Scientific and Statistical Committee

Pacific Fishery Management Council
Online Meeting

March 8-9, 2022

Members in Attendance

Dr. John Budrick, California Department of Fish and Wildlife, Belmont, CA
Mr. Alan Byrne, Idaho Department of Fish and Game, Boise, ID
Dr. Fabio Caltabellotta, Oregon State University, Corvallis, OR
Dr. John Field, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Melissa Haltuch, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Owen Hamel, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Dan Holland, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Galen Johnson, SSC Chair, Northwest Indian Fisheries Commission, Olympia, WA
Dr. Kristin Marshall, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Steve Munch, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. André Punt, University of Washington, Seattle, WA
Dr. William Satterthwaite, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Jason Schaffler, Muckleshoot Indian Tribe, Auburn, WA
Dr. Ole Shelton, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Cameron Speir, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Tien-Shui Tsou, Washington Department of Fish and Wildlife, Olympia, WA

Members Absent

None.

SSC Recusals for the March 2022 Meeting		
SSC Member	**Issue**	**Reason**
Dr. Kristin Marshall	E.8 - Initial Stock Assessment Plan and Terms of Reference	Dr. Marshall contributed to the Stock Assessment Prioritization Workbook
Dr. Will Satterthwaite	H.2 - California Current Ecosystem and Integrated Ecosystem Assessment (IEA) Report	Dr. Satterthwaite's work was reviewed in the ecosystem subcommittee report adopted under this item

A. Call to Order

Dr. Galen Johnson called the meeting to order at 0800. Mr. Merrick Burden briefed the Scientific and Statistical Committee (SSC) on their tasks at this meeting.

Dr. Dan Holland was elected to be the next SSC Chair and Dr. Jason Schaffler was elected to be the next Vice Chair. Dr. Steve Munch volunteered to serve on the Salmon and Coastal Pelagic Species (CPS) Subcommittees.

D. Salmon Management

2. Review of 2021 Fisheries and Summary of 2022 Stock Forecasts

The Scientific and Statistical Committee (SSC) discussed the Review of 2021 Ocean Salmon Fisheries and Preseason Report I for 2022. Dr. Michael O'Farrell (Southwest Fisheries Science Center, Salmon Technical Team [STT] Chair) provided a brief summary of the reports and members of the STT were available to answer questions. The SSC appreciates the work of the STT in compiling the reports and providing an early look at key pieces of Preseason Report I in draft form, which was very helpful. The availability of the Preseason Report I was not announced until Monday March 7, limiting review of the remainder of the report. Sampling of fisheries in 2021 was not affected by the COVID-19 pandemic; however, the disruption of tagging and marking of juveniles in 2020 will affect recoveries of coded-wire-tags (CWTs) from adults of that cohort and may affect planning and implementation of mark-selective fisheries on that cohort.

The Council is tasked with specifying annual catch limits (ACLs) for Sacramento River fall Chinook (SRFC, indicator stock for the Central Valley fall Chinook complex), Klamath River fall Chinook (KRFC, indicator stock for the Southern Oregon/Northern California Chinook complex), and Willapa Bay natural coho. Preseason Report I presents ACLs for these three stocks (Table V-4). The forecasts for SRFC and KRFC are derived from forecast models that have been reviewed and approved by the SSC in previous years. The Willapa Bay natural coho forecast methodology was reviewed and endorsed by the SSC in November 2021. The SSC found the calculations of the

acceptable biological catches (ABCs) and corresponding ACLs correct based on the forecasts for all three stocks.

The Council adopted rebuilding plans in 2019 for five salmon stocks: SRFC, KRFC, Queets River coho, Juan de Fuca coho, and Snohomish River coho. In 2021, SRFC met the criteria for rebuilt status. The three-year geometric mean spawning escapements for the other stocks in 2022 are:

- KRFC. The three-year geometric mean natural area spawning abundance is 25,039 which is less than the minimum stock size threshold (MSST) of 30,525. The stock meets the criteria for overfished status.
- Queets River coho. The three-year geometric mean adult spawning escapement is 2,654 which is less than the MSST of 4,350. The stock meets the criteria for overfished status.
- Juan de Fuca coho. The three-year geometric mean adult spawning escapement is 6,002 which is less than the MSST of 7,000. The stock meets the criteria for overfished status.
- Snohomish River coho. The three-year geometric mean adult spawning escapement is 46,418 which is more than the MSST of 31,000, but less than the S_{MSY} of 50,000. The stock meets the criteria for not overfished / rebuilding status.

Hood Canal coho meet the overfished criteria as the three-year geometric mean adult spawning escapement is 9,990 which is less than the MSST of 10,750.

None of the Chinook or coho stocks were determined to be subject to overfishing; however, the exploitation rates for 2021 were not available except for SRFC and KRFC.

A stock is approaching an overfished condition if the three-year geometric mean of the most recent two years and the 2022 forecast of spawning escapement given last year's fishing regulations is less than the MSST. The KRFC and Juan de Fuca coho meet the criteria for being at risk of approaching an overfished condition.

