in identifying a robust base model make Pacific cod a good application for ensemble modeling. The SSC acknowledges the trade-off between review capacity and the addition of models comprising an ensemble, but also recognizes that the goals of developing an ensemble that describes a range of structural uncertainties differs from those of refining a single best model.

Ecosystem and Socioeconomic Profile

The ESP for EBS Pacific cod closely follows the template for ESPs developed by Shotwell et al. (in review). It replaces the ecosystem considerations section that was previously reported in the EBS Pacific cod SAFE report. Development of an ESP for EBS Pacific cod was identified as a high priority because of the high commercial importance of cod and the habitat requirements of early life history stages.

The metrics assessment revealed high vulnerability of cod based on its maximum length, spawning duration, top-down ecosystem value, natural mortality, and length at 50% maturity. For socioeconomic metrics, high vulnerability was indicated by commercial importance and non-catch value and constituent demand fell within the 80th percentile rank.

Ecosystem processes were described corresponding to each life history stage, starting with spawning, hatch timing and success, larval feeding success based on match with prey, ocean acidification effects on growth, and predation and competition among juvenile and adult stages. Socio-economic processes include the allocations of cod among industry sectors, prices, and value of various derived seafood products (e.g., head and gut, fillet).

A suite of indicators was developed, including ecosystem indicators, such as the North Pacific Index, sea ice extent, spring sea surface temperatures, bottom temperatures, and lower and upper trophic level indicators. Socio-economic indicators include ex-vessel value, estimated revenue per effort and community indicators.

The ESP monitors these indicators using three stages of statistical tests that gradually increase in complexity. This ESP reports initial results of the first (traffic light) and second stage (regression) statistical tests of the indicator monitoring analysis for EBS Pacific cod.

For community harvest revenue indicators, the SSC recommends that the analysts consider aggregating small communities that cannot be individually disclosed into a single indicator that can be displayed along with the limited number of larger community indicators that can be disclosed, for consistency with other

ESPs and for the sake of a more comprehensive portrayal of EBS Pacific cod community engagement trends.

The SSC greatly appreciates the thoroughness of this ESP and looks forward to further development including the third stage (modeling) tests.

Aleutian Islands

There were no public comments for AI Pacific cod. This stock has been managed under Tier 5 using a random effects model since it was first assessed separately from the EBS in 2013. No changes were made to assessment methods, but catch data over 1991-2019 were updated and preliminary catch data for 2020 were included.

Total catch declined from 19,162 mt in 2019 to 11,918 in 2020. Public comment at the BSAI GPT meeting indicated that reasons for lower catches included no shoreside processing set-aside, closure of the Adak processing plant, parasite loads, and limited markets. Also at the BSAI GPT meeting, anecdotal information indicated that there were small fish with high parasite loads and large fish with no parasites. Reasons for this are unknown.

The author and BSAI GPT continue to recommend a Tier 5 assessment. The OFL and ABC are unchanged from last year. **The SSC agrees with the tier and resultant catch specifications.**

Risk table scores were assessment (1), population dynamics (1), environmental/ecosystem (2), and fishery performance (2). Because the highest risk score (2) is greater than 1, a case could be made for additional reductions in ABC. In 2019 the highest risk table score was also 2 but the SSC concluded that no additional ABC reduction was necessary because Tier 5 estimates are generally considered more conservative than Tier 3 models. **As a result, no additional reduction below maxABC was recommended; the SSC agrees.** The SSC reminds the authors not to report an "overall score" for the risk tables.

During 2012 - 2016, 22 different age-structured models were reviewed in the assessments of AI Pacific cod. However, none of them were accepted by the BSAI GPT or SSC. An age-structured model was not presented this year, but one will be presented in the future for consideration as a Tier 3 assessment. The BSAI GPT recommended presentation of an age-structured assessment at the BSAI GPT meeting in September 2021. This stock is scheduled for an ESP. The SSC looks forward to an age-structured assessment and ESP for this stock.

BSAI Flatfish

Yellowfin Sole

The SSC commends the authors of the assessment on a much improved document. The SSC appreciates the implementation of the risk table. There was no public testimony for the yellowfin sole assessment.

The base model for this Tier 1 assessment (Model 18.1) was first developed in 2018 and was modified in 2019 to include the survey start date, in addition to temperature, as a covariate for estimating trawl survey catchability. New data included this year were the total catch for the 2019 fishery updated through the end of the year, an estimate of total catch for 2020, estimated survey and fishery age compositions for 2019, and estimated fishery weight-at-age based on the catch-at-age methodology used in the walleye pollock assessment. No new survey biomass estimate for 2020 is available due to the cancellation of the 2020 bottom trawl survey. In addition to the base model, which uses the same natural mortality (M = 0.12) for males and females, three other models were presented. The first, Model 18.2, was the author and BSAI GPT's preferred model and was first presented in 2019. The model uses a fixed value for female natural mortality (M=0.12) but estimates male natural mortality. Two other models are based on Model 18.2, but use VAST estimates and standard errors for the EBSbiomass (Model 18.3) or VAST estimates and standard errors of the combined EBS and NBS biomass (Model 18.4).

Model 18.2 provides a clear improvement over the base model with a considerable reduction in the overall likelihood due to better fits to the age composition data. The estimated survey biomass (design-based) increased by 6% in 2019 compared to 2018 and, combined with a male natural mortality that was estimated to be slightly higher than female natural mortality at 0.135, resulted in higher total (+11%) and spawning biomass (+23%) estimates for 2020 (Model 18.2) than projected last year. Compared to model 18.2, using the VAST estimates of survey biomass resulted in somewhat lower (18.3) or higher (18.4) estimates of total and spawning biomass.

The SSC concurs with the author and BSAI GPT recommendation to use Model 18.2 to set the OFL and ABC for 2021 and 2022. Under the recommended model, yellowfin sole continues to be managed as a Tier 1a stock and remains well above B_{MSY}. We also agree that no adjustment to the maximum ABC is necessary at this time, based on the risk table. However, the SSC suggests that the authors and BSAI GPT consider a level 2 designation for the assessment category in the risk table, given the strong retrospective bias in the model.

The SSC offers the following additional recommendations:

- The SSC remains concerned about the large retrospective pattern and supports the PT recommendation to investigate decreased female natural mortality and weight at age.
- The SSC commends the authors for including temperature-dependent growth, validated by otolith chronologies, into the model as noted on p. 8 of the assessment. However, details of the implementation are not documented and the list of parameters does not show any parameters related to temperature-dependent growth. The SSC requests a clarification and, as appropriate, additional documentation of how temperature-dependent growth is implemented in the model.
- The SSC appreciates the discussion of YFS biomass trends in the NBS, including trends in the ADF&G survey in Norton Sound, as well as the inclusion of a model that uses VAST estimates of the combined EBS + NBS survey biomass time series (Model 18.4). Both models 18.3 and 18.4 provided good fits to the survey biomass estimates and reasonable estimates of total and spawning biomass. We note that the biomass in the NBS increased from 311,000 t in 2010 to 520,000 t in 2019 based on the NBS bottom trawl survey. Similarly, YFS catch per unit effort in the ADF&G trawl survey in Norton Sound has shown an increasing trend over time since the late 1970s with peak catches in 2019. The design-based estimates of survey biomass for the EBS and NBS suggest that just over 20% of the portion of the stock that is sampled by the survey occurred in the NBS during the summer of 2019. **Therefore, and in anticipation of annual surveys in the NBS and potential further increases in YFS biomass in the NBS, the SSC encourages the authors to bring forward a model in the next assessment cycle, such as Model 18.4, that includes the NBS survey biomass estimates.**
- The SSC was concerned about some of the posterior distributions from the MCMC analysis, specifically the bimodality in log(Recruitment) for Model 18.2. The SSC requests that the authors provide standard diagnostics for assessing MCMC convergence and parameter correlations. If the bimodality in log(Recruitment) is a feature of Model 18.2, the SSC recommends that the authors examine if the issue is related to the separation of sexes in the model.
- The SSC recommends further investigation of previously noted issues as time allows, including possible further adjustments to estimating separate natural mortality for males and females, explorations of the sex ratio relative to the timing of annual spawning migrations as an alternative explanation for a high proportion of females, a potential link between wave height and catchability, and a single selectivity curve for both sexes. We note that the latter is supported by survey selectivity estimates that are virtually indistinguishable in Model 18.2 (Fig. 4.17) and by time-varying fishery selectivities that are very similar between males and females since the early 1980s, but diverge widely and inconsistently in some earlier years (Fig. 4.18).

- With regards to estimating natural mortality, we note that the author suggested that the data provide more information on female than male M, hence we support the PT suggestion to fix male M at the estimated value from Model 18.2 and to estimate female M in the model as one possible approach to modeling sex-specific values. However, other options could be explored and the SSC does not intend to be prescriptive but encourages further examinations of sex-specific mortality and how to implement it.

Greenland Turbot

A full assessment was presented for Greenland turbot. There was no public testimony. This stock is assessed on a biennial basis, with the last full assessment in 2018. The 2020 assessment presented a single model, Model 16.4a (2020). The SSC commends the authors on a well-written assessment that is responsive to SSC and BSAI GPT comments.

Model 16.4a is the base model from 2016 and 2018, with one correction. The AFSC longline relative population numbers (RPNs) were corrected to units of numbers of fish, rather than biomass. The SSC commends the authors for identifying and correcting this error. Updated data include:

- 2019 NMFS shelf bottom trawl survey biomass estimate and length composition
- 2019 and 2020 AFSC longline survey RPNs
- Updated catch for 2018 and 2019, and a preliminary estimate for 2020.
- Fishery length compositions from 2019 and 2020

The SSC concurs with the use of Model 16.4a as recommended by the author and the BSAI GPT. Total likelihood results indicate that Model 16.4a is an improvement on the original base model from 2018, which may be due to the AFSC longline survey units now being correctly specified. Results from this model indicate that total biomass (age 1+) has generally increased from a low in 2010 to a recent high in 2017, and has been slowly declining since. Spawning biomass has been increasing since 2013, resulting from the strong 2007 – 2010 year classes coming into the population, but is projected to decline starting in 2021.

The estimated 2021 female spawning biomass is above $B_{40\%}$, placing Greenland turbot in Tier 3a. **The SSC agrees with this tier designation and the recommended OFL and ABC. The SSC appreciates the application of the risk table in this assessment and agrees that no reduction from the maximum ABC is necessary**, despite the risk level of 2 in the environmental/ecosystem category. Apportionment of the ABC to the AI and the EBS uses an average of adult biomass in the AI region of 15.7%, as in previous years. This is based on an unweighted average of the EBS slope and AI survey biomass from the four most recent survey years when both of these surveys were conducted. The SSC supports this allocation.

The SSC has a number of suggestions for improvement of the assessment and the model. First, we recommend a more realistic alternative than the maximum ABC be used for two-year harvest projections, as only roughly one third of the ABC was caught in 2019. **The SSC emphasizes the importance of the EBS slope survey for Greenland turbot as a key source of trends in adult biomass for this stock, while also recognizing that the SSC recommended that the EBS slope survey have a lower prioritization than other major AFSC surveys if funding is limited**. The SSC suggests that it might be useful for the author to explore the use of VAST for the EBS slope and longline surveys, given the recent cancelations and relative paucity of trawl surveys of the slope.

With regard to maturity, recent information (Cooper et al. 2007) suggests that the maturity at size may be larger than estimated from a previous study in the early 1980s, though this recent study had limited samples at smaller sizes. The SSC suggests that pooling the data from these two studies might provide a more defensible approach than the approximation of the D'yakov 1982 results presented in the assessment.

The SSC appreciates the authors tracking SSC and BSAI GPT recommendations from 2018 and looks forward to the authors addressing them in the next full assessment in 2022, as is practicable. Included in

these recommendations were a number of recommendations regarding selectivity. As suggested by both the BSAI GPT and the SSC in 2018, a rationale for the numerous time blocks used for the time-varying selectivity curves is needed and exploration of consistency of time blocks across surveys should be explored. In addition, the SSC noted the relatively large changes in selectivity among the time blocks for the trawl fishery in particular. These changes are suggestive of dramatic changes in the fishery or in the distribution of the species and the SSC recommends an exploration of whether such changes are reasonable and can be explained. If large shifts are occurring in the fishery, the timing of these shifts may inform what time blocks are appropriate. There were also several data components that were included in the assessment but did not contribute to the likelihood estimation, and justification should be provided for these decisions in the assessment document. These include the AFSC longline survey length compositions and the shelf survey age compositions.

Arrowtooth Flounder

Arrowtooth flounder in the BSAI is assessed on a biennial basis and a full assessment was presented this year. There was no public testimony. The SSC commends the authors on their work on this assessment and for their responses to previous BSAI GPT and SSC recommendations, including adding the risk table and their careful examination of both species identification in survey data and species compositions of arrowtooth and Kamchatka flounder in past observer data. In the past, arrowtooth was assessed along with Greenland turbot, and more recently, as a complex with Kamchatka flounder. However, in 2010, Kamchatka and arrowtooth flounders began to be assessed separately due to the development of a directed fishery for Kamchatka flounder. Arrowtooth flounder are encountered in the EBS bottom trawl shelf survey, the EBS slope survey, and the AI bottom trawl survey. Updated data sources include:

- biomass point estimates and standard errors from the 2019 EBS shelf survey,
- age composition data from the 2018-2019 EBS shelf and 2018 AI surveys,
- length compositions from the 2019 EBS shelf survey,
- fishery length compositions for 2018 (updated) and 2019, and
- updated catches for 2019 and 2020.

In response to the SSC request to examine species identifications in historical survey data, the recommended model also excluded EBS shelf survey data for 1982-1991 and retained surveys from 1992 forward. The SSC appreciates the comparison of total and spawning biomass estimates over the last 20 years with the uncorrected (1982-2019) and corrected index (1992-2019). Catch proportions of Kamchatka and arrowtooth flounders were slightly adjusted for 2008-2010 after consultation with the NMFS Fisheries Monitoring and Analysis Division of AFSC and the Alaska Regional Office. There was little net effect on the model results from these changes.

There were no changes in assessment methodology for 2020. Results from Model 18.9 indicate that arrowtooth flounder total biomass increased approximately three-fold since 1976. After a peak in 2009 and a slight decrease through 2016, total biomass has increased since 2016 due to recent recruitment. Female spawning biomass has followed a similar trend, but after peaking in 2012, has declined slightly and has stabilized between 2018 and 2020. While still estimated to be the largest age-1 recruitment since at least 1976, the estimate of 2017 age-1 recruitment has decreased 19% from the estimate in the 2018 assessment. The 2017 age-1 year class is still less than 25% selected by the fishery and is less than 50% mature (50% of female maturity attained at 7 yr). Arrowtooth flounder has remained lightly exploited with catches averaging 14,228 t from 2011-2019. Arrowtooth flounder continue to be captured in pursuit of higher value species and since the implementation of Amendment 80 in 2008 are highly retained (93% in 2020). The largest catches occur in the flatfish fisheries and the trend of high retention is expected to continue in the near future. Estimates of female spawning biomass from the past two decades are well above $B_{40\%}$ and, if

fishing continues as it has over the past five years, projected female spawning biomass is expected to remain above $B_{40\%}$.

The SSC concurs with the recommended Model 18.9 for use in setting 2021 and 2022 harvest specifications for the reasons specified by the author and BSAI GPT. Female spawning biomass is estimated to be greater than $B_{40\%}$, and therefore arrowtooth flounder are defined as a Tier 3a stock**. The SSC agrees with the author and BSAI GPT recommended OFL and the maximum permissible ABC for 2021 (Table 1).**

The SSC notes that model fits to the female fishery composition data are poor and this may still be related to the amount of sex-specific data available for certain years and issues with speciation. The authors are planning to investigate data quality issues as they relate to sample size and speciation issues associated with the compositional information. The SSC looks forward to this additional information in the next assessment.

The SSC recommends that the authors check the parameterization for selectivity and the estimated selectivity curves for the shelf survey to verify that the peaks of the domed shape failing to reach a value of 1.0 does not create any unexpected artifacts in the calculations or change the interpretation of catchability or other model results. In addition, the SSC requests the authors bring forward historical information on the rationale used for the selectivity parameterizations used in the assessment.

Kamchatka Flounder

A full assessment of Kamchatka flounder was presented. There was no public testimony. This stock is assessed on a biennial cycle, and the last full assessment was in 2018. The SSC appreciates the authors' responsiveness to past SSC comments. For this assessment, two models were presented. First, Model 16.0a, the base model, was presented with updated data and a correction to the weight-at-age matrix. The impacts of the corrected weight-at-age matrix were evaluated in Appendix A and were minor. The second model (Model 16.0b) retains the characteristics of the base model and updated data, but also updates weight at age and the age-length transition matrix. The SSC appreciates this stepwise approach to changes in the assessment.

Recent catch estimates were updated, including a preliminary estimate for 2020. The SSC notes that the 2020 TAC has been exceeded but catch is not estimated to exceed the 2020 ABC. Given the interest in this stock, the SSC recommends continued close monitoring of catches. The SSC appreciates the work the authors did to re-examine assumptions and update species compositions between arrowtooth and Kamchatka flounder in the historical catches. Recent fishery length compositions from 2019 and 2020 were included, in addition to 2019 EBS shelf survey biomass and length compositions. The 2016 EBS slope survey age compositions were substituted for the 2016 length compositions. Similarly, the 2016 and 2018 AI survey age compositions were substituted for their respective length compositions. In Model 16.0b, the age-length transition matrix was also updated with new length-weight and von Bertalanffy growth relationships from the aggregated (AI, EBS shelf, and EBS slope) bottom trawl survey datasets.

The model with the updated biological information, Model 16.0b, was the recommended model by both the authors and PT. In general, both models presented performed similarly, though the retrospective pattern improved slightly with the recommended model. Given that Model 16.0b uses the most recent data and includes biological information based on a more complete dataset, the SSC agrees with the use of Model 16.0b for harvest specifications for 2021.

Results from this model indicate that the Kamchatka flounder spawning biomass and total biomass continue to increase from 2013. Numbers at age indicate a series of strong cohorts from 2008 to 2016 that are becoming a part of the spawning biomass. The 2021 estimate of SSB is above the estimate of $B_{40\%}$, placing this stock in Tier 3a. **The SSC agrees with the authors' and BSAI GPT's recommended OFL and ABC.** The SSC appreciates the application of the risk table in this assessment **and agrees that no reduction from the maximum ABC is necessary.**

The SSC supports authors' plans for explorations and has a number of suggestions with regard to model improvements. Specifically, the SSC supports the authors' plans for evaluating formal data weighting, given the fits to the EBS shelf survey, and plans to explore separating age- and length- composition data between the Bering Sea and Aleutian Islands subareas. The SSC noted the poor fit to the shelf survey in recent years and flags this for continued investigation. With the improvements seen in the arrowtooth flounder assessment, the SSC continues to support the incorporation of aging error into the assessment. The SSC appreciates the re-examination of the age-length transition matrix and looks forward to the evaluation of assumptions about constant or changing CV in the next full assessment. Finally, the SSC continues to encourage the examination of the relationship between temperature and catchability.

Northern Rock Sole

There was no public testimony for northern rock sole. This is a Tier 1 assessment and the assessment model was updated with new information including estimated catches for 2019 and 2020, estimated discards and retained portions of the 2019 catch, survey and fishery age composition for 2018 and 2019, and estimated trawl survey biomass and standard error for 2019. The survey biomass in 2019 declined 7% from 2018 and was the lowest since 1985.

Three models (15.1 and 18.3, and an exploratory model that downweights the age compositions) were presented this year. Model 15.1 is the base model that has been used since 2006. The new models all estimate separate natural mortality rates for males. Model 18.3 estimates survey catchability in addition to male M and adds an offset for male selectivity in the fishery (allowing the asymptote to differ from females) based on earlier recommendations to address sex-specific targeting in the fishery.

Model 18.3 was presented to the SSC in 2018 as part of a potential ensemble, but it was not accepted at that time. However, the BSAI GPT and the SSC thought Model 18.3 was a good candidate for future assessments. The SSC agrees with the BSAI GPT recommendation to adopt Model 18.3 because there is some evidence, and a good rationale, for sex-specific differences in both M and fishery selectivity.

The SSC expresses its appreciation for the authors' attempts to use bottom temperatures to inform survey catchability. Unlike yellowfin sole, a relationship between bottom temperature and catchability was not found. There is a distinct lack of fit in the last few years of survey biomass data. Survey biomass has been declining recently, but the age compositions are indicating high recent recruitment. The authors presented an exploratory model that substantially down-weighted the age composition data, which did little to improve the fit to the survey data. **The SSC suggests that the authors experiment with fixing M at high values or forcing dome-shaped selectivity to see if this helps address the poor fit. In addition, northern rock sole has a rich age composition history. It might be useful to examine the model when previous large recruitment groups were entering the population to see if the poor fit to survey biomass data is a persistent feature of the model that dissipates as the incoming cohorts age, or if this issue is only happening in this instance. The SSC agrees with the authors' and BSAI GPT's recommendations regarding model choice and for setting ABC and OFL under Tier 1a.** Because of the lack of survey fit, the authors chose a level 2 concern for the "Assessment" column of the risk table, but neither the BSAI GPT nor the authors found that it was sufficiently risky to warrant a reduction from maximum permissible ABC. The SSC agreed with the authors' and GPT's risk assessment.

The SSC found Appendix E interesting and looks forward to seeing some of the more promising recruitment covariates such as the cold pool and wind index potentially applied in future assessment models.

Flathead Sole

A full assessment was presented for BSAI flathead sole, a complex that includes two species. True flathead sole overlap with Bering flounder, a morphologically similar species, at the northern end of their range. Flathead sole represents over 97% of the combined biomass of the two species from the EBS bottom trawl surveys and Bering flounder represent only about 0.2% of the catch; therefore, the assessment focuses on

flathead sole. This stock is assessed biennially and is managed under Tier 3. The last full assessment was in 2018. There was no public testimony.

New input data for the assessment model included final catch biomass estimates for 2018-2019, and estimated projected catch for 2020; the 2019 survey biomass index, which included the 2019 EBS shelf survey biomass and predicted AI biomass for when the AI survey did not occur; age composition estimates from the 2018-2019 fishery and survey; and length composition estimates from the fishery (2020) and survey (2019). Finally, flathead sole ages 1-2 from the survey were added and Bering flounder ages 1-2 were removed to correct mistakes from the previous assessment.

This assessment model went through a CIE review prior to the last full assessment in 2018; several alternative models were considered, and many improvements were incorporated then. For this assessment, only the previously accepted model (Model 18.2c) was considered. This sex- and age-structured model appears to be very stable and the retrospective analysis indicates low retrospective bias.

A risk table was completed for the first time for this stock complex and all categories were ranked at level 1 indicating that there is little concern; therefore, there is no recommendation to reduce ABC from the maximum permissible. The data suggest no apparent ecosystem concerns, although it is noted that predation pressure may be rising (potential large 2018 Pacific cod cohort). The catch for this stock is consistently well below the ABC (~16% of ABC).

The SSC concurs with the use of Model 18.2c for harvest specifications, and the resultant Tier status and harvest specifications. Estimated spawning biomass for 2021 is greater than the estimate of B40%, therefore flathead sole is in Tier 3a. The OFL and ABC recommendations for 2021 are slightly lower than what was projected with the 2020 partial assessment model. **The SSC accepts the BSAI GPT's and authors' recommended 2021 and 2022 OFL and ABC.**

In their review, the SSC noted that fishery selectivity is length-based whereas the survey selectivity is age-based. **The SSC requests that the author provide a rationale for selecting length-based selectivity for the fishery in the assessment model.** It was also noted that male and female age-based survey selectivity curves are similar. **The SSC recommends the authors explore whether estimating separate male and female selectivity is necessary.** Finally, the SSC commented on the large Pearson residuals for the fisheries lengths, which may skew the likelihoods. **The SSC recommends that the author explore the influence of these large residuals - perhaps through data weighting or other means.**

The authors noted that some previous SSC comments were not addressed for this assessment but will be addressed in the next assessment. For example, this assessment previously incorporated average summer bottom temperature directly in the model, but was removed in the 2018 assessment because it no longer improved model fits and the authors thought that it may not be adequate to describe the relationship among the environmental drivers of flathead sole stock distribution and behavior. At the time the SSC recommended that the temperature relationship continue to be explored. The assessment authors plan to revisit the temperature/catchability relationship in the future and suggested that using spatially-varying coefficient models in VAST may be a promising alternative. The authors also may explore the use of VAST to estimate a BS & AI joint biomass index, which would replace the linear regression approach currently used. **The SSC supports these plans for future work and for addressing outstanding SSC recommendations.**

The SSC welcomes Dr Monnahan to the assessment team and commend the authors for a clear and detailed assessment report.

Alaska Plaice

A partial assessment was prepared for the BSAI Alaska plaice stock. There was no public testimony. Alaska plaice is a non-target species, but retention is high and biomass is slowly declining. A statistical age-structured model is used as the primary assessment tool for the BSAI Alaska plaice assessment, a Tier 3

stock. In a partial assessment year, the full assessment model is not rerun but instead a Tier 3 projection model with an assumed future catch is run to estimate the stock level in future years.

This projection model incorporates the most current catch information without re-estimating model parameters and biological reference points. The Tier 3 projection estimates future female spawning biomass, age 6+ total biomass, ABC and OFL based on the 2019 estimated numbers-at-age and weight-at-age from the full model.

Catch is well below maxABC and while the exploitation rate is trending upward it remains low, between 3-5% in recent years.

The BSAI GPT agreed with the author recommended 2021 and 2022 OFL and maxABC. No risk table analysis was presented as this is a partial assessment.

The SSC concurs with the author and team recommended OFL and maxABC.

Other flatfish

A full assessment of the other flatfish stock complex is conducted every four years. Catch estimates were added for 2017, 2018, 2019, and 2020 and catch for 2016 was updated. Survey biomass estimates were also added for recent years. The modeling methodology for this Tier 5 assessment was unchanged from the previous assessment. There was no public testimony.

There are no directed fisheries for the species in this complex. Catch estimates of the 15 flatfish species included in the assessment were dominated by starry founder on the Eastern Bering Sea Shelf and rex sole in the Aleutian Islands. The author reported that longhead dab showed a big decrease in survey biomass on the EBS shelf, but the cause is unknown. There is no ESP available for this stock complex. Exploitation rates are generally less than 5% and not increasing, and the total catch is substantially lower than the ABC. The risk table was added to this assessment for the first time this year but had no elevated concerns.

The BSAI GPT accepted the author's recommendations for the 2021 and 2022 ABCs and OFLs. The author and the BSAI GPT agreed that no adjustment to the maximum ABC was advised.

The SSC concurs with author and BSAI GPT recommendations for harvest specifications and supports BSAI GPT recommendation that the author consider adding a secondary table, by species, to the risk table. This breakdown will highlight species-specific concerns that can be tracked over time.

BSAI Rockfish

Pacific Ocean Perch (POP)

A full assessment was conducted for BSAI Pacific ocean perch (POP). There was no public testimony. Changes to the input data include:

- Catch data was updated through 2019, and total catch for 2020 – 2022 was projected.
- The 2018 AI survey length composition was replaced by the 2018 survey age composition.
- The 2018 fishery length composition and the 2019 fishery age composition were added.
- The estimated length-at-age, and age-to-length conversion matrix, were updated based on data from the NMFS AI trawl survey beginning in 1991.
- The estimated weights-at-age were updated based on data from the NMFS AI trawl survey beginning in 1991.
- The input multinomial sample sizes for the age and length composition data were reweighted using the McAllister-Ianelli iterative reweighting procedure.

There were no changes to the assessment methodology. The high survey biomass estimates over the past five years have contributed to a substantial increase in estimated stock size in recent years; however, there remains a poor residual pattern in the fit to the AI survey index.

The SSC agrees with the authors' and BSAI GPT's recommended model (Model 16.3a), OFLs and ABCs (Table 1). Based on current status, this stock qualifies for management under Tier 3a for 2021 and 2022. The SSC appreciates the work on the risk table by the authors. Despite the relatively strong retrospective pattern, lack of fit to the AI trawl survey, and the uncertainty in M, the **SSC agrees that there should be no reduction from the maximum ABC.**

There continues to be a conflict between the age and length composition data and the AI survey index data. With no new AI survey biomass data in the model this year due to COVID-19, the new compositional data have more influence and create a stronger decrease at the end of the modeled time series. While the high AI survey biomass estimates over the last five survey years contributed to a substantial increase in stock size, there is a poor residual pattern in fit to the AI survey index. The model consistently overestimates the middle of the time series and underestimates the last five survey years. **The lack of fit in recent years is concerning and the SSC suggests that this should continue to be a focus of future work**. With no new survey data in 2020, it is not possible to know whether the decline in the model trend in recent years is representative of a true population trend or whether it reflects a continued conflict between the survey index and the compositional data and is the result of missing survey data. The SSC emphasizes the importance of the AI trawl survey data to this stock, while recognizing the SSC's prioritization of AFSC surveys in the case of insufficient funding. The fit to the slope survey has not changed and the age and length composition data look similar to past data. While the OFLs for 2021 and 2022 are BSAI-wide, the ABCs are apportioned among four areas (western, central and eastern AI, and EBS) using a random effects model. The estimated proportion of the stock in each subarea is unchanged from the 2018 assessment due to the cancelation of recent surveys. **The SSC concurs with the authors' and BSAI GPT's recommended apportionments**.