The results presented in Preseason Report I are point estimates and associated uncertainties are generally not reported. The SSC reiterates its strong recommendation that PFMC salmon reports provide and incorporate appropriate measures of uncertainty as is currently done for groundfish, coastal pelagic species, and highly migratory species.

The SSC notes that there remains considerable uncertainty about which aspects of the Preseason Report I the SSC is specifically charged with reviewing and endorsing under the Pacific Coast Salmon Fishery Management Plan (FMP) and about the process of initiating potential changes to salmon reference points (e.g., MSST and MFMT; see the Salmon Subcommittee Report attached to Agenda Item C.10.a, Supplemental SSC Report 1, June 2021).

SSC Notes:

The approach used to convert the SRFC forecast from the logarithmic to arithmetic scales may warrant exploration as a Methodology Review topic. Using the median rather than the mean would be more consistent with the P/sigma approach used for groundfish and CPS and might address a recent tendency to over-forecast more than half the time.*

The KRFC and SRFC forecasted ocean harvest rates have both been under-predicted recently. The STT modified the data range used to make these predictions, which resulted in an improvement of the forecast compared to post season estimates when applied retrospectively within-sample (Appendix D). Further exploration of potential model changes should be considered as a topic for the salmon Methodology review in October.

2020 ocean sampling, especially in CA was affected by COVID and some harvest estimates and CWT recoveries were "imputed" (see the 2021 SSC statement and PRE-1 report). This affects run reconstruction for stocks that used the "imputed" 2020 harvest data.

For southern Oregon Chinook, the MFMT specified in Pre-1, Table V-4 is 0.54 but in Table A-1 it is 0.78.

Check Table A-1 for errors (for example, Hallock 1977 specifies a Sacramento Fall Chinook capacity of 245,000 natural-area spawners, not 240,000) and inconsistencies with the FMP (for example, the SRFC conservation objective does not distinguish natural versus hatchery fish but the FMP [p. 49] states the goal of fisheries management for California stocks is to maximize natural production). Full references should accompany the citations.

Forecasting methodologies used for salmon stocks in Preseason Report I may have changed over the time periods shown. The SSC recommends that the STT develop a database or appendix for their report where changes to forecasting methodologies for each stock can be described and archived.

Provide a quantitative analysis of forecast performance.

No overfishing occurred however the maximum fishing mortality threshold (MFMT) reference point for many stocks are based on old data and old analysis. A review and re-analysis of MFMTs using recent data and newer methods is warranted.

Can we learn something about improving the forecasted exploitation rate of SRFC and KRFC by looking at the Sacramento winter Chinook harvest model, which did not show a similar pattern of consistent under-prediction (although post-season estimates may be so uncertain that noise simply swamps any bias that might be present).

The NMFS ESA consultation standard for the California Coastal Chinook ESU sets a limit on the preseason expectation of the KRFC age-4 ocean harvest rate ≤ 16%. In 2021, the realized age-4 ocean harvest rate was estimated to be 27.2%.

E. Groundfish Management

3. Stock Definitions

The Scientific and Statistical Committee (SSC) discussed options and approaches for defining stocks in the Groundfish Fishery Management Plan (FMP).

The SSC discussed the alternative uses of the word "stock", noting that for these purposes "stock" refers to a status determination unit/management unit rather than an assessment unit. Assessment

areas should take into account, but not be dictated by, status determination/management boundaries, while status must be reported at the status determination/management unit.

A variety of information may be useful for defining stocks for status determination and management. This includes a suite of data on species biology and distribution, as well as information on data availability across space. Properly considering the available information will require a multi-stage process, including development and review of a proposed framework for defining stocks, application of said framework to FMP species, review of results, and Council deliberation and decision making. Option 2 does not provide adequate time for this process, and therefore would largely involve formalizing the status quo, while the more deliberative approach of Option 1 would still need to be undertaken at a future date.

Changes in stock definitions may occur in the future due to, for example, new or improved data or shifts in ranges due to climate change.

SSC Notes:

Any framework for defining stocks should include consideration of approaches and timing within the assessment cycle for future changes in stock definitions and associated FMP amendments, as well as for defining complexes and determining when species should be designated as ecosystem components or removed from such designation.

How to calculate stock status in the future if an assessment straddles a status determination/management boundary? Assessments or assessment sub-areas should be subsets of status determination/management units whenever possible.

4. Limited Entry Fixed Gear Catch Share Program Review

The Scientific and Statistical Committee (SSC) received a presentation from Ms. Jessi Doerpinghaus on the analyses conducted for the limited entry fixed gear catch share program review. The SSC discussed progress on the review items recommended during the June 2021 SSC statement for the previous review (Agenda Item G.2.a, Supplemental SSC Report 1, June 2021). The SSC concluded that the concerns that an observer effect might be causing underestimation of high grading (discarding of smaller marketable sized fish) had been adequately addressed. Progress has been made in collecting data on permit prices; however, collection and analysis of additional permit prices remains as a research and data need in order to evaluate barriers to entry and expectations of future profitability in the fishery. While participant data for vessel owners and dealers have been incorporated into the analysis, additional data and analysis of impacts on crew and operator remains a research and data need. The SSC also recommends adding to the research and data needs section further analysis of changes in the spatial distribution of the fishery and whether outcomes are equitable between ports and users to evaluate future alternatives for measures to increase equity.