The SSC appreciates the authors' responsiveness to several previous SSC requests and for including the economic performance report (EPR) as done in 2018, which the SSC found extremely helpful. The SSC appreciated the initial work the author did on natural mortality, by reviewing three methods from Then et al. (2015). The SSC supports continued work on evaluating M, including examining the impact of loosening the prior on M and considering time blocks in M, as suggested by the BSAI GPT, if an appropriate rationale can be developed. The SSC also supports the BSAI GPT recommendation to investigate Francis weighting. Finally, the SSC appreciates the authors sequentially removing data sources to see what data source may be causing the poor fit and residual pattern for the AI survey. The results of this effort suggested that the poor fit to the AI survey biomass is not attributable to any single compositional data set, but rather the combination of compositional data sets. The SSC **further suggests the author considers evaluating combining the two surveys biomass and age compositions through geo-spatial models.**

Northern Rockfish

BSAI northern rockfish is on a biennial schedule and a partial assessment was conducted this year. There was no public testimony. Updated data for the projection model included replacing the estimated 2019 catch with the final catch value (3% increase) and revising the 2020 and 2021 catch estimates. Exploitation rates averaged 0.017 during 2004 – 2020, which is below $F_{40\%}$. Catch in 2020 is projected to be 29% larger than the estimate in the 2019 projection, resulting in substantial increase in estimated 2020 fishing mortality relative to that assumed in the 2019 projection. Exploitation rates for northern rockfish dropped overall in 2020, with a large decrease in the eastern Aleutian Islands and slight increases in the central and western Aleutian Islands. Northern rockfish are determined to be in Tier 3a. **The SSC supports the authors' and BSAI GPT's recommendations for ABC and OFL. As during the 2019 full assessment, no reduction from maxABC was recommended.** The SSC appreciates the authors' reply to the SSC's comment last year regarding strong spatial patterns in the length at age and abundance, despite it being a partial assessment year. During the full assessment next year, the SSC brings forward their 2019 request that

clarification be included regarding the extent to which concerns listed in the risk table are addressed in the assessment and tier system for this stock.

Blackspotted and Rougheye Rockfish Complex

This was a full assessment of the BSAI blackspotted/rougheye (BS/RE) rockfish complex. This is a non-target stock complex and the last full assessment was presented to the SSC in December 2018.

The SSC received public testimony from Todd Loomis (Ocean Peace, Inc.). Mr. Loomis noted that Ocean Peace Inc. has four Amendment 80 C/Ps, and one catcher vessel that participates in the Aleutian Islands fisheries. He stated that from the fishery's perspective there is a lot of BS/RE on the grounds and he indicated that while the fishery had not been successful at staying below the AI sub-area ABC and WAI MSSC in recent years it has not been for lack of trying. He summarized the A80 sector's BS/RE avoidance efforts including: 1) industry recommended 543 POP TACs below the ABC for multiple years in an effort to reduce BS/RE catch. He noted that this resulted in over 11,000 mt of forgone POP harvest in 2019 and 2020, 2) shifting fleet effort to shallower fishing depths to avoid BS/RE. He reported that traditionally the fleet fished POP as deep as 180 fm, but owing to fear of catching large BS/RE their average POP tow depths have been reduced by over 40 fathoms since 2010. He indicated that historically this would have avoided most of the BS/RE, but for several recent years the fleet has encountered small BS/RE in areas as shallow at 80 fm and that small BS/RE have been showing up in Atka mackerel targeted fishing as well. 3) Fishery support for cooperative research to improve understanding of BS/RE. This includes having NMFS scientists onboard industry vessels to collect samples from AI rockfish, work with the stock assessment author on proposals to get more observer-collected lengths and otoliths, support for post-doc and graduate student projects looking at surveying untrawlable habitats and ways to better incorporate fishery-dependent information in rockfish assessments. Mr. Loomis stated that he believed the industry's efforts to avoid BS/RE by fishing shallower are largely responsible for the change in fishery size composition, and that there is a large year class or classes just becoming available to the fishery. He noted that this is apparent in the recent fishery and survey age/size composition data but that the lack of an AI survey this year limits our ability to confirm this in the current assessment. He indicated that the industry thinks the large BS/RE are still present, but are not showing up in the fishery composition data due to lack of directed fishing effort in deeper waters. Finally, Mr. Loomis said that he believed the MSSC approach has had benefits in that it has identified area-specific targets for the fishery to try to stay below, but that the current challenges are likely because the AI spatial management boundaries do not correspond to anything biologically meaningful for BS/RE. He noted the large differences in BS/RE apportionment between areas 542 and 543. The SSC asked Mr. Loomis about potential additional industry efforts or ideas for addressing the disproportionate spatial harvesting of BS/RE in the AI. He indicated that distribution of targeted fishing was driven by the splits in POP and Atka mackerel quota among the AI sub-areas, that while excluders in use for Pacific cod might be effective for large BS/RE they were unlikely to reduce the catch of small fish, and that shifts back to deeper fishing might reduce catches of small BS/RE but would probably increase catches of larger, older fish.

The BS/RE rockfish complex is assessed with an age-structured model for the AI portion of the stock, managed in Tier 3, and a Tier 5 random effects model for the EBS portion of the stock. The 2020 assessment includes updated 2019 and projected 2020 catch data, replacement of the 2018 AI survey length composition with the 2018 survey age composition, and 2018 and 2019 AI fishery length compositions. The length-at-age, weights-at-age, and age-to-length conversion matrices were also updated with NMFS AI trawl survey data.

In Oct 2020, the SSC reviewed an investigation of recruitment for the AI portion of the stock that focused on the base model presented in the 2018 stock assessment employing McAllister-Ianelli weighting for compositional data, and a new model with Francis weighting as well as an update to the ageing error matrix, application of dome-shaped selectivity for the survey composition, and a new prior distribution for natural mortality. The SSC pointed out that while the new model with Francis weighting performed better by down-

weighing the composition relative to survey data, it did not resolve the conflict between these two datasets. The SSC requested the authors bring forward an AI model without the length data, updated maturity information, the updated aging error matrix, and an updated estimate of natural mortality. No changes were recommended for the Tier 5 EBS model. In response to SSC recommendations, the current assessment considers the accepted model from 2018 (18.1) and four alternative models.

In all the new models, the mean of the prior distribution for *M* was increased from 0.033 to 0.045, the average value from three maximum age natural mortality models developed by Then et al. (2015). The aging error matrix was updated using the Punt et al. (2008) procedure applied to 2,341 double readings of BS/RE rockfish from the BSAI sampled during 1986 – 2017 and resulted in higher CVs for ages than those that were estimated in the 2018 model. The proportion mature at age was estimated within the assessment model based on 237 aged blackspotted rockfish collected in the GOA from 2009-2012. Models 20 and 20b use Francis weighting, with 20b excluding the fishery length composition data. Models 20a and 20c use McAllister-Ianelli weighting, with model 20c excluding the fishery length composition data.

The authors noted that the primary challenge for this assessment is the conflict between the compositional data and the AI survey index. The authors recommended Model 20 based on improved fits to the AI survey biomass, decreased positive retrospective bias and recruitment variability, inter-assessment stability and their conclusion that the primary differences between the models resulted from different data weighting procedures with the exclusion of fishery length data having relatively little effect on model results. The EBS portion of the stock continues to be assessed using the random effects model. The resulting 2021 BSAI maximum ABC is a 32% decrease from the 2020 ABC primarily due to the change in the method for weighting the compositional data. **The SSC appreciates the authors' efforts to address October 2020 SSC recommendations and concurs with the author and BSAI GPT recommended model. This places BSAI BS/RE in Tier 3b. We also appreciate the examination of area-specific exploitation rates provided in Appendix 14A.**

This assessment includes the first risk table analysis for this complex. The authors ranked assessment-related considerations for the recommended Model 20 as a level 3 concern (Major problems with the stock assessment) citing very poor fits to data, high level of uncertainty, inability of model to explain decline in abundance of older fish, highly constrained estimate of M, and strong retrospective bias. Population dynamics considerations were ranked as a level 2 concern (Substantially increased concern) based on abundance (particularly older fish) decreasing faster than usual, the unusual pattern of recent strong recruitments, and the inadequacy of the existing spatial management structure. Environmental/ecosystem considerations were ranked as a level 1 concern (no increased concerns) but the authors noted recent increased temperatures and acknowledged that the lack of ecological data relevant to the stocks (particularly blackspotted rockfish), as well as lack of 2020 survey data, limit the assessment of potential recent ecosystem impacts on this stock. Fishery Performance was ranked as a level 2 concern citing the perspective that for a bycatch stock, fishery performance is evaluated with respect to how well the target fishery can avoid bycatch. The fishery CPUE in the WAI is higher than would be expected based on the spatial distribution of survey biomass estimates with catches consistently exceeding the WAI MSSC, and the increase in these overages over time. Further, the catches in the WAI/CAI subarea have also exceeded the subarea ABC in 2019 and 2020.

The BSAI GPT agreed with the authors' recommended risk table ranks and with their conclusion that, given the incidental nature of these species' removals, an ABC reduction would likely increase discards but not reduce catch. Additionally, while the recommended model lowers the 2021 and 2022 ABCs relative to the 2020 ABC, this outcome is strongly influenced by the selected component weighting approach and a reduction in the ABC would not address the apparent mismatch in spatial management and the spatial structure of the stock. Finally, the author and the plan team noted that since 2015 the BS/RE TACs have on average been 48% smaller than the maximum ABC and as such a reduced ABC would have little effect. For these reasons, neither the authors nor the BSAI GPT recommend a reduction from maximum ABC.

The SSC appreciates the authors' work to complete the risk tables and shares the authors' and BSAI GPT's concerns about the elevated risk scores. The author and BSAI GPT noted that in the case of target fisheries such scores would likely warrant a reduction from maxABC. **In this case, the SSC agrees with the author and BSAI GPT that due to the incidental nature of BS/RE catch and the ongoing fishing fleet avoidance efforts highlighted in public testimony a reduction in maxABC is unlikely to result in reduced catch. Further, the SSC notes that the new AI model does appear to be more appropriate in terms of tracking the substantial reduction in the scale of the stock shown in the survey data and improvements in fit and retrospective behavior. As such, the SSC supports the author and BSAI GPT recommended OFL and maximum ABC.**

A random effects model is used to smooth subarea survey biomass estimates to obtain the proportions of biomass across the spatial areas, which is used for sub-area ABC apportionment to the western and central AI, and the eastern AI and EBS. The subarea ABC for the western and central AI is further partitioned into MSSC levels for the WAI and EAI.

The BSAI GPT minutes reflect a high-level of concern regarding the disproportionate spatial harvesting of this stock in the AI sub-areas and note that the MSSC-approach intended to help guide the fleet to voluntarily reduce catch in the WAI has been ineffective in recent years. However, they did not recommend removing the MSSCs because a better alternative has not yet been identified and there may be some positive influence of providing a target for the fleet. This is consistent with public testimony provided by Mr. Loomis. Finally, the BSAI GPT requested guidance from the SSC and Council on how to reduce incidental catch in areas with disproportionate spatial exploitation because the MSSC tool is not proving effective.

The SSC continues to be strongly concerned about the disproportionate spatial harvest including catch in excess of the WAI/CAI subarea ABC in 2019 and 2020, and notes that despite the limited information on stock structure this rockfish complex may be vulnerable to localized depletion. The SSC recommends that the MSSCs continue to be used as a means to monitor and give industry a target maximum catch and offers the following comments:

- The SSC supports the BSAI GPT recommendation that the authors explore the distribution of the survey samples to evaluate trends by depth, to help determine risk considerations and potentially help inform the industry on how to reduce incidental catch.
- Similarly, the SSC recommends an exploration of the spatial footprint of the AI survey and incidental catch fisheries with an eye towards potential mismatches due to untrawlable habitat that might provide context for interpreting conflicting survey abundance and fishery size/ age composition. We note that a graduate research project investigating the survey – fishery alignment along with recent changes in Atka mackerel and POP fishing behavior is underway at Alaska Pacific University. In addition, the SSC pointed out that a NMFS – University – Industry cooperative effort entitled "The Science-Industry Rockfish Research Collaboration in Alaska" being led by Dr. Madison Hall is currently underway. While this effort is primarily focused on GOA rockfish, it may provide important analytical tools and insights for application to the BSAI BS/RE complex.
- The SSC supports the BSAI GPT suggestion to explore other survey data (e.g. NMFS and IPHC long-line or ADF&G survey data) to augment abundance and size/ age composition information. We note that a new graduate research project looking at combining data from different surveys and gears is underway at the College of Fisheries and Ocean Sciences at the University of Alaska Fairbanks.
- The SSC notes that the values of M used in the AI assessment are very high, especially for a long-lived species, and requests that the authors fully explore the ranges and interactions of catchability and M in the AI assessment model.

- The SSC requests an update on work (e.g. genetics) to further refine BS/RE stock structure in the AI.
- Given the information regarding shifts in fishing effort to shallower areas provided in public testimony, the SSC requests that the authors investigate the effects of fleet behavior on apparent size/ age compositions, and to what extent this may be influencing fishery selectivity
- The JGPT proposed a Council workshop in 2021 to evaluate both the fishing mortality rates by gear associated with different apportionment schemes as well as the management and socio-economic considerations of alternatives. The SSC concurs with the JGPT's note that the area apportionment approach currently used for the BSAI BS/RE complex should be included in the Spatial Management Workshop proposed for 2021.

Shortraker Rockfish

A full assessment was presented for shortraker rockfish. There was no public testimony. There were no changes in the assessment methodology since the last full assessment in 2018, and no new data were added in this assessment. Catch data were revised and updated through October 25, 2020. There were no survey updates this year for the AI trawl survey or for the EBS slope survey.

Biomass has been relatively stable since 2002 with a slight increase from 20,932 t in 2006 to 24,055 t in 2018. Since 2015, TAC has been set below ABC. Catches are consistently below ABC but exceeded TACs in 2017, 2018, and 2019. Estimated removal for 2020 through October 25 is below the 2020 TAC.

The risk tables were completed and constructed as recommended by the SSC and the BSAI GPT. The stock scored at Level 1 in all categories, which suggests no need to reduce the ABC below the maximum permissible.

Shortraker rockfish is managed under Tier 5 and the average survey estimated biomass is 24,055 mt based on the random effects model. **The SSC accepts the OFL and maximum ABC estimates for 2021 and 2022 as recommended by the authors and the BSAI GPT.**

The authors indicated in the SAFE report that for the next full assessment the utility of both the AFSC and IPHC longline surveys to improve biomass estimates will be examined. The SSC thanks the authors for including a description of these surveys as they pertain to shortraker rockfish as well as the current data in the SAFE report and look forward to updates with the next full assessment.

Other Rockfish

The other rockfish complex is a combination of 24 rockfish species. This complex is dominated by shortspine thornyhead (SST, *Sebastolobus alascanus*), which comprise approximately 95% of the estimated total other rockfish exploitable biomass. The remaining non-SST species are dominated by dusky rockfish (*Sebastes variabilis*). A full stock assessment was conducted in 2020. There were no changes in the assessment methodology. There was no public testimony. Changes in the input data included:

- Catch and fishery lengths updated through October 13, 2020.
- The only new survey biomass for this assessment is a zero-biomass observation for non-SST species in the 2019 EBS shelf survey. The 2020 AI and EBS shelf surveys were canceled due to COVID-19, and there has been no EBS slope survey since 2016.
- Following guidance from the Resource Assessment and Conservation Engineering Division (RACE) division, survey biomass inputs to the random effects (RE) model were limited to: AI (1991-present), EBS shelf (1982-present), and EBS slope (2002-present).

The overfishing level for other rockfish is set as a combined limit for the entire BSAI since 2005. Catches for the entire BSAI area have been below the combined TACs, but in 2014 and 2019. Catches in the AI consistently exceeded area-specific TACs since 2011, and in some years exceeded area specific ABCs.

Catches in the EBS area have been below area-specific TACs, except in 2014 and 2019. **However, the overall BSAI OFL remains well above the recent catch.**

The BSAI other rockfish complex is currently managed in Tier 5. The assumed natural mortality differs between SST and non-SST species. Therefore, they have different definitions of F_{OFL} and F_{ABC}. A random effects model was used for estimating survey biomass.

The 2020 biomass estimate of the BSAI other rockfish complex from the random effect model results is 53,248 t, with 50,694 t for the SST component and 2,554 t for the non-SST component. **The SSC accepts the authors' and the BSAI GPT's recommendation for the 2020 model and the associated recommendations for Tier 5 ABCs, and OFLs. The SSC agrees with the authors' and BSAI GPT's recommendations for area apportionments based on the random effects model.**

In response to SSC requests, a risk table was completed. The stock complex scored at Level 1 in three of the four categories and at Level 2 in the assessment considerations category due to increasing concerns with potential bias and high uncertainty in survey data, and with future availability of EBS slope survey data. **Despite the elevated level of concern for the assessment, the SSC agrees that a reduction from the maximum permissible ABC is not warranted at this time.**

There was some discussion of whether the non-SST portion of the stock should be moved to Tier 6, but there was a recognition that the default Tier 6 formulae could either fail to give adequate protection to some species or prove to be unduly constraining in the future, given the upward trend in biomass estimates for some species. **The SSC concurs with the BSAI GPT's recommendation not to change the management of non-SST to Tier 6 at this point** given research planned this year as well as the increasing trend in catch in the AI non-SST component of other rockfish.

The SSC agrees with the authors' and the BSAI GPT's recommendations on future research topics:

- Pursue the planned work in collaboration with other authors to consider issues with the Tier 5 model process for stocks with variable, and at times sparse or missing, survey observations. Specifically, the manner in which biomass estimates of 0 are handled (i.e., currently ignored) should be revisited.
- Consult with other rockfish assessment authors to consider revising M for the non-SST portion of the population in future assessments, noting that recent assessments reported to have based the M=0.09 assumption on GOA dusky rockfish, when in fact M=0.07 has been the GOA dusky rockfish value used since 2006
- Conduct more spatial analyses of AI catch of non-SST rockfish to explore the locations, depths, seasons, the encounter rates and concentration of catch (i.e., frequent constant bycatch rates or a smaller number of highly concentrated hauls)

BSAI Atka Mackerel

There was no public testimony on the BSAI Atka mackerel assessment. The stock assessment document describes the history of assessments, fisheries, historical management actions including mitigation actions associated with Steller sea lions, and the current stock assessment modeling approach.

Aleutian Islands surveys indicate a long-term decline in biomass during 2004-2018. No survey was conducted in 2020 because of COVID-19 related cancellations. Bottom trawl surveys have consistently revealed a strong east-west gradient in Atka mackerel size, with the smallest fish in the west and largest fish to the east. The 2018 survey age composition consists mainly of 5- and 6-year olds of the 2013 and 2012 year classes, respectively, and 3-year olds of the 2015 year class.

Since 2002 the BSAI Atka mackerel stock assessment has been conducted using the Assessment Model for Alaska (AMAK) from the NOAA Fisheries Toolbox, but is customized for Atka mackerel and written in AD Model Builder. This year's assessment represents a straightforward update involving catch and age

composition data. The base model continues to fit the data well including survey and fishery age compositions.

The authors and BSAI GPT propose to use Model 16.0b for deriving Tier 3b specifications of OFLs and ABCs for 2021 and 2022. No additional adjustment to ABC was indicated as a risk table for this stock indicated Level 1 ratings for all four categories. The SSC agrees with these specifications.

Recently, area apportionment among regions of the AI has been based on the most recent four-survey weighted average biomass. Because no AI surveys have been conducted since 2018, the relative apportionments remain unchanged. **The SSC agrees with these apportionments.**

The authors have been responsive to recent SSC and BSAI GPT recommendations. In the current assessment, the SSC noted the rather unique retrospective pattern involving a "scale change" in the pattern after data from 2012-2014 are dropped from the model. The SSC appreciates the discussion about this phenomenon in the SAFE. However, the SSC requests reporting on other retrospective patterns in the next assessment as additional diagnostics. Other statistics that can be reported include Woods Hole rho, RMSE, and Hanselman's phi. The 2013 Retrospective Investigations report from the BSAI GPT explains these statistics and their rationale. It might also be informative to plot values of estimated parameters related to scale such as catchability over retrospective peels.

Additionally, the SSC offers the following two minor comments:

- Figure 17.4 shows Atka mackerel survey biomass by area and year, however the three panels (areas?) and x-axes (years?) are not labeled.
- Likewise, in Figure 17.7 (top panel) the x- and y-axes are not labelled.

BSAI Skates

Harvest recommendations for the BSAI skate complex includes two components, a Tier 3 age-structured model for Alaska skate in the EBS and a Tier 5 random effects model for all other skates. These components are combined to produce the harvest specifications for the BSAI skate complex. This was a full assessment presented, and BSAI skates are assessed on a biennial schedule, with the next full assessment to occur in 2022. There was no public testimony. Updated data for this assessment includes:

- Updated catch estimates for 2019 and 2020
- New biomass estimates from the 2019 EBS shelf survey
- The Tier 3 model also includes 2019 length compositions from the EBS shelf survey and the fishery, and estimated catch through 2020

With regards to the Tier 3 model for Alaska skate, only a single model was presented, Model 14.2, which remains unchanged except for updated data. Overall, the model performed similarly to the 2018 model. There is some moderate retrospective bias. Results from this model estimate that 2020 total biomass is down slightly in recent years but spawning biomass continues to increase. There is also a limited indication of a few stronger year classes from 2016 – 2018 entering the population. **The SSC accepts the BSAI GPT and author recommended model.** The 2021 estimate of female spawning biomass is above B40% and harvest specifications for Alaska skate are provided under Tier 3a. **Further, the SSC concurs with the BSAI GPT and the authors recommended OFL. The SSC appreciates the implementation of the risk table and concurs that no reduction from the maximum ABC appears to be necessary.**

The other skates complex consists of many species over multiple BSAI regions. Species composition varies by region. Three surveys are utilized for this assessment, including the EBS shelf, the EBS slope and the AI survey. In contrast to previous assessments, where biomass estimates are aggregated into a single random effects model for each survey, this assessment created separate RE models for each survey/species combination. Species that appeared inconsistently in survey data or exhibited extreme variability were

aggregated into a "minor skate" group. The SSC notes that this approach represents a considerable improvement in the ability to delineate stock-specific trends within the complex.

Results from the individual RE models suggest that most species have fairly stable spatial distributions. An exception is the big skate, which increased in the southeastern Bering Sea, likely reflecting an extension of the GOA big skate population. Biomass trends differed by area. In general, results from the RE models suggest that EBS shelf species declined, whereas EBS slope and AI species' biomass trends were flat or slightly increasing relative to last year. Shelf species are generally increasing. However, the declining trend of leopard skate is notable, from a high of 11,825 t in 2010 to 2,634 t in 2018. The SSC registers some concern with the decline of this endemic species, and asks if there are any additional data that could be brought forward to attempt to discern if there is a conservation issue associated with this decline. The SSC further notes that the text for this section was confusing as to whether it referenced the biomass estimates provided by the surveys or the RE model estimates. This should be clarified for the future.

An exploitation rate analysis was provided. In general, exploitation rates were much less than 0.1. Bering skate and big skate both had several years in which the exploitation rates were greater than 0.1, and these are discussed in more detail in the assessment. A value of M = 0.1 was used for harvest specifications of this Tier 5 stock complex. **The SSC concurs with the recommended OFL and ABC, based on the combined RE model results from the 2019 shelf survey and the 2018 estimates from the EBS slope and AI.**

There is an extensive section on ecosystem considerations presented for all species included in the BSAI skate complex. This information is much appreciated. The SSC suggests that it may be appropriate to update the stock structure template during the next full assessment, with a focus on Alaska skate, as was requested by the SSC in 2018. Also, the SSC further emphasizes the importance of the slope survey to this complex; despite the complex being dominated by a shelf species, the slope contains the highest diversity of skate species in the North Pacific. This is noted within the context of the survey prioritization process outlined by the SSC in previous minutes (October 2018, October 2020).

BSAI Sharks

This assessment was changed to a biennial cycle beginning with the 2014 assessment and a full assessment was conducted this year. There were no public comments. Updates to input data include: (1) total estimated catch through 2020; (2) IPHC longline survey relative population numbers (RPNs) through 2019, and (3) biomass estimates for the EBS shelf trawl survey through 2019.

Most sharks taken in the BSAI fisheries are Pacific sleeper sharks and salmon sharks. Starting in 2000, catch rates of sleeper sharks declined sharply for several years in IPHC longline surveys and bycatch fisheries, leading to conservation concerns. In 2017, the IPHC RPN showed a slight increase. It seems that all sleeper sharks taken in the survey and fisheries are juveniles, so it is impossible to know what effect these catches have on spawning stock biomass. Although bycatch of salmon sharks has increased since 2010, recent catch levels are well below ABC.

Total shark catch in 2019 was 150 t, and catch in 2020 through October 13, 2020 was 198 t. Both are well below the 2019 and 2020 OFL (689 t) and ABC (517 t).

Sharks remain a Tier 6 stock. In the base model (Model 16.0), OFL is fixed at the maximum catch during 2003–2015 (689 t). Three alternative models were presented in the 2020 assessment. In the 2018 assessment, alternative models using the mean historical catch (Model 18.0), the 95% and 99% confidence intervals (Models 18.1 and 18.2, respectively) were presented. As there were concerns over the non-normality of the data, those models were not selected in the 2018 assessment. As a result, the SSC requested that the 2020 assessment include alternatives using the 5^{th} and 95^{th} percentiles of the catch data over 2003–2015. Also, the median historical catch is presented as another model alternative. These models (20.0, 20.1 and 20.2) are calculated at the complex level. While these are interesting for contrast, the authors and BSAI GPT felt that there were no compelling reasons to deviate from the status quo. While these alternatives are

more conservative than Model 16.0, the conservation concern has yet to be established. Moreover, the accuracy of current catch estimates are uncertain. Ongoing research projects are examining the accuracy of catch estimates.

The assessment authors and BSAI GPT continue to recommend Model 16.0 with no changes to the assessment methods pending evaluation of alternative data-limited assessment methods and results of ongoing research projects. Therefore, the recommended OFL is fixed at the maximum catch during 2003–2015 (OFL = 689 t) and ABC is set at 75% of OFL (ABC = 517 t). **The SSC agrees with the authors' and BSAI GPT's recommended model and resultant catch specifications.**

A risk table was completed for the BSAI shark complex. The assessment risk is set at level 2, because the shark assessment does not incorporate any biological or trend information. Likewise, the population dynamics is also set to level 2, because IPHC longline survey RPNs for Pacific sleeper shark have declined since the late 1990s and remained low since 2004. Whereas the risk for other species in this complex is assigned level 1, the overall risk level for population dynamics is set at level 2 based on Pacific sleeper shark. Risks associated with environmental/ecosystem considerations and fishery performance are assigned the typical level of concern, level 1. **Despite two risk levels of 2, the authors and BSAI GPT do not recommend additional reductions in ABC owing to risk at this time. The SSC agrees, noting that pending research should help better identify the current levels of risk to BSAI sharks.**

The authors have been responsive to previous SSC comments. For instance, at the request of the SSC, 5th and 95th percentile of catches were presented as an alternative for confidence intervals to avoid the issue that catches are not normally distributed. The authors are beginning to address other SSC comments. These include an investigation into the potential role of temperature on catch trends in both the GOA and BSAI. Also, pilot work into ageing methods for sleeper sharks have been undertaken and a proposal has been submitted to investigate a promising method (bomb-radiocarbon in the eye lens core of Pacific sleeper shark as an indicator of age). Finally, alternative data-limited methods are currently being explored for this assessment. The SSC looks forward to results of these endeavors and future concomitant advancements in this assessment.

BSAI Octopus

The BSAI octopus complex is on a biennial schedule and a full assessment was presented this year. There was no public testimony. Octopus are managed as an assemblage of at least nine species. BSAI octopus are assessed using an alternative Tier 6 method. This method uses an underlying model from Tier 5 where MSY is obtained at half the total natural mortality. For octopus, a predation-based estimate of total natural mortality is used, which is derived from Pacific cod stomach collections. The consumption estimate using Pacific cod predation of octopus as an estimator of biomass lost due to natural mortality was first accepted by the SSC in 2011 and uses the AFSC's food habits database to estimate the total amount of octopus consumed by their primary predator, Pacific cod. The amount of octopus consumed is considered a conservative estimate of total natural mortality for octopus.

Since the 2015 assessment, no changes have been made in the methodology for assessing BSAI octopus. Estimated consumption was relatively low through 2004 and has increased considerably through 2015, though there has been no data since. The increase through 2015 is due to increases in both Pacific cod abundance and the increased percentage of octopus in Pacific cod diets that increased the annual consumption estimates from 2009-2015.

The SSC supports the authors' and BSAI GPT's recommended OFL and ABC, which are identical to those in 2019, and also supports their recommendation for no reduction from the maximum ABC.

Incidental catch of octopus declined during 2016-2018, but 2020 catch is on track to be largest in the time series. The discard rate was also high in 2020, compared to previous years. It is possible that the increase in catch may be due to an increase in pot fishing in AI, where most of the increase in catch has occurred.

The SSC recommends continued monitoring. Despite the increases, all catches are still nearly an order of magnitude below the recommended ABC.

For the next full assessment, the SSC recommends including more detail on how the estimate of biomass lost due to natural mortality was calculated. The SSC appreciates the references included in the document but suggests that an overview of the calculation and data sources would aid future reviews. The assessment reports on a number of supporting datasets that are valuable to reference but are not used in the direct calculations for the assessment. For clarity, the SSC suggests that the authors indicate which datasets are used directly in the calculations for the assessment and which are presented as supporting information.

C-4 GOA SAFE and Harvest Specifications for 2020/21

GOA Plan Team Report

Electronic monitoring

The SSC received a report from the GOA GPT regarding the need to ensure biological data are available for stocks that have fisheries covered by electronic monitoring. The SSC notes there are several Council committees that provide input for the development of observer programs: the Fisheries Monitoring and Advisory Committee, Trawl EM committee, and Partial Coverage Monitoring Committee. The SSC agrees that collection of biological data is critical for fishery assessments, and also appreciates the input provided by committee members to inform the development of data collection programs. Analytical support for these committees likely requires a broad range of expertise, including scientists involved in stock assessments. Therefore, the SSC supports efforts by the agency to have appropriate experts available to communicate data collection needs, including specific concerns described by the GOA GPT. The SSC anticipates that scientific and policy expertise needed for the committees will evolve as new technologies are incorporated into our monitoring portfolio, so continued participation and re-evaluation of needed agency expertise is likely necessary.