SSC Notes:

On page 33 of the report, figure 11 the Puget Sound ports group percentage of revenue coming from LEFG revenue appeared high relative to that for the coast at nearly 50% of total revenue. This suggests a level of dependence on LEFG that does not seem plausible. The ports of landing for the Puget Sound port groups should be reviewed to ensure the values observed are consistent with historical expectations. Missing data points for dealers for 2014-2019 and 'rule of three' constraints on data availability and Trawl Operations were limited in 2020. This may be a semantic issue since the address recorded for some dealers may be in Puget Sound, but the catch is likely to have originated from the coast, since the analysis is only considering west coast landings and not effort in Puget Sound itself. Jessi will follow up regarding Puget Sound.

Fish tickets for Washington for some time periods record the address of the first receiver rather than the port of landing. This mismatch may be influencing the results on port involvement and port dependence, including possibly the issue with Puget Sound ports described above.

Consideration of implications for the primary tier fleet of gear-switching restrictions for the trawl IFQ being considered by the Council should be undertaken in the evaluation of gear switching alternatives.

8. Initial Stock Assessment Plan and Terms of Reference

The Scientific and Statistical Committee (SSC) discussed planning for new groundfish stock assessments for 2023 and 2025 and revisions to the three Terms of Reference (TOR) that guide the stock assessment process. The upcoming stock assessments will inform the harvest specifications and management measures decisions for groundfish fisheries in 2025 and beyond. Drs. Jim Hastie and Chantel Wetzel (Northwest Fisheries Science Center) presented information and analyses that support the proposed stock assessment priorities and responded to questions. These analyses remain largely unchanged since 2020. The SSC appreciates the analyses and reports completed for this agenda item.

The SSC provided Dr. Hastie with minor suggestions for modifications to the stock assessment prioritization workbook for future cycles that include a better explanation of the range and rationale for the scores used for each category of information ranked in the prioritization and provision of a consistent rationale for the calculation of the factor scores for each category.

The SSC discussed the interaction between the species prioritized for stock assessments, many of which are nearshore species, and the Council action on groundfish stock definitions and future Fishery Management Plan amendments that will define regions for management units and stock status determinations. Despite this uncertainty in future stock definitions, stock assessment considerations for a few more highly prioritized stocks were discussed. Black rockfish is an important recreational species with new data to inform future assessments. Rosethorn and Redbanded rockfishes could be assessed as full or data-moderate assessments, but both of these assessments will need to address the higher than usual uncertainty in the catch data given these species are very minor components of rockfish fisheries. Treefish is likely to only be possible to assess using data-moderate methods. Brown rockfish would likely need to be conducted as a full

single-area assessment in California waters because this assessment would depend on recreational catch per unit effort for an index of abundance; there is limited age data for Brown rockfish. Rex and English soles are good candidates for length-based data-moderate assessments.

While update assessments require less time for review, they require nearly the same amount of time to complete for the analyst. Catch-only projections could be completed for stock assessments that cannot be updated due to limited staff capacity for full and update assessments. Alternatively, data-poor methods could be applied to such stocks or a less intensive update method, such as those informed with just lengths and indices, could be considered.

The SSC reviewed marked-up versions of the three TOR that will guide the groundfish stock assessment process for 2023-2024 . The changes reflect the outcomes from the 2021 Groundfish Stock Assessment Process Review Workshop held in January 2022, including input from stock assessment authors. The SSC recommends that future data-moderate assessments be reviewed in a stock assessment review (STAR) Panel. The SSC recommends that suggested changes to the TOR be available for public review. The SSC did not recommend changes to the Methodology Review TOR. The SSC Groundfish Subcommittee intends to hold a webinar during April 2022 to resolve comments in the current draft TOR. The SSC concurs with the CPS Management Team plan for revised CPS TORs that could be considered during the June and November Council meetings.

SSC Notes:

Check the equations in the stock assessment prioritization document for calculating commercial fishery importance. Add text that explains the origin of the power function, it is very precise.

Add text in the stock assessment prioritization document that explains the range of scores and the origin of the negative factor value for choke species.

Add text in the stock assessment prioritization document that explains why the ecosystem factor scores tail off quickly. Provide a consistent rationale for calculation of factor scores across the categories that feed into the final prioritization.

Add the steepness value to pages 15-16 of the stock assessment prioritization document.

Both rosethorn and redbanded rockfish tend to be infrequently encountered in fisheries targeting more abundant rockfish species and are generally landed in multiple market categories. The combination of sparse occurrence in multiple market categories is typically associated with greater uncertainty in recent and historical catch estimates (as discussed during the 2017 review of "Improving Catch Estimation Methods in Sparsely Sampled Mixed-Stock Fisheries" (https://www.pcouncil.org/documents/2017/09/e3_att1_improvingcatchest_sept2017bb.pdf/).

The scope of less intensive stock assessment update methods would need to be defined in the TOR. The GFSC should discuss at the April TOR review the potential for reduced reporting requirements for such updates if clear limits on the data updated sufficiently reduces the

complexity of the update. If sufficiently different from a typical update with greater latitude for changes, a separate description of the "lite" update may need to be added to the TOR.

Stock assessments that are older than 10 years are generally considered to be expired, although catch-only projections have been used to extend these assessments. The SSC needs to determine how best to update projections for expired assessments.

Change the draft Rebuilding TOR on p. 6 (bottom of page) to refer to the buffer rather than the sigma.

H. Ecosystem Management

2. California Current Ecosystem and Integrated Ecosystem Assessment (IEA) Report

The Scientific and Statistical Committee (SSC) met with representatives of the California Current Integrated Ecosystem Assessment (CCIEA) team, Drs. Toby Garfield (Southwest Fisheries Science Center) and Chris Harvey (Northwest Fisheries Science Center). The SSC's discussion with the CCIEA team encompassed three topics, which are reported upon below in turn: 1) the 2022 California Current Ecosystem Status Report (CCIEA Team Report 1), 2) the report of the August 31 - September 1 2021 SSC Ecosystem Subcommittee (SSCES) meeting (appended to the end of this statement), and 3) ecosystem science review topics proposed for 2022 (CCIEA Team Supplemental Report 2).

Review of the 2022 CCIEA Ecosystem Status Report

The Ecosystem Status Report provides important information on environmental, biological, social, and economic indicators and provides an ecosystem perspective on West Coast fish stocks, fisheries, and coastal communities for the Council process. The SSC commends the CCIEA team's openness and responsiveness to Council and SSC questions and recommendations, and their continuing efforts to improve the Status Report each year. Significant additions to the report this year include an indicator of krill biomass off northern California potentially relevant to Klamath River Fall Chinook, quantitative marine survival projections in association with some salmon indicators, information from acoustic trawl surveys for Coastal Pelagic Species, albacore diet information, analyses of overlap between wind energy areas and non-confidential limited-entry groundfish bottom trawl fishing activity, expansion of the fishery participation network analyses, and a climate change appendix.

Recent changes in distribution and abundance of species and in fisheries have been accompanied by rare combinations of extremes that make it difficult to identify drivers of observed changes, a challenge that is likely to be further intensified by ongoing climate change. Further development of the climate change appendix would be an important step in attempting to address this challenge.

An overarching theme in this year's Ecosystem Status Report is that oceanic indicators largely returned to states similar to generally favorable pre-2013 conditions, aside from a marine heatwave that largely remained far offshore, while conditions in freshwater were characterized by drought, record heat, and reduced snowpack and flows.

The SSC discussed several issues that could affect the interpretation of the indicators in the report including:

1. Natural-area Sacramento River Fall Chinook (SRFC) escapement in 2019 (giving rise to the dominant age-3 age class for 2022 fisheries) is described as "relatively favorable" for natural-area Central Valley Fall Chinook and noted as having "met goal" in Table 3.3.2. However, while natural-area escapement in 2019 was higher than other years under consideration, there is currently no natural-area escapement goal established for SRFC, and multiple studies indicate that natural production would be maximized at substantially higher escapements than the typical natural-origin fraction of the current combined goal.
2. The boundaries between colors in stoplight charts are based on ranks and are sensitive to the time period used for reference, and subject to change over time.
3. Increased incorporation of predator-prey considerations into salmon indicators could be warranted.
4. A "sawtooth" pattern of strong upwelling followed by relaxation events is apparent in 2021, which is thought to be characteristic of good conditions for productivity. Further quantifying this pattern through the development of indicators that capture the variation in upwelling over relevant timescales and link to productivity could strengthen the biological relevance of upwelling indicators to managed species.

Ecosystem Science Review Report from 2021

The SSC reviewed the SSC Ecosystem Subcommittee (SSCES) report from its meeting held via webinar on August 31 and September 1, 2021 and discussed the report with SSCES Chair Dr. Kristin Marshall (NWFSC). The SSC agrees with the SSCES recommendations that:

1. Future CCIEA reports should identify times when environmental conditions are beyond thresholds associated with poor salmon forecast performance in the past;
2. A size-based krill indicator would be a useful addition to the Klamath River Fall Chinook stoplight table and a biomass indicator would be a helpful addition (these were included in the 2022 report);
3. It would be useful to include port-level network analyses in future CCIEA reports (some analyses were added to the 2022 report); and
4. It would be helpful to see more cross references between the CCIEA report and other Council materials, for example mention of the CCIEA report in salmon reports and vice versa.
5. The SSC also agreed with the SSCES recommendations to develop robust juvenile groundfish abundance indices based on spatially-explicit information on size and abundance from the West Coast Bottom Trawl Survey to inform management between assessments, such as through assessment prioritization scoring or scientific uncertainty buffers. These analyses should focus on species that are well-sampled by the survey and not associated with rocky habitats.