VAST treatment of depth data

For GOA stocks that use VAST modeling of survey data, the SSC notes that excluding depths >700 m because of sparse observations may result in a negatively biased estimator. The SSC recommends investigating a depth covariate or an indicator variable for deep areas to account for the lower catch rates but still allow for an unbiased prediction of biomass.

GOA Walleye Pollock

For this assessment, no changes were made to last year's approved model 19.1 for the western portion of the stock (W/C/WYAK) and **the SSC continues to support the choice of model 19.1 for specifications**. There was no public testimony. Several new 2020 data sources for the western portion of the stock were available to inform the assessment, including: biomass, length and age compositions from the Shelikof Strait acoustic survey and the ADF&G trawl survey biomass index. The relative to 2019, the 2020 Shelikof Strait acoustic and ADF&G trawl surveys showed a 64% decline and a 16.5% increase in biomass, respectively. The drop in the acoustic survey estimate from unusually high estimates in 2017-2019 brings this estimate more in line with the trend in recent NMFS and ADF&G bottom trawl surveys and with the 2019 GOA summer acoustic survey. The new data and results support last year's 10% buffer that was implemented over concerns about conflicting trends in the data. This assessment alleviates some of those concerns as the new Shelikof Strait survey index is more consistent with other data sources and with previous estimated population trends. Overall, the model fit in this year's assessment is reasonable given the most recent data, and the increased consistency among survey indices provides for greater confidence in assessment model results.

Preliminary research on survey timing suggests that the high biomass estimates in the 2017-2019 Shelikof Strait acoustic surveys, and the subsequent large drop in 2020, may in part be due to survey timing relative to spawn timing. The survey occurred well before the estimated peak spawning date in 2020, whereas it occurred much closer to peak spawning in 2017-2019, suggesting that fewer spawners had moved into Shelikof Strait prior to the 2020 survey compared to years when the survey occurred closer to peak spawning. While this is currently not accounted for in the model, this pattern may provide an explanation for the unusually high survey abundances in 2017-2019. If the relationship between relative survey timing and survey biomass residuals holds, it may help inform survey catchability (see recommendations). The SSC appreciates the authors' analysis of the relationship between residuals from the model fit to the Shelikof Strait survey index and both the difference between spawn and survey data, and the proportion of spawned and spent female pollock.

An important new concern identified in this year's assessment was the low abundance of age-2 fish from the 2018 year class, which was initially estimated to be strong based on 2019 surveys. Age-2 fish were rare in the available 2020 surveys and also did not appear to be well represented in the fishery size composition data. However, even without a strong 2018 year class, the near-average 2017 and 2018 year classes should provide some stability in biomass in the coming years based on current projections. Although the 2012 year class remains the dominant component of the catch, which previously raised concerns over the reliance on a single year class, some diversification in the age structure is becoming evident as the 2017 and 2018 year classes enter the fishery.

The author and GOA GPT recommended setting the ABC for 2021 and 2022 at the maximum permissible ABC allowed under model 19.1. Because the model projection of female spawning biomass in 2021 is above B40%, the W/C/WYAK pollock stock would remain in Tier 3a. Last year's risk table identified a level 2 concern in the assessment category because of the contrasting trends in abundance indices. More consistent trends in this year's assessment led the author to reduce the risk level, resulting in level 1 concerns for all categories, therefore no additional reduction from maxABC was recommended. **The SSC concurs with the GOA GPT recommendation to set the ABC and OFL for 2021 and 2022 at the maximum permissible value under Tier 3a.** This results in a 2.6% decrease from the 2020 ABC in 2021 and an expected larger decrease in 2022 due to the reduced recruitment estimate for 2018, as well as a low estimate for 2019. For the East Yakutat and Southeastern areas, pollock continue to be managed under Tier 5. As there was no new survey data for the region this year, the SSC concurs with the author and GOA GPT recommendations to set the ABC and OFL for 2021 and 2022 at last year's levels for 2020. This recommendation is based on the random effects model fit to the 1990-2019 bottom trawl survey biomass estimates in Southeast Alaska and a natural mortality of 0.3.

The assessment was updated to include the most recent data available for area apportionments within each season, following established methodology (Appendix C of the GOA pollock chapter). New data were only available for the winter fishing seasons and were used to apportion catches based on winter acoustic surveys. Apportionments for the B1 and B2 seasons are based on a 3-year weighted average of the sum of the AFSC bottom trawl survey and the gulf-wide acoustic summer survey and are unchanged from the previous assessment as no new data were available. **The SSC concurs with the recommended area apportionments as outlined in the document, which includes an allocation of 2.5% of the ABC for the State of Alaska managed pollock fishery in Prince William Sound.**

The SSC offers these additional comments and recommendations:

- The SSC concurs with the GOA GPT recommendation to further explore the apparent and unusual disappearance of the 2018 year class. The authors note that over the historical Shelikof Strait survey time series, high age-1 estimates were always followed by high age-2 estimates the next year, suggesting unusually high mortality for this year class. Therefore, the SSC supports the GOA GPT recommendation to examine possible sources of increased mortality, for example trends in the diets of predators such as sablefish, which have been unusually abundant on the shelf in recent years.

- The SSC appreciates the very helpful analysis of spawn timing based on the work of Rogers and Dougherty (2019, Global Change Biology, 25: 708–720. https://doi.org/10.1111/gcb.14483). The SSC encourages the authors to explore the use of covariates related to the timing of the survey to inform survey catchability. Specifically, including the difference in timing between peak spawning and mean survey date as a covariate informing time-varying catchability in the Shelikof Strait survey is likely to improve the model fit based on the apparent relationship between survey residuals and measures of survey timing relative to peak spawning. As an alternative, the proportion of mature fish in the survey may also provide a measure of survey timing that holds information about survey catchability.
- In addition to the relationship between survey timing and catchability, the SSC encourages the authors to consider the influence of survey timing in relation to spawn timing on selectivity at size. Given that there is a difference in spawn timing between younger and older pollock, survey timing is likely to affect the observed age and size composition. For example, a relatively earlier survey would presumably sample a larger proportion of younger and smaller fish, thereby changing size selectivity in the survey. Survey selectivity is currently time-invariant in the model, but one or both of the selectivity parameters (size at 50% selectivity and/or slope) could be modeled as a function of survey timing to account for changes in the size composition of spawners as the spawning season progresses.
- The SSC was pleased to see new research on cohort-specific maturity schedules that show more stable and more reasonable trends in maturity at age over time compared to the previously used approach that fit maturity schedules by survey year, rather than by cohort, and resulted in high and unrealistic variability. The SSC encourages the authors to explore ways of incorporating these new estimates into the model to the extent possible, or at least continue including them in the assessment as an important population-level metric.
- The strong trends in weight-at-age and their implications for stock dynamics remain a concern in the assessment and the SSC encourages further research on the possible causes of these trends, including possible density-dependence and environmental drivers.
- The SSC is encouraged by the inclusion of GOA pollock in whole-genome sequencing analyses and looks forward to results from genetic studies when they become available.
- The SSC appreciates the updated ESP for this stock that includes improved socio-economic indices and additional environmental indices that provide better context for the analysts, Plan Team and SSC to understand recent variability in recruitment. For example, it has long been understood and was recently confirmed by Wilson and Laman (2020) that retention of larvae and juvenile pollock in the Shelikof Strait region and along the Alaska Peninsula benefits pollock survival. A newly derived wind index presented in the ecosystem chapter shows favorable winds in 2012 and 2017, both years with above average recruitment, and holds promise for informing recruitment variability in the model.
- For the ESP socioeconomic indices, the SSC suggests using Kodiak and small community categories for the annual percent harvesting revenue indicators similar to what was done for the annual percent processing revenue indicators, for consistency with the text in this ESP (pg. 110) and the approach used in other ESPs, as well as for comprehensiveness.

GOA Pacific cod

The GOA Pacific cod stock is managed under Tier 3 and assessed with an age-structured single-sex model parameterized with length-based selectivity. There was no public testimony on this item. New data available for the 2020 assessment include:

- Updated state and federal fishery catches for 2019 and 2020.
- State and federal fishery size compositions from 2019, and preliminary size compositions for 2020.
- 2020 AFSC longline survey RPNs and size compositions.
- 2019 AFSC bottom trawl survey conditional length-at-age.

Dr. Barbeaux noted that length composition samples with less than 30 fish in a specific year, area, quarter, and gear combination were excluded from the input data, which represent less than 1% of the overall catch. The SSC considers this a reasonable choice in input data screening.

The SSC notes that the 2020 AFSC longline survey showed a 30% increase in RPN when compared with 2019, but this index remains the 2nd lowest in the time series.

In 2020, the authors present two assessment models. Model 19.1 is the 2019 accepted model configuration with updated data. Model 20.1 is an exploratory ecosystem-linked model that incorporates temperature-dependent growth and scales the stock-recruitment relationship with the MHW index during spawning. Despite these differences in configuration, both Model 19.1 and 20.1 estimate similar biomass trends over the recent period, with Model 19.1 providing a slightly better retrospective pattern. The assessment authors conclude that the temperature relationships represented in Model 20.1 are not well enough established, and therefore the authors and GOA GPT only recommended Model 19.1 for consideration. Despite this conclusion, the SSC thanks the authors for their diligence in exploring the ecosystem-linked model structure and thoughtful approach to incorporating temperature-dependent larval growth from experiments conducted by Dr. Laurel (NOAA) and colleagues. **The SSC supports future exploration and development of assessment models that inform growth and recruitment based on temperature, to the extent the authors believe this effort will help better understand the population dynamics of this stock now and in the future.**

The SSC supports the authors' and GOA GPT's recommendation to use Model 19.1 as the basis for 2021 and 2020 harvest specification. Under Model 19.1 the 2020 spawning stock biomass remains below $B_{40\%}$, however the stronger 2018 recruitment and limited fishing mortality in 2020 are projected to result in increased spawning biomass in 2021 and 2022 with both projected to be above $B_{20\%}$. With spawning biomass projected to remain below $B_{40\%}$ in 2021, this stock falls under Tier 3b.

In the risk table for the 2020 assessment the authors identify a risk level of 2 for assessment-related and population dynamics considerations, and level 1 for environmental/ecosystem considerations and fishery performance. However, the authors assert that based on the overall score of level 2, setting ABC below the maximum permissible level is not warranted. **The SSC supports the authors' and GOA GPT's recommendation to set ABC and OFL for 2021 and 2022 at the maximum permissible level under Tier 3b.**

ABC apportionment based on the 2019 GOA bottom trawl survey would result in a large decrease in apportionment to the WGOA. In response, in 2019 the authors' and GOA GPT recommended, and the SSC supported, using a stair step approach wherein the average apportionment recommendations based on the 2017 and 2019 trawl surveys were used last year. For 2021, the authors and Plan Team are again recommending this average apportionment scheme**. The SSC supports this recommendation**, but notes that this is at best a short term solution and encourages the authors to consider whether information from the IPHC setline survey and NMFS longline survey, alongside the NMFS bottom trawl survey, may provide a superior basis for apportionment recommendations, perhaps through the use of an integrated spatio-temporal model.

In 2020, the authors continue to express concern regarding the availability of biological data with the expansion of electronic monitoring in the GOA. Several maps were presented describing the spatial distribution of EM in the 2019 longline and pot fishery, which highlighted that EM is primarily conducted in the CGOA while observer data is more readily available in the WGOA. The SSC echoes the concern put

forth by the GOA GPT that selectivity could become biased if this pattern of spatial variation in the availability of composition data continues.

The SSC supports the GOA GPT recommendations to:

- Continue exploration of whether the ADF&G trawl survey might provide the basis for an informative index for inclusion in future stock assessments, given that its spatial footprint spans state and federal waters.
- Evaluate how expanded EM will impact the biological data available for this assessment in the future, and collaborate with the existing EM committees to identify data collection schemes that will ensure sufficient composition data are available to inform this stock assessment.
- Identify a mutually-agreeable structure for collaboration with the IPHC that ensures reliable and timely access to informative fishery-independent setline survey data.

The SSC offers these additional recommendations:

- Given that Model 19.1 fixes steepness at 1.0, while the ecosystem-enhanced model (M20.1) estimates steepness in conjunction with the temperature-linked stock-recruitment relationship, if this model is brought forward in the future an intermediate model that estimates steepness but does not include the temperature effect should also be brought forward in parallel. The SSC feels this would be a useful bridge, permitting separation of the effects of estimating steepness and the temperature linkage on resulting changes to assessment model estimates and recommendations.
- In the 2021 assessment, greater detail should be provided on which time blocks for natural mortality and recruitment are used to generate future projections.

The first ESP for GOA Pacific Cod was completed during this assessment cycle, and the SSC commends the authors, Dr. Shotwell, and other ESP collaborators and contributors in its development. The SSC supports continued exploration of additional habitat, biological, or environmental indicators that may be appropriate for describing trends in recruitment. With respect to socioeconomic considerations within the ESP, the SSC recommends trying to separate fishery engagement from fishery dependency, given that a focus only on engagement may provide a biased perspective toward the most successful fishery participants. As such, the SSC supports exploration of dependency indices for inclusion in the next ESP for this stock. The SSC further suggests that ESP authors consider avenues for allowing coastal community members to provide review of, and feedback on, subsequent ESPs. The SSC finds aggregating small communities to address confidentiality concerns to be effective in capturing regional socioeconomic trends.

GOA Flatfish

Shallow-water Flatfish Complex

The shallow-water flatfish complex consists of eight species and is assessed every four years. The last full assessment was in 2017. This year, a partial assessment was presented. There was no public testimony.

Northern and southern rock sole are assessed separately from the other shallow-water flatfish in this complex using an age-structured model and are managed in Tier 3. For these species, the standard projection model was updated with the final 2019 catch and estimated 2020-2022 catches. For the Tier 5 species, biomass was estimated for each species using the GOA bottom trawl data through 2019 in the random effects model. The OFLs and ABCs for northern and southern rock sole increased slightly from the 2020 values, but remained unchanged for the Tier 5 species. The OFL and ABC are the sum of all species in the complex. Area apportionment was estimated by fitting the random effects model to the survey biomass summed for all species including northern and southern rock sole by area and estimating percent biomass by area. This was unchanged from 2019 because there was no new survey data. Catch for shallow-water flatfish is well below the combined ABC

The SSC endorses the GOA GPT's and authors' recommended ABC and OFL for the shallow-water flatfish complex for 2021 and 2022, as well as the associated area apportionments of ABC.

Deepwater Flatfish Complex

The deepwater flatfish complex is composed of Dover sole, Greenland turbot, and deepsea sole and is assessed on a 4-year cycle. The last full assessment was in 2019. There was no public testimony. Dover sole is assessed with an age-structured model under Tier 3, whereas the other species (Greenland turbot and deepsea sole) are assessed under Tier 6. Because of COVID-19 and prioritization of staff time, this assessment is a rollover of 2021 specifications for 2021 and 2022 that were from the last full assessment in 2019. The projection model using new catch data from 2019 and 2020 was not run because the difference in previous catch assumptions and actual catches were minor and annual catch is consistently well below the ABC. Area apportionments from the 2019 assessment are also proposed to be rolled forward for 2021. An updated partial assessment will be conducted in 2021, and a full assessment in 2023.