The SSCES reviewed six documents, five of which were journal articles that are cited in the SSCES report and publicly available (but in some cases behind paywalls) and one unpublished addendum to an earlier article produced specifically for the SSCES meeting. The addendum is

attached at the end of the SSCES report. In the future, the SSC recommends establishing a process for posting items (or at least links for copyrighted material) provided for SSCES review to the briefing book under an appropriate agenda item to facilitate transparency and public access to materials reviewed by the SSC. A single, easily found repository of all previous SSC Ecosystem Subcommittee reports and a consistent process for distributing the Subcommittee reports would also be useful and increase transparency.

Proposed Ecosystem Science Review Topics for 2022

The CCIEA team has proposed three potential topics for review in September 2022 (Supplemental IEA Team Report 2): 1) strategic review of the salmon indicator portfolio, 2) reference periods for plotting recent means and trends in fishery landings and revenues, and 3) development of the climate change appendix.

The SSC and CCIEA team agreed that point 2 could be addressed without the need for a meeting, with input from relevant advisory subpanels, and then the end product could be reviewed during the March meeting review of the first Ecosystem Status Report to incorporate it. The SSC recommends scheduling a half day for each of the two remaining topics in a September 2022 meeting of the SSCES, noting that both are complicated and ambitious topics that will likely require multiple meetings with additional advisory bodies to fully address. The salmon review could focus on identifying stocks where ecosystem information would be most useful, and how it could be used to better inform management, which could include data-poor stocks and/or stocks whose life histories are not amenable to conventional forecasting techniques. The climate change review could initially focus on technical discussions between the SSCES and the CCIEA team as well as identifying potential processes for involving additional advisory bodies. Given the focus on salmon, the SSC Salmon Subcommittee, Salmon Technical Team, and Salmon Advisory Subpanel should be invited to attend the SSCES meeting in September.

SSC Notes:

From November 2021 Future Planning statement: In March, we may want to discuss an IEA Workshop to talk about whether we still need all the indicators that are in the report-- authors have been doing a lot of adding, without thinking about subtracting/overlap.

There is a major marine heatwave offshore starting to appear in February 2022 - this is very early to see a marine heatwave developing.

Total fishery landings are down <1% compared to 2020 and just below the 30-year average, which is a more optimistic picture than that painted in the report due to late-breaking data on Washington salmon landings.

Rare combinations of extremes make it difficult to identify drivers of species and fisheries responses, and climate change is intensifying this challenge. The Climate Change Appendix is intended as a first step toward unraveling this, identifying needs and corresponding research capabilities and the potential for the indicators and/or forecasts that are responsive to the

identified needs. The developers are encouraging co-development with stakeholders and managers, as they want the products to be useful.

Marine indicators used for salmon are nearshore and relate to periods shortly after ocean entry – but salmon, especially Chinook, spend an extended period of time in the ocean, and not all of it is in the nearshore (though this varies by stock) and not all of the time in the nearshore is spent near the source river mouth.

Related to the sawtooth pattern in upwelling, there is a relevant paper by Mike Jacox identifying a sweet spot in strength of upwelling and when nutrients are retained long enough. The work is not yet at the stage of an indicator but is being actively worked on.

Two of the three ABC salmon stocks (Sacramento and Klamath River Fall Chinook) have freshwater indicators in the report, so could similar indicators be developed for Willapa Bay natural coho, the third ABC salmon stock? So far Brian Burke has developed quantitative indicators for upper Columbia and Snake Chinook and tried developing survival indicators for Oregon Production area hatchery coho survival but they did not work out very well. However, the potential for Willapa Bay can be explored.

In general, CCIEA authors are advised to stay away from potentially loaded language with respect to policy (e.g., status determinations, which stocks have OFLs).

Refine the description of state-by-state landings in Appendix S-54 which seems to contain some self-contradictory language, e.g., landings simultaneously among the lowest ever and within one standard deviation of the mean.

In terms of what qualifies as "good" natural-area Sacramento River Fall Chinook escapement: The SRFC rebuilding plan estimates that natural production in just the Sacramento River above Red Bluff Diversion Dam would be maximized with an escapement of 80,000 females to that area alone; Hallock 1977 as cited in the FMP suggests a natural-area escapement goal of 245,000; Munsch et al. 2020 as cited in the CCIEA report suggests natural production would be maximized by a combined fall, spring, and winter run natural-area escapement of approximately 400,000. The FMP quotes a smaller number from Reisenbichler 1986, but that document is not publicly available, and when Dr. Satterthwaite attempted to reproduce the FMP's quoted number from his copy of the document, he was unable to do so, and noted that significant parts of the system (e.g., Battle Creek and Yuba River) were not included.

Posting journal articles to the briefing book could pose copyright concerns, but pre-copy-editing manuscripts should generally be suitable to post or linking to copies posted in the NOAA Institutional Repository. Or links to the published journal articles could be provided with the explanation that authors generally will provide reprints upon request.

SCIENTIFIC AND STATISTICAL COMMITTEE'S

ECOSYSTEM SUBCOMMITTEE REPORT

Pacific Fishery Management Council

Via Webinar

August 31 and September 1, 2021

The Scientific and Statistical Committee's Ecosystem Subcommittee (SSC-ES) met via webinar August 31 and September 1, 2021 to review new analyses conducted by the NMFS California Current Integrated Ecosystem Assessment (CCIEA) team that may potentially inform future annual Ecosystem Status Reports (hereafter CCIEA report) to the Pacific Council on the state of the California Current Ecosystem. The SSC-ES reviewed four topics: A) Threshold Relationships Between Environmental Drivers and Performance of Salmon Preseason Abundance Forecasts, B) Krill-based Indicators, C) Year Class Strength and Distribution of Small Groundfish, and D) Port-level Linkages Between Fisheries using Network Analysis. Dr. Kristin Marshall chaired the meeting. Meeting participants are listed in Appendix A.

A. Threshold Relationships Between Environmental Drivers and Performance of Salmon Preseason Abundance Forecasts

Dr. William Satterthwaite (NOAA, Southwest Fisheries Science Center) presented his paper "Ecological thresholds in forecast performance for key United States West Coast Chinook salmon stocks" (Satterthwaite et al. 2020) and an addendum he prepared for the SSC-ES, "Ecological thresholds in forecast performance for key United States West Coast Chinook salmon stocks – Addendum". This research evaluated whether the performance of Chinook salmon abundance forecasts are related to environmental conditions, focusing on non-linear threshold relationships. Non-linear relationships have potential to disrupt fisheries management and are not incorporated in current forecast models. Satterthwaite et al. (2020) focused on stocks of high priority for US west coast fisheries management and of predicted importance as prey for Southern Resident Killer Whales. The authors tested 2688 stock-driver-time lag combinations and found 65 non-linear relationships. Of these, 60 demonstrated threshold relationships, determined to exist when the 95% confidence interval of the second derivative of the nonlinear function excluded zero. Among indices capable of explaining at least 33% of variance in forecast performance, oceanic environmental indices were much more common than freshwater or local environmental indices. This may be because forecasts already make use of some measure of cohort strength (e.g., jack returns) that takes place after freshwater and ocean-entry conditions have had their immediate effects. There were mechanistic explanations for many of the observed relationships. When many of the relationships were re-examined with updated datasets (see Addendum), in almost all cases where non-linear relationships had been previously selected, they were re-selected. This work could help fisheries managers identify environmental thresholds past which increased precaution may be warranted. For example, as suggested in the Addendum, NPI could be added to the annual CCIEA report as extreme values of it appear to predict poor Sacramento River Fall Chinook forecast performance and it may be relevant for interpreting some Puget Sound abundance forecasts. Dr. Satterthwaite also demonstrated a straw-person method by which fisheries managers could quantify uncertainty in forecasts and increase precaution when a threshold is exceeded, using similar logic to how groundfish are managed.

While this was the first presentation on forecast thresholds to the SSC-ES, Dr. Satterthwaite addressed many comments the SSC and SSC-ES made in previous discussions of threshold approaches. The SSC-ES appreciated that feedback had been incorporated in many instances, and that acknowledgment was made where previous SSC recommendations were applicable but not yet incorporated. For example, a null model randomization procedure approach was used to look at the chance for false positives and Bonferroni corrections were used for p-values, as previously suggested by the SSC and others when large numbers of tests were conducted in screening for relationships. In the Addendum, Dr. Satterthwaite also examined how robust the identified relationships were to new data, as suggested by previous SSC reviews of threshold work. The relationships tended to remain non-linear, and R^2 tended to decrease with small increases in new data. When examining thresholds, one expects little change when "average" new data is added but more substantial changes when more extreme observations are added; this pattern was, in most cases, observed. Non-stationarity in the threshold relationships is not addressed in this work but is worth consideration in further work.

The SSC-ES discussed several other technical aspects of the work and makes the following suggestions:

- The SSC-ES agreed that R^2 is a useful metric, but should not be the sole metric to evaluate the utility of models because the performance variable is truncated and thus non-normal, but R^2 is from a normal model
- Multi-variable responses or multidimensional indices. Multi-variable responses are certainly possibilities, but difficult. More localized indicators with clear mechanistic hypotheses would be a good place to start such an investigation. Multi-dimensional indices could be useful, but only if the components are related to forecast performance with the same lag
- Another potential approach to explore is using a logit response; if a forecast breaks down with extreme values in either direction (a u-shaped rather than sigmoidal response) then logit might not capture that
- Results showing strong linear relationships should be investigated for inclusion in forecast models
- Consider exploring additional ways to quantify errors in forecasting because this approach is less likely to capture under-forecasts than over-forecasts and multiple metrics may be needed to fully capture the magnitude of error, proportion of error, and the consequences of errors to management.