The SSC endorses the GOA GPT's and authors' recommended ABC and OFL for the deepwater flatfish complex for 2021 and 2022, as well as the associated area apportionments of ABC.

The SSC also references their recommendations from the December 2019 SSC report to include a Tier 6 OFL and ABC for Kamchatka flounder in the combined GOA deepwater flatfish complex OFL and ABC and examination of the area apportionment relative to Kamchatka flounder during the next partial assessment year.

Rex Sole

GOA rex sole is assessed every four years and the last full assessment was in 2017. Rex sole is assessed using an age-structured model in two distinct areas (WGOA-CGOA and EGOA) and is managed under Tier 3. The OFL and ABC are a sum of the two areas. The GOA GPT evaluated catches and noted that they were minor differences so recommended continued to use the projections from 2019. Catches are well below maximum ABC.

The SSC concurs with the author's and GOA GPT's recommended OFL and ABC for GOA rex sole for 2021 and 2022, as well as the associated area apportionments of ABC.

Arrowtooth Flounder

A partial assessment was presented this year for GOA arrowtooth flounder. There was no public testimony. GOA arrowtooth flounder is assessed on a biennial basis with an age-structured model and is managed in Tier 3. The last full assessment was in 2019. New input data for the projection model included final 2019 catch and estimated catches for 2020-2022. The OFL and ABC recommendations for 2021 and 2022 are similar to those projected for 2020 and 2021. Area apportionments were based on the proportion of survey biomass projected for each area using the survey averaging random effects model. Catches of arrowtooth flounder are well below the ABC.

The SSC concurs with the author's and GOA GPT's recommended OFL and ABC for GOA arrowtooth flounder.

The SSC reiterates its request that the authors investigate including IPHC survey data in this assessment, and whether fishery catch-at-age information is available for inclusion in the model.

Flathead Sole

GOA flathead sole is assessed every four years with an age-structured assessment model and is managed in Tier 3. The last full assessment was in 2017. This year, a partial assessment was conducted. There was no public testimony. New data for the projection model included updated catch for 2019 and estimated catches for 2020-2022. The OFL and ABC recommendations for 2021 and 2022 are very similar to those projected for 2020 and 2021. Catches are well below maximum ABC. Area apportionments for flathead

sole ABCs are based on the proportion of survey biomass projected for each area using the survey averaging random effects model.

The SSC concurs with the authors' and GOA GPT's recommended ABC and OFL for the flathead sole for 2021 and 2022, as well as the associated area apportionments of ABC.

GOA Rockfish

Pacific Ocean Perch

Pacific Ocean Perch (POP) in the GOA are assessed on a biennial stock assessment schedule. The last full assessment was conducted in 2019. There was no public testimony. Although GOA POP was originally scheduled for a partial assessment in 2020, a full assessment was conducted in order to incorporate recent model developments developed by an assessment internal review team formed in 2020. This assessment serves as an intermediate step to additional model changes that may result from the CIE review scheduled for spring 2021.

The 2019 assessment was first updated to include survey age compositions for 2019, final catch for 2019 and preliminary catch for 2020-2022. Based on this updated 2019 model, four alternative models were constructed to explore influences from a revised ageing error matrix, fishery age compositions, prior on trawl survey catchability, and prior on natural mortality. The final 2020 model integrates changes made in all scenarios while keeping the model structure identical to the adopted 2019 assessment. The largest differences observed were between the updated 2019 model and the models using the revised ageing error matrix and the revised natural mortality parameter prior.

Compared to the 2019 results, the estimate of survey catchability decreased whereas the estimate of natural mortality increased. **The SSC recommends the author examine if the new natural mortality prior is still constraining.** Spawning biomass and recruitment estimates are higher in the 2020 model than those estimated in 2019. The biomass shows a decreasing trend in recent years due to the influence of composition data.

The assessment model continues to underestimate the trawl biomass since the 2013 survey, although the retrospective pattern has improved since the 2019 assessment, with a Mohn's rho of -0.15 in the 2020 model and -0.27 in 2019 model. This indicates that the model fit to the trawl survey data is continuing to improve.

In general, the 2020 model results in reasonable fits to the data, estimates biologically plausible parameters, and produces consistent patterns in abundance compared to previous assessments. **The SSC accepts the authors' and the GOA GPT's recommendation for the 2020 model and the associated recommendations for Tier 3a ABCs, and OFLs. The SSC agrees with the author and the GOA GPT recommendations for area apportionments based on the random effects model.**

The risk table is unchanged from 2019, with the assessment-related considerations and the population dynamics considerations at Level 2, and the environmental/ecosystem considerations and fishery performance considerations at Level 1. **The SSC accepts the recommendation not to reduce ABC below the maximum permissible**.

The SSC supports the GOA GPT's and the authors' recommendation to explore 1) incorporating hydroacoustic information into the assessment, 2) examining catchability and selectivity, 3) examining the VAST model for POP abundance and apportionment, 4) examining data weighting for compositional data, 5) re-evaluating the plus age group; and 6) examining how fishery-dependent ages are being collected.

Northern Rockfish

The SSC expresses its appreciation to the authors' for a complete and well-written assessment. The last full assessment for northern rockfish was completed in 2018. This assessment uses a statistical age-structured model rockfish, placing it in Tier 3. There was no update to the 2018 stock assessment model in this assessment. There was no public testimony. The 2020 assessment provides an update to the following data

inputs: trawl survey biomass and age compositions for 2019, final catch for 2018 and 2019, preliminary catch for 2020, fishery age compositions for 2018, and fishery size compositions for 2019. The assessment considers three alternative models to evaluate fits to the bottom trawl survey data: a variation of the 2018 accepted model that includes an update to input data and small changes to the VAST methodology (Model 18.1); a model that uses the VAST Groundfish Assessment Program (GAP) method to estimate trawl survey biomass (18.1a); and a model that uses the VAST GAP method with an updated aging error matrix (18.2b).

Model 18.2b was the authors' and GOA GPT recommended model. This model had the best overall fit using likelihood criteria and results in similar fits to the compositional data in the base model. Model 18.2b underestimates the survey abundance, but with a small improvement to fit compared with the base model 18.1. The differences between the model outputs were largely attributed to the differences in VAST methodology; the updated aging error matrix resulted in very small change in model results. The risk table assessment rated this stock as a level 1 for concern for all categories, and the stock is projected to be well above $B_{40\%}$ for 2021 and 2022, but is showing a downward trend in spawning stock biomass. The fishery in recent years has not utilized its full TAC having harvested approximately 61% of the TAC in 2019. **The SSC concurs with the author and GOA GPT recommended model, and associated OFL and ABC that is set to the maximum permissible ABC under Tier 3a.** This ABC is a 24% increase compared to the 2020 ABC and a 30% increase from the projected 2021 ABC from last year

Area apportionment was based on the random effects model used in recent assessments and resulted in a shift in biomass to the WGOA for 2021 in response to an increase in 2019 survey biomass in the WGOA. The SSC supports the author and GOA GPT recommended apportionment.

The SSC offers the following topics for future work:

- The SSC supports the GOA GPT recommendation that the authors' for this assessment and the dusky rockfish assessment collaborate on producing model-based estimates of abundance since both assessments are using VAST GAP methodology. For future assessments, the SSC recommends the authors' provide diagnostic information of the VAST GAP model fits, noting that a standard approach may not be appropriate for all species.
- The SSC notes that eliminating strata with low but not zero abundance levels (e.g., >700 M) will result in a negatively biased estimator. The SSC recommends consideration of depth covariates or strata-specific indicator variables to allow for modelling of these strata.
- The SSC recommends that temporal autocorrelation should be a topic for continued exploration. The SSC notes that statistical trend prediction when there are missing strata or missing years in the survey time-series may be improved by letting the data inform the appropriate degree of temporal correlation.
- The SSC requests the author provide both the design-based estimate and VAST model fits on the survey biomass figure (Figure 10.4).
- The authors note that they will continue to evaluate appropriate model weighting structure. The SSC looks forward to future work on this issue and advice from the 2021 POP CIE review may be useful for this assessment, as noted by the authors.
- The SSC reiterates its 2018 request for the author to explore alternative binning for the plus group used in the assessment.
- The GOA GPT discussed that the trawl fishery does not appear to encounter the older portion of rockfish that are apparent in the survey. The SSC notes the trawl fishery is localized and may access different habitats than the survey and, therefore, recommends investigation of the spatial distribution of older fish in survey versus the fishery. The SSC highlights that a cooperative effort entitled "The Science-Industry Rockfish Research Collaboration in Alaska", led by Dr. Madison Hall (AFSC & APU-FAST Lab) and with direct involvement of both Amendment 80 and the

Kodiak-based catcher vessel trawl fleets and AFSC survey and assessment staff, is currently underway. The effort seeks to develop a solution for quantifying commercial fishery catch and effort data for northern and dusky rockfish in "survey untrawlable" areas for inclusion in stock assessment. The SSC looks forward to seeing the outputs of this work as it may provide important information on survey and fishery catch compositions, local fish spatial distributions, as well as new perspectives on survey and fishery detection rates which will be helpful in the selection and parameterization of assessment models going forward.

Dusky Rockfish

The SSC would like to thank the author for their work on this assessment, including the MCMC and Bayesian analyses presented, and to the GOA-GPT for their thorough discussion on this assessment. This was an off-survey year for the GOA. A full assessment was presented for dusky rockfish. This is a Tier 3 stock with an age-structured model that is assessed on a biennial schedule. There was no public testimony. Updated data for this assessment includes: fishery length compositions from 2019, survey and fishery age compositions from 2019, final catch estimates for 2018 and 2019, a preliminary estimate of 2020 catch, and finally, VAST survey biomass estimates were updated. The most significant change in assessment inputs was a new VAST model parameterization based on recommendations from the VAST Groundfish Assessment Program (GAP). The assessment model has not changed from the accepted 2018 assessment. The dusky rockfish assessment has used a form of VAST to estimate trawl survey abundance since 2015. Three models were presented for this assessment:

- Model 15.5 with 2018 data (delta-lognormal observation model and 1000 knots in the VAST parameterization; the base model)
- Model 15.5 with 2020 data (delta-lognormal observation model and 500 knots in the VAST parameterization, which essentially acted as a bridge model)
- Model 15.5a, which is 15.5 (2020) with delta-gamma observation model and 500 knots in the VAST parameterization

The SSC appreciates all of the work associated with the changes to the VAST model in this assessment. The VAST survey biomass estimates used in all three models are presented in the figure on page 14 of the assessment. This figure illustrates the relatively dramatic increase in survey biomass estimates between 2017 and 2019 with the incorporation of the updated data. Also, biomass estimates from the new parameterization of VAST that uses a gamma PCR (used in Model 15.5a (2020)) exhibited greater interannual variability than either those used in the base model (Model 15.5 (2018)) or the bridge model (15.5 (2020)), both of which used the lognormal PCR.

However, the model-estimated spawning stock and total biomass trends are similar between the bridge model (Model 15.5 (2020)) and Model 15.5a (figures on pages 23 and 24 of the assessment). As noted in the assessment, the addition of the 2019 trawl survey data and other updated data is driving the change in the trajectory of estimated spawning and total biomass from Model 15.5 (2018) to Models 15.5 (2020) and 15.5a (2020). The SSC notes that the addition of new data changes the trajectory over an extended period of time (over 20 years).

The author and the GOA GPT recommend model 15.5a, which generally fit the data well. While the focus on the comparisons among models in this assessment was understandably the VAST estimates and associated predicted values, in future assessments, overall model fits to component datasets from all models should also be included in the assessment document, in addition to the author recommended model. According to Table 12-12, the bridge model appears to have the best overall fit to the data, the main difference between the two updated models being the increased likelihood value from the fit to the VAST survey biomass estimates for Model 15.5a. While the model trajectory is similar for Models 15.5 and 15.5a, the increase in variability of the VAST estimates using the delta-gamma observation model results in a poorer fit of the model to the VAST estimates. Fits between the two models with updated data are otherwise

quite similar, and provide a similar assessment of the biological status of the stock, with a near doubling of the estimated female spawning biomass, total (age 4+) biomass, OFL and maxABC between the projected 2021 estimates from the last assessment to the estimated 2021 estimates in the current assessment. The SSC notes the retrospective bias dramatically increased between the 2018 accepted model (15.5 (2018)) and both 2020 models, going from a Mohn's rho of 0.06 with the 2018 base model to over 0.50 with both of the models with updated data (15.5 = 0.53 and 15.5a = 0.51).

The SSC concurs with the use of the recommended model (15.5a) for 2021 and 2022 harvest specifications. This model includes updated data, and fits the component datasets well.

For the next assessment cycle, the SSC had a number of suggestions for this assessment. In the current assessment, having a bridge model that included both updated data and some changes to the VAST model (change in the number of knots) hampered SSC review of the impact of each of these two changes. **The SSC registers concern with the large positive retrospective pattern in the recommended model and suggests that further investigation of this be a very high priority.** The SSC supports the GOA GPT recommendation that authors examine survey index and age composition weighting relative to the retrospective patterns. The SSC also supports the GOA GPT recommendation to evaluate catchability among the retrospective runs and how age and length composition sample sizes are impacted by the patchiness of samples (frequency of occurrence). It may be useful to add remove datasets one at a time and report on observed changes, as this may shine some light on the mechanism behind the change in the scale of the population and the increase in the retrospective bias. Additional discussion, as brought up by the GOA GPT, focusing on the biological basis for this change in the scale of the population is necessary as well. There is some note of some incoming recruitment of fish between 10 and 13 years old.

The PT recommended further work on VAST survey estimates and the SSC strongly supports this recommendation. **The SSC requests the assessment author justify the use of the new parameterization of VAST specifically as it relates to dusky rockfish. Past SSC discussions regarding the general implementation of VAST in assessments precluded a highly prescriptive approach and specifically recommended allowing for some species-specific adaptations of the VAST framework** (October 2020 SSC minutes).. The SSC has also requested diagnostics to evaluate VAST model fit and suggests the author frame the discussion of these diagnostics in a species-specific manner, including consideration of the life history of the species. For example, the use of the delta-gamma observation model would seem to be appropriate for a species with patchy survey distribution. However, the implementation of this VAST-GAP recommendation resulted in a large increase in the interannual variability of the VAST survey estimates, which the SSC notes may be biologically implausible for a long-lived species such as dusky rockfish. The SSC also supports the GOA GPT recommendation to further explore the number of knots that are optimal for this species. Finally, the SSC requests that design-based estimates of survey biomass be included in comparisons with VAST model estimates.

Results from Model 15.5a indicate that the estimated 2021 spawning biomass is above the estimated $B_{40\%}$, placing this stock in Tier 3a for management. For the risk table, authors recommended a risk level of 2 for the assessment concerns category due to the large increase in model-estimated total and spawning biomass, resulting from the low variance of the geospatial model configuration coupled with the high 2019 survey biomass estimate, and the strong positive retrospective bias. Authors recommended a risk level of 1 for the other risk table categories. The SSC appreciates the implementation of the risk table for this species.

The SSC notes that the use of the maximum ABC would nearly double the ABC from 2020 (a 93% increase). **Given the large increase in the retrospective pattern, resulting primarily from two additional years of data but also potentially arising from new VAST parameterization, the SSC recommends a stair step approach for setting the ABC in 2021 and 2022, and therefore a reduction from the maximum ABC.** Since this stock is on a biennial schedule and another full assessment will not be completed until 2022, the SSC recommends utilizing a 50% stair step for both of the 2021 and 2022 ABCs. **Under this approach, the 2021 ABC would be set halfway between the 2020 ABC (3,676t) and**

the 2021 maximum ABC from the recommended model (Model 15.5a). This would amount to a 24% decrease from the maximum ABC for 2021. The 2022 ABC would be set similarly, at halfway between the 2020 ABC and the 2022 maximum ABC, resulting in a 23% decrease from the 2022 maximum ABC. In 2021, a partial assessment for dusky rockfish will be completed, and the projection model will be re-run with updated catch data, which will update the 2022 maximum ABC. **The SSC recommends continuing with the 50% stair step methodology (applying a 50% stairstep between the 2020 ABC and the updated 2022 maximum ABC and the same for the estimated 2023 maximum ABC) when setting specifications until a new full assessment is presented for 2023.**

Area apportionments are based on the random effects model applied to GOA bottom trawl survey biomass estimates, as is typical for the GOA, and the **SSC continues to support this area apportionment for 2021 and 2022.**

Rougheye and Blackspotted Rockfish

A partial assessment was presented this year for the GOA rougheye and blackspotted rockfish (RE/BS) complex. The complex is assessed every two years with an age-structured assessment model and is managed in Tier 3. The last full assessment was in 2019. There was no public testimony.

New input data for the projection model included updated catch for 2019 and catch estimates for 2020-2022. The new OFL and ABC recommendations for 2019 are very similar to what was projected with the 2017 full assessment model. The ABC area apportionment is calculated with a three-survey weighted average method and was identical to last year.

Catches have averaged 48% of the ABC since 2017, although catch decreased in 2020 for all areas compared to 2019. The majority of the RE/BS catch remains in the rockfish and sablefish fisheries, with some increase in the flatfish fisheries.

The SSC concurs with the author's and GOA GPT's recommended maximum permissible ABC and OFL for GOA RE/BS as shown in Table 1, under Tier 3a. The ABC for 2021 is within one ton of that projected last year and the ABC for 2022 is slightly higher.

The apportionment percentages are the same as in the 2019 full assessment. This year's assessment uses the two survey random effects model, which was first used in 2019. This method equally weights the longline and trawl survey indices.

The 2020 longline survey RPN was not used for updating the 2020 projection model, as this was an off-cycle year, but it decreased 43% from the 2019 estimate and is well below the long-term mean. The authors note that the steep decrease in RE/BS RPN could potentially be attributed to hook competition with sablefish.

The SSC looks forward to responses from the 2019 SSC and GOA GPT meetings in the next full assessment. These include both those noted by the authors (incorporating additional information about species identification obtained through otolith morphology and investigating how selectivity is modeled), as well as others from the SSC in 2019 (concern regarding whether otolith morphology is a valid method for differentiating these species, encouraging efforts to incorporate species-specific information into alternative model configurations, and to ultimately move towards splitting this complex).

Demersal Shelf Rockfish

A partial assessment was completed for the demersal shelf rockfish (DSR) complex in 2020 and the next full assessment is scheduled for 2021. There was no public testimony. Yelloweye rockfish comprise the largest component of the DSR complex and are managed using the Tier 4 harvest rule. The ABC and OFL for non-yelloweye DSR are calculated using the Tier 6 harvest rule. The Tier 6 ABC and OFL are added to the Tier 4 values for yelloweye rockfish to determine the ABC and OFL for the DSR complex.

There were no changes in assessment methodology in 2020. Changes in input data include: 2019 remotely operated vehicle (ROV) survey data from one of the four management areas (EYKT) and updated catch information. Directed commercial and recreational DSR fisheries were closed to harvest in Southeast Alaska marine waters in 2020 due to a continuous general decline in the relative abundance estimates produced from the annual ROV surveys. Average weight of yelloweye rockfish caught in the 2019 commercial fishery were used for biomass estimation, rather than updating for 2020, because there were not enough 2020 yelloweye rockfish weight samples to quantify an accurate biomass estimate. Survey data was collected in 2020 from the SSEO and an updated density estimate for this region is expected in 2021.

Estimated yelloweye rockfish biomass has shown a long-term decrease in biomass since the early 1990's. The slight increase from 2020 to 2021 results from the increased 2019 survey estimate in the EYKT management area. The Tier 6 values for non-yelloweye DSR utilizes catch data from 2010–2014, as this is the only time period with data available from the commercial, sport, and subsistence fisheries.

As in previous years, authors recommend an OFL and ABC based on the lower 90% confidence interval rather than the biomass point estimate. In addition, authors recommend the harvest rate be set at F=M=0.2, rather than (i.e., lower than) the maximum allowed under Tier 4. This results in an author recommended ABC that is slightly from the estimate from last year for 2021. The OFL is set using F35%=0.032 for 2021.

As in past years, the SSC agrees with the author and GOA GPT that precaution is necessary due to the long-term decline in the biomass estimate, though the stable biomass since 2015 is encouraging. The SSC endorses the GOA GPT's and authors' recommended ABC and OFL for demersal shelf rockfish in the SEO District for 2021 and 2022. DSR management is deferred to the state of Alaska and any further apportionment within the SEO District is at the discretion of the state.

In the full assessment next year, the SSC looks forward to seeing alternatives for setting OFLs and ABCs that are more in line with current practice (i.e., using point estimates instead of lower 90% confidence intervals and incorporating uncertainty with the risk table rather than in the biomass estimates). The SSC also agrees with the authors' and GOA GPT that an age-structured assessment is desirable for this stock and the SSC continues to encourage its development.

Finally, the SSC notes previous author, GOA GPT and SSC proposed changes to the composition of the DSR and OR complexes. In the GOA Other Rockfish (OR) section of the December 2017 and December 2019 SSC reports (there was no Other Rockfish assessment in 2020) the SSC supported the GPT's recommendation for the Council to move forward with Step 2 of the Spatial Management Policy for the Other Rockfish complex. Specifically, both the DSR and OR stock assessment authors proposed moving the DSR subgroup that are currently in the OR complex in the WGOA, CGOA, and WY areas into the DSR complex, which would effectively create a GOA-wide DSR complex. The SSC highlights this issue because both the OR and DSR complexes are scheduled to be full assessments in 2021. The process used for evaluating RE/BS spatial management in 2021 (see spatial management discussion in these minutes) may be informative to the process needed to address the DSR/OR spatial management issue, and inform GPT and SSC review of those assessments in 2021.

Thornyheads

A full assessment of the thornyhead complex was presented. There was no public testimony. The thornyhead complex is assessed on a biennial schedule with no assessment in off-years. The thornyhead complex is a Tier 5 assessment and includes three species of thornyheads but focuses on shortspine thornyhead.

New information in this full assessment includes:

- catch estimates (though October 6th 2020);
- length compositions from the 2018 and 2019 longline and trawl fisheries;

- length compositions from the 2019 GOA bottom trawl survey;
- updated RPNs, relative population weights (RPW), and length compositions from the 2018, 2019, and 2020 AFSC annual longline surveys;
- updated RPWs from the 1992–2020 GOA longline survey for use in the random effects model; and
- updated biomass values from the 1984–2019 GOA trawl surveys for use in the random effects model.

Estimates of spawning biomass are unavailable for thornyheads. Instead, a random effects model is used to estimate exploitable biomass. This assessment used same methodology (Model 18.1) as 2018 where a random effects model was fit to two indices: the AFSC longline survey RPW index and the AFSC GOA bottom trawl survey biomass index by region and depth in order to compensate for missing data (i.e., thornyheads are found down to 1000m, but deep survey strata are not sampled in in each trawl survey). The inclusion of the longline RPW index reduces the random effects model's sensitivity to the bottom trawl index, and further smooths the biomass estimates as well as apportionment across time.

The most recent 2019 trawl survey estimate was 4% lower than the 2017 estimate, whereas the longline survey RPW increased 15% between 2018 and 2019, and then decreased by 27% in 2020. The biomass estimates from the random effects model show a slightly increasing trend from 2010–2019 and a projected stable trend after 2020. Shortspine thornyhead are taken incidentally in the sablefish and rockfish fisheries and are typically retained. Catch in 2019 was 39% of the TAC, where the TAC was set equal to the ABC. The majority of the catch occurs in the CGOA and is consistently below the TAC.

Apportionment for the thornyhead complex is based on the two-index random effects model of biomass by region, fit to 1984–2019 trawl survey biomass estimates and the 1992–2020 longline survey RPW index. For 2021, the WGOA apportionment increases 8%, the CGOA remains relatively unchanged, and the EGOA decreases 11%.

The SSC concurs with the GOA GPT's and authors' recommended model (Model 18.1), tier (Tier 5) and ABCs and OFLs for 2021 and 2022. There was no recommended decrease from maxABC. The SSC also concurs with the recommended area apportionments.

The GOA GPT noted the recent decrease in commercial catch and decrease in both the longline and trawl survey indices, and they discussed potential causes. The SSC supports the GOA GPT recommendations to (1) investigate hook competition with sablefish on the longline survey and, if appropriate, develop a correction factor either by using existing data or conducting a hook timer study; and (2) investigate potential shifts in gear or fishing behavior in thornyhead habitat as a possible cause of the decrease in catch.

The SSC notes an unprecedented increase in biomass in the EGOA 1-100 m survey depth bin (Table 15-6 in the assessment). The SSC recommends further investigation into the length composition of these fish as well as the spatial extent of the event. The IPHC survey may be useful for comparison with the trawl survey information to determine the spatial extent of the event.

The authors' indicate that discards in the longline fishery are higher than expected. The SSC notes that some discard is expected in the longline fishery because rockfish will drop off the line as the gear is brought onboard. The SSC appreciates any information the author can provide related to the amount of discard expected under the newly implemented full-retention regulation.

Finally, the SSC continues to encourage research focused on aging shortspine thornyheads to potentially allow moving to an age-structured assessment in the future.

GOA Sharks

The SSC appreciates this stock assessment, which includes information on life history of the main shark species, their ecology, catches from a host of surveys and fishery catch data that collectively provide an

excellent basis to understand the difficulties to assess the diverse species in this data-poor complex. The GOA shark complex is assessed on a biennial cycle with a full assessment conducted this year. New information for this assessment includes GOA shark catch over 2003-2020 (through October 13, 2020), as well as updated survey indices: NMFS bottom trawl through 2019, NMFS longline through 2020, IPHC longline through 2019, and ADF&G trawl through 2019 and longline through 2020. There was no public comment.

There are currently no directed commercial fisheries for sharks in federally or state-managed waters in the GOA. However, sharks are caught incidentally in many target fisheries; most incidental catch is discarded. Total shark catch was 1,997 t in 2019 and catch so far (as of October 13) in 2020 was 1,117 t. These catches are well below the ABC (7,757 t) and OFL (10,343 t) for both of these two years.

While shark catches in multiple surveys help to broadly inform this assessment for all shark species, only the AFSC biennial trawl survey catches for spiny dogfish are used to estimate OFLs and ABCs. It is noteworthy that **spiny dogfish biomass from the AFSC biennial trawl survey declined from the near record peak in 2013 of 160,384 t to just 22,014 t in 2019**. **This is the lowest biomass estimate since 1990**. Other recent surveys provide mixed signals. For instance, ADF&G trawl surveys do not regularly encounter sharks in Kachemak Bay. The ADF&G trawl survey in Prince William Sound encounters dogfish semi-regularly where catches were dominated by a large spike in 2016 but otherwise remain trendless. Relative population numbers of spiny dogfish in the IPHC longline survey have been increasing from the historic low in 2013. However, the RPNs have wide confidence intervals. Likewise, catches of spiny dogfish in the AFSC longline survey are variable with no obvious long-term trend, although catches decreased from 2019 to 2020. ADF&G longline surveys in southeast Alaska have indicated a downward trend in spiny dogfish since 2009, whereas ADF&G longline survey catches from Prince William Sound are highly variable.

No changes were made in assessment methodology from the last assessment in 2018. This is a split assessment involving Tier 5 for spiny dogfish (using Model 15.3a) and Tier 6 (using Model 11.0) for all of the other shark species including Pacific sleeper shark, salmon shark, and others. For the Tier 5 spiny dogfish assessment, the time series of AFSC biennial trawl survey biomass estimates are analyzed with a random effects model that essentially acts as a smoother. On the other hand, Tier 6 specifications for the other sharks are calculated using Model 11.0 based on average historical catches over 1997-2007. Because the method and time series is fixed, there was no change in these catch specifications for this assessment of Tier 6 species in this complex. The total OFL for the GOA shark complex as a whole is the sum of the Tier 5 and Tier 6 specifications for each species.

Specifically, for spiny dogfish, the Tier 5 estimates of OFL and ABC are derived in the following manner. The time series of AFSC trawl survey catches is analyzed by a random effects model that produces biomass estimates that are divided by a catchability coefficient ($q = 0.21$) to estimate adjusted biomass. The estimate of q is informed by a tagging study that investigated vertical availability of dogfish to trawl survey gear (Hulson et al. 2016). The random effects biomass model is fit separately by area (WGOA, CGOA, and EGOA) and then summed to obtain GOA-wide dogfish biomass estimates. The Tier 5 portion of the OFL is then calculated by multiplying the estimated exploitable biomass by the F_{OFL}, which is equated to F_{max} (0.04) estimated from demographic analysis. This novel approach using field studies to inform q was applied and approved by the SSC in the last full assessment (December 2018). **The SSC agrees with the authors' and GOA GPT's recommendation on tier level, model choice, and ABC and OFL recommendations for 2021 and 2022.**

This ABC represents a 54% decrease from the 2020 ABC. For reference, the largest estimated recent catch of GOA sharks in federally managed fisheries was 3,423 t in 2018 (Table 19.3). As another frame of reference, the SSC notes that the switch to the new Tier 5 model in 2018 led to an 81% increase in OFL and ABC from 2016 to 2018.