The SSC-ES appreciated this innovative work and supports using the approach in the CCIEA report to characterize conditions when salmon forecasts may perform poorly. In previous reviews of threshold research, the SSC recommended that the CCIEA report include a small set of pressure variables where a threshold is indicated. The report currently includes recent PDO, and it may be useful to add a "now-cast" or a forecast, as well as include the NPI. These indices could aid in categorizing the risk associated with Sacramento River Fall Chinook and certain Puget Sound Chinook salmon forecasts. If an indicator is in a range that is a threshold for any fish stock, the SSC-ES notes that it is worth mentioning in the CCIEA report. At the same time, the SSC-ES recognizes that nuance is needed in describing errors in forecasting. An indicator being above a threshold does not imply that a forecast will be wrong, but it does mean that more caution might be warranted if the consequences of forecast error are undesirable and forecast error is more likely due to environmental conditions. In general, it would be helpful to see more cross references between the CCIEA report and other Council materials, for example mention of the CCIEA report in salmon statements and vice versa.

B. Krill-based Indicators

Dr. Eric Bjorkstedt and Ms. Roxanne Robertson (Humboldt State University) presented an overview of data and methods behind krill-based indicators entitled "Size of adult *Euphausia pacifica* along the Trinidad

Head Line: an ecosystem indicator for the California Current." The review was suggested by the SSC in March of 2021 to better understand how the mean krill size data presented in the CCIEA report could be interpreted in the absence of relative abundance data, given the nuanced nature of interpreting size data alone with respect to population trends and abundance.

Dr. Bjorkstedt described the indicator as representing density-weighted mean body length of adult *Euphausia pacifica* captured in standard bongo net sampling along the Trinidad Head Line (THL), just north of Cape Mendocino, based on biweekly to bimonthly sampling of five standard stations that run along the continental shelf and slope (35 to 780m depth). The region is characterized as having considerable mesoscale variability in ocean conditions and advection patterns, and a key motivation for the location of this survey line was the hope that the resulting data could help inform regional productivity of Klamath river salmon stocks. The survey began in 2007 and is ongoing, details on survey methods and a great many additional survey results are reported in a publication (Robertson and Bjorkstedt 2020) that was also made available to the subcommittee. Data collected in this survey include hydrographic sampling (temperature, salinity), water sampling (nutrients, chlorophyll) and zooplankton sampling (krill, other zooplankton, ichthyoplankton).

Importantly, in this survey adult krill are identified by maturity factors rather than size thresholds, and the results of their analysis indicate that there would be considerable misclassification of adults and juveniles during warm periods if based on size alone. Adult krill are more abundant over the outer shelf and upper slope, although they are often found inshore, though at lower densities, during the upwelling season (and are often larger on such occasions). There are clear indications of shifts in the size distribution over time, for example, in 2008 krill catches were of generally larger individuals, while in 2015 (during the large marine heatwave) adult krill tended to be considerably smaller. While the authors estimate and have reported biomass indices in the literature, they also noted that numerical abundance (the number of individuals) does not change substantially over time, such that a considerable fraction of the change in total biomass is driven by changes in size. This suggests that changes in adult size represent an integrative index of krill in this region and reflect insights into both available biomass and how it is "packaged and distributed." The authors also note that they have not yet attempted to develop population models, or relate spawning biomass to recruitment, in order to better evaluate the consequences of smaller females to potential spawning output and productivity.

Considerable effort has focused on relating shifts in size distributions from this dataset to environmental conditions. Among the findings are that low frequency shifts in size distributions appear to reflect changes in upper water column ocean conditions, particularly temperature, with convergence towards median adult sizes at warm temperatures. Seasonal increases in average size of mature adults are reduced under warm conditions, and size increases with colder years and with higher chlorophyll levels. Conversely, early furcilia stages are larger during warm years. There is some suggestion that dynamics are preconditioned at some level, with population and size trajectories for spring and summer reflecting observed patterns during the winter. However, there is uncertainty regarding the extent to which shifts in size structure might result from advection rather than local dynamics, as there is evidence for advective drivers of some observations, such as a rapid and steep drop in mean size coincident with the arrival of "warm blob" waters at the coast in late 2014, which happened too fast to reflect localized population dynamics.

For Klamath salmon, it was noted that early ocean survival rates appear to have some general relationship to krill size, such that juvenile salmon rarely have high survivorship when krill are small as adults. The dataset also includes potential assemblage indicators, through the relative abundance of species with warm or cool water affinities.

In discussion, the SSC-ES asked about the spatial representativeness of the index, and the extent to which this indicator is localized or reflects larger scale trends. The proponents suggest that the index is likely to represent the region between Cape Blanco and Cape Mendocino, and thus could be a useful indicator for Klamath River salmon, but differences in oceanography make it uncertain whether the THL index to be a robust indicator of krill demographic or abundance trends reliably beyond this region. However, Dr. Bjorkstedt noted that earlier investigations found that the THL copepod time series (which is behind several years on data processing) correlated well with the Newport Hydrographic Line (NHL), several hundred km to the North, though with important differences in composition and within-season timing. The SSC-ES suggested that more comparisons among krill surveys could be helpful to get a sense of the scale of variability in krill across the California Current Ecosystem, and some surveys that occur less frequently over broader spatial areas could also inform this scale.

The subcommittee also discussed the extent to which mean adult size is the most appropriate indicator, or whether the addition of or shift to a biomass based indicator could be more appropriate or informative. The potential benefits of combining or adding biomass to length, or adding assemblage-based indicators was discussed, recognizing that the precise mix of indicators to report would depend on how the indicators would be used or intended to represent. The SSC-ES suggested greater development of both biomass and size indicators for future CCIEA reports. The potential for "growth products" (e.g., indicators of individual growth rates) was discussed, as were indicators related to shifts in the distribution of mass.

The subcommittee recognized all of these products as helpful indicators of key ecosystem processes in this region but was uncertain regarding just how to integrate the results into informing management in a useful manner. The potential for helping to inform early marine survival indicators for Klamath salmon was discussed, although it was noted that the current assessment model for salmon fisheries is based on sibling regressions, which reflect information obtained after fish have gone through the presumably more variable initial marine survival phase. However, it could be that an indicator could provide an extra year or more of lead time, which could be helpful given that Klamath River Fall Chinook are currently under a rebuilding plan. Additionally, forage indicators also reflect the conditions that 2, 3, and 4 year old fish are facing in the ocean, and thus krill (or krill predators) could still be affecting later maturation and mortality rates in Klamath salmon. Moreover, as river returns are observed with error, modeling approaches (such as state-space models) that forecast based on multiple indicators of cohort strength could be more robust than univariate approaches that ignore uncertainty. Finally, the SSC-ES suggested that the size-based indicator or other indicators could be useful in the Klamath River stoplight table.

C. Year Class Strength and Distribution of Small Groundfish

Dr. Nick Tolimieri (NOAA, Northwest Fisheries Science Center) presented an analysis of juvenile groundfish habitat and abundance proposed for inclusion in a future CCIEA report. A recent publication was the basis of the presentation (Tolimieri et al., 2021). The motivation for the work is to inform Essential Fish Habitat for juvenile groundfish and identify important nursery areas. This research could also potentially lead to an index of recruitment for some species.

The analysis used lengths and abundance for 13 species from the West Coast Bottom Trawl Survey. The survey ages a subsample of fish. To estimate age for the measured but unaged fish, length was converted to age using a fixed age-length key for each species. For some species, there were not enough individuals in the smallest age-class (age-0 or age-1), age classes were combined (grouped) for the analysis. In

discussion, the SSC-ES suggested that for species with sufficient data, a year-specific age-length key would better account for variability in growth.

Abundance was standardized using the Vector Autoregressive Spatio-temporal (VAST) package, assuming a common intercept across years and spatial variation was explained by spatial and spatiotemporal autocorrelation. The SSC-ES suggests further investigation of the variance surfaces (in addition to abundance) to better understand how the assumption of a common intercept might be affecting the results. For example, a comparison could be done by fitting a temporal model without the spatial field. The SSC-ES caution against extrapolating into areas that have particularly high variance. Investigating alternative approaches to VAST (e.g., sdmTMB) may also allow for more flexibility in the fixed spatial field.

The resulting juvenile spatial distributions were qualitatively categorized as: distinct hotspots (dover sole, shortspine thornyhead, splitnose), distinct hotspots that were temporally variable (hake, darkblotched rockfish), large distinct areas of high juvenile abundance (arrowtooth flounder, English sole, sablefish), and limited latitudinal distributions but no obvious hotspots (Pacific grenadier, lingcod, longspine thornyhead, petrale sole). The SSC-ES agreed that these spatial distributions are a useful starting point for defining juvenile habitat groundfish habitat. Due to multiple distinct patterns, the SSC-ES recommends continuing to focus on species-specific distributions and cautions against combining species into a single juvenile groundfish distribution map.

Validation of the juvenile abundance indices was explored by comparing against the recruitment deviations from the stock assessment model for sablefish, arrowtooth flounder, lingcod, and hake. Only sablefish appeared to have strong agreement. However, the SSC-ES noted in discussion that there are many reasons the two indices may not align, including the structure and assumptions of the assessment model. Therefore, it should not be assumed that the assessment recruitment deviations represent a "true" recruitment index.

The SSC-ES was asked to provide guidance on additional species that could be investigated with this approach and offers the following suggestions:

- Choose species that are well-sampled by the survey. Flatfish are likely good candidates
- Consider using survey selectivity estimated in the assessment models to guide size cut-offs. Assessments typically do not use length at age at very small sizes because they are not well sampled by the trawl
- Avoid applying this method to species that are rock-associated, particularly with the VAST approach. These likely include widow rockfish, darkblotched rockfish, shortbelly rockfish, and possibly chilipepper rockfish.
- Prioritize species that are important to fisheries

The SSC-ES discussed with the CCIEA team how to include this analysis into future CCIEA reports. The SSC-ES suggests the analysts consider developing indices representing temporal and/or spatial stability. This would condense the distribution maps into annual anomalies in hotpots or area and distribution of juvenile habitat, for example. The SSC-ES suggests that a future application of this work could be to use

robust juvenile abundance