A risk table was completed for the GOA shark complex. Regarding assessment, spiny dogfish is ranked 1 given the incorporation of survey data whereas the other sharks are ranked 2 as no life history or biological information is included in the OFL and ABCs calculations. However, while considering assessment risk, the SAFE says "The spiny dogfish survey trends appear to be stable" (p. 23), but the AFSC trawl survey (and random effects model) suggest a declining trend in survey catches since 2013 including a fairly sharp drop in dogfish biomass from 2018 to 2020 (Figure 19.24). Regarding population dynamics, spiny dogfish are ranked 1 as population dynamics are somewhat understood, whereas the others are ranked 2 owing to concerns about declining trends and high uncertainty. Risk associated with the environment/ecosystem was ranked 1 as normal for all shark species given recent ocean conditions and prey availability. Defining risk associated with fishery performance is difficult for non-targeted, low retention species, especially when confounded with concerns over accuracy of catch estimates. However, the risk level was ranked 1 for the complex. **Although the two risk scores are level 2, the authors and GOA GPT concluded that these levels of concern do not warrant additional ABC reduction. The SSC agrees with the risk scores and that no additional reduction in ABC is indicated at this time.**

The SSC offers the following comments:

- During the last assessment review, the SSC requested the reporting of uncertainty in q and suggested running the model using a plausible range of alternative values of q as a sensitivity analysis. In the current assessment, the authors replied that uncertainty around q was discussed in the parameter estimates section and that a suite of models with a range of q values were reported in Appendix 20A of Tribuzio et al. (2018). The SSC appreciates these clarifications.
- The SSC appreciates the risk table and noted the authors' comment that completing the risk table for complexes raises questions on when different members of the complex might be assigned different risk scores. The authors asked whether the complex risk score should be based on the bulk of the complex, or highest level of concern? For example, in the GOA shark complex, three of the four species would be level 1 in all categories, but one species has level 2 risk in at least one category. The SSC appreciates this question. **In cases of a complex, the risk score for a given risk category should represent the highest risk score for that category of any member of that complex.**
- The SSC is pleased to see planned and ongoing research progress pursuant to previous GOA GPT and SSC requests. **The SSC provides the following feedback on proposed and ongoing research projects:**
    - Collection of over 400 samples for a genome sequencing project for Pacific sleeper shark to address concerns about stock structure and a potentially low effective population size. **To develop a comprehensive understanding of Pacific sleeper shark stock structure, the SSC recommends inclusion of samples from Pacific sleeper shark from adjacent regions (California Current, western North Pacific) to the extent practical.**
    - Progress (e.g., literature review) to develop a stock structure document for sleeper shark pending the outcome of the genetic study. The SSC is glad to see that the literature review will include other members of the Somniosidae family.
    - Submission of a grant proposal to develop a potential new ageing method for Pacific sleeper shark that appears promising.
    - A new collaborative study with UAF to attempt to incorporate multiple survey indices into VAST. This is a potentially very important study. While the upgrade of spiny dogfish from Tier 6 to Tier 5 is a welcome improvement to the stock assessment, **dogfish biomass estimated by the random effects model applied to just one survey (AFSC trawl survey) may lead to interannual changes in estimated abundance that may not be fully commensurate with dogfish population dynamics, such as extreme longevity** (Figure

19.24). Different trends and patterns are indicated by other survey indices (Figure 19.13). While some surveys catch dogfish too infrequently to provide meaningful indices, **development of a biomass index that includes estimates from other surveys that routinely catch many dogfish (e.g., IPHC longline survey) should provide improved dogfish biomass estimates**.

- **The authors have been attempting to improve catch estimates through several avenues (e.g., improving historical time series, use of EM, improvement in species ID). The SSC strongly encourages these efforts to improve shark catch estimates as sustainable fishery management depends heavily upon accurate catch data.** In the last assessment, the SSC recommended the authors to continue efforts to ensure that shark catches in federal fisheries in Areas 649 and 659 are fully reported. The authors had replied that the outcome of the NMFS-UAF VAST project may be informative for the spiny dogfish assessment as the IPHC and ADF&G Southeast Alaska longline surveys provide data in inside waters that may provide a means to expand the biomass estimates into Areas 649 and 659. The SSC looks forward to ongoing improvements in shark catch estimation.
- **Given the possibility that sharks could become "choke" species to other fisheries in the not-so-distant future, information on discard mortality could become extremely important. The SSC requests the GOA GPT to list shark discard mortality estimation as a high priority research area and requests the stock assessment authors to consider developing a project to make progress in this area.** Discard mortality is likely to vary by shark species and to be highly dependent upon at-sea discard practices, which likely vary by fishery sector, so collaboration with industry will be important for a successful project. Likewise, education and outreach will be critical to convey findings and to recommend "best practices."
- **The SSC recommends that the authors consider future research into variability in catchability coefficient for spiny dogfish, specifically temperature-dependent q**, for the following reasons:
    - Interannual variability in smoothed random effects biomass estimates from trawl survey data may still not be fully consistent with the population dynamics of this extremely long-lived species
    - Size distributions of female and male spiny dogfish appear to be remarkably stable over time and do not seem to be consistent with relatively large interannual variability in trawl survey estimates of dogfish biomass.
    - Hulson et al. (2016) used tagging data to investigate the availability of spiny dogfish to the survey gear and found that the species spends a large portion of time in near-surface waters (i.e., out of the range of the survey gear) during summer when temperature is warmer. If temperature may have such a strong seasonal effect on the vertical distribution of dogfish, it may be likely that they would also be sensitive to interannual (or station-to-station) variability in temperature.
    - **Analytical approaches to address potential temperature effects on survey q include attempts to use temperature as a covariate in model fitting to time series of dogfish survey biomass.** Are very low (high) survey catches related to warmer (cooler) than average temperatures? This may help to account for peaks and valleys in the biomass time series that are inconsistent with the population dynamics of this long-lived species. The EBS yellowfin sole stock assessment is an excellent example. Also, a field tagging program with temperature recorders may provide empirical data for a temperature-depth relationship. **As the satellite tags used in the Hulson et al. (2016) study included**

temperature recorders, perhaps those data can be analyzed to identify temperature effects on dogfish vertical distribution that may affect survey catchability coefficient.

- Finally, the spatial distribution of spiny dogfish in the BSAI is mistakenly shown in Figure 19.6, which should show the spatial distribution of spiny dogfish in the GOA.

GOA Forage Species

A status report on forage species in the GOA is completed on a biennial basis in even years. There were no public comments.

Species considered to be critical components of the forage base in the GOA include a wide variety of small fish and invertebrates, including juvenile pollock, herring, capelin, eulachon, and squid. They are generally not surveyed well in the standard AFSC biennial surveys, though the CGOA and WGOA summer acoustic surveys provide limited information on the abundance of capelin, as do the bottom trawl surveys. Capelin favor cooler waters. Between 2003 and 2019, acoustic estimates of capelin have varied by two orders of magnitude, with an apparent low in 2015. As of 2019, there is evidence that capelin numbers may again be increasing, though their unusually light use by seabirds nesting on Middleton Island in 2020 indicated that capelin were scarce. An ADF&G estimate of spawning biomass of 48,000 t for 2016 is within the range of biomass estimates in 2013-2017 from the AFSC bottom trawl surveys.

Most squid are not well sampled by the AFSC biennial surveys, though the large, near-bottom-dwelling adult *Berryteuthis magister* is regularly encountered in the bottom trawl surveys and estimates of biomass have fairly narrow confidence intervals. The 2019 catch was the third lowest in the time series since 1984.

The forage report shows shrimp catches, but does not report shrimp from the AFSC trawl surveys. The SSC recommends the inclusion of a plot showing the combined biomass time series of shrimp species in the GOA.

While the forage report does not guide any formal management recommendations, the SSC appreciates the report and its useful context for conditions in the GOA.

C-6 Initial review of BSAI Pacific cod pot catcher processor latency analysis

The SSC received a presentation from Sam Cunningham (NPFMC) of an initial review draft RIR document that analyzes a proposed regulatory change that would eliminate the License Limitation Program (LLP) license endorsement for catcher/processor (CP) vessels to fish for Pacific cod with pot gear in the BS and AI fishery management plan (FMP) subareas if the license was not credited with a minimum amount of directed Pacific cod landings during a specified period. Public testimony was provided by Mike Shelford (Shelford's Boat Ltd., F/V Aleutian Lady), Shannon Carroll (Trident Seafoods, F/V Bountiful), Leonard Herzog (Arctic Sablefish LLC), Mary Boggs (Pavlof Fisheries LLC), and Heather McCarty and Jeff Kauffman (CBSFA). No written comments were posted to the SSC agenda during the public comment period (but some written comments were posted to the Council agenda).

In 2006, the Council took action on Amendment 85 to the BSAI Groundfish FMP for the BSAI, which became effective in January 2008. That amendment assigned a portion of the BSAI Pacific cod TAC to the pot CP sector with the primary goals of aligning Pacific cod allocations with actual dependency and use and providing stability to all sectors. Three major changes relevant to the pot CP sector have occurred since the implementation of Amendment 85, which has resulted in less stability for the dependent vessels on which the Amendment 85 allocation was based: (1) low crab TACs and consolidation within the crab fisheries has provided increased flexibility for pot CPs; (2) the TAC for Pacific cod in the BSAI has decreased over the last several years; and (3) the availability of rollovers to the pot CP sector has declined. The Council is considering action to eliminate latent capacity in the fishery to increase stability for cod

dependent pot CPs, maintain consistently low rates of halibut and crab bycatch, and ensure that condensed fishing seasons do not result in safety-at-sea concerns.

The RIR analysis includes two alternatives: Alternative 1, the no-action alternative, and Alternative 2, which would remove the Pacific cod endorsement from any of the eight pot gear CP LLP licenses that currently hold a BS or AI area endorsement if that license was not credited with a minimum amount of catch in the sector during a defined period of time. Alternative 2 contains two options for the qualifying period, 2005-2019 (Option 1) and 2012-2019 (Option 2). Additionally, two suboptions (A and B) are proposed; however, based on the analysis of the LLP licenses' catch history during the relevant qualifying period(s), there is no apparent difference in outcomes between the two suboptions, and there is no difference in outcomes compared to excluding the suboptions altogether. The net result is that, under Council staff's interpretation of Alternative 2, of the eight relevant LLP licenses, four would retain their Pacific cod endorsement under both qualifying periods, three licenses would lose their endorsement under both qualifying periods, and one license would either retain or lose the endorsement depending on which qualifying period (Option 1 or Option 2) is selected.

The SSC commends the analysts on a clear, thorough, and thoughtful presentation and analysis. The analysis assembles the available and relevant information on the BSAI Pacific cod pot CP sector, including a detailed description of fishery management, a history of Pacific cod-endorsed CP LLP licenses and the diversity of their endorsement portfolios, fishery harvest trends, bycatch management data, harvest value trends, vessel engagement and dependency levels, community linkages, and safety considerations as well as management and enforcement considerations. Within the analysis of alternatives, effects on latent LLP licenses holders and effects on historically active LLP license holders are clearly differentiated and described. The SSC notes that the analysis of the no-action alternative, often treated at a relatively high level of abstraction in RIRs, is particularly well developed in this analysis. An overriding challenge to the analysts for this proposed action is the limited number of entities participating in the fishery and the accompanying data confidentiality constraints. The analysts, however, through a combination of quantitative data and qualitative narrative, have presented an analysis that is comprehensive and sufficient for understanding the various costs and benefits of the proposed action, including the unambiguously negative effect on the owners of LLP licenses who would lose Pacific cod endorsements under Alternative 2. Public testimony that the SSC received and that the Council has received in the form of written comments will provide the Council additional information on an individual permit level that is otherwise not publicly available due to data confidentiality constraints.

The SSC finds the analysis adequate to allow the Council to understand the impacts of the alternatives. **The SSC recommends the draft be released for public review**, after the analysts address the following minor recommendations:

- Confirm with the Council that their operating assumptions regarding the wording of the 1,000 mt threshold for Alternative 2 are appropriate, including that it is to be evaluated based on retained commercial catch (RIR page 19) and that it is meant to be applied to cumulative catch throughout the relevant qualifying period (RIR page 21).
- Add a clarifying or qualifying statement to the communities analysis (RIR Section 3.4.8) to help readers understand which communities may receive the beneficial and adverse impacts of LLP licenses. This could reflect public information about particular licenses, or generally state that while LLP license ownership address is considered the best proxy available to link LLP license ownership with communities, LLP license ownership structures may be complex and, as such, individual LLP license ownership addresses may not accurately reflect the communities to which beneficial or adverse impacts of LLP license ownership may ultimately flow.

The SSC cautions the Council that removing endorsements from LLP licenses as a mode for reducing excess capacity is only a short-term solution to declining Pacific cod TACs. The action alternatives do not consider longer-term issues, such as how capacity will adjust in the Pacific pot cod CP sector if Pacific cod

TACs recover sometime in the future. Moreover, the SSC also cautions the Council that removing endorsements from LLP licenses as a mode for reducing excess capacity could also have negative consequences for LLP license holders outside of the Pacific cod pot CP sector. Specifically, Alternative 2 could signal to all LLP license holders that their endorsements are subject to being revoked if they are not actively used. Not only does this have the potential to reduce the value of an LLP license on the transfer market, it may also create a "use-it-or-lose-it" mentality among LLP license holders, which could incentivize license holders to use their latent endorsements, even if it is not optimal for their business plan. As the analysis correctly points out, even latent endorsements have an option value, which is the value of having the option to exploit unused harvesting privileges in the future. The removal of latent endorsements could therefore threaten the strategy of holding an LLP license with multiple (possibly latent) endorsements as a way for license holders to adjust their business model in response to an uncertain operating environment.

SSC Member Agenda Associations

At the beginning of each meeting, members of the SSC publicly acknowledge any direct associations with SSC agenda items. If an SSC member has a financial conflict of interest (defined in the 2003 Policy of the National Academies and discussed in Section 3) with an SSC agenda item, the member should recuse themselves from participating in SSC discussions on that subject, and such recusal should be documented in the SSC report. In cases where an SSC member is an author or coauthor of a report considered by the SSC, that individual should recuse themselves from discussion about SSC recommendations on this agenda item. However, that SSC member may provide clarifications about the report to the SSC as necessary. If, on the other hand, a report is prepared by individuals under the line of supervision by an SSC member, then that SSC member should recuse themselves from leading the SSC recommendations for that agenda item, though they may otherwise participate fully in the SSC discussion after disclosing their affiliations with the authors. The SSC notes that there are no financial conflicts of interest between any SSC members and items on this meeting's agenda.

At this December 2020 meeting, multiple SSC members declared an association with various agenda items. Anne Hollowed directly supervises Steve Barbeaux (BSAI PT co-chair, GOA Pacific cod), Martin Dorn (GOA pollock and AI pollock), James Ianelli (GOA PT co-chair, EBS pollock, Bogoslof pollock), Sandra Lowe (GOA PT, Atka mackerel), Paul Spencer (GOA PT, AI Pacific ocean perch, AI Blackspotted/Rougheye rockfish), and Grant Thompson (BSAI PT co-chair, EBS Pacific cod). She also supervises the supervisor of Meaghan Bryan (BSAI Greenland turbot, BSAI Kamchatka flounder), Carey McGilliard (Northern rock sole), Cole Monnahan (Flathead sole), Olav Ormseth (Alaska plaice, skates, octopus, forage fish), Kalei Shotwell (BSAI PT, Arrowtooth flounder, AI shortraker rockfish, multiple ESPs), and Ingrid Spies (BSAI yellowfin sole, AI P. cod). Sherri Dressel and Franz Mueter were co-authors on ESR contributions. Curry Cunningham supervises Kari Fenski (sablefish and GOA dusky rockfish). Dana Hanselman is a co-author on the sablefish assessment, supervises Chris Lunsford (GOA-GPT co-chair), and is married to Kalei Shotwell. Jason Gasper is married to Cindy Tubiuzo (GOA and BSAI shark assessment author). Finally, Andrew Munro supervises Rich Brenner, a contributor to the GOA ESR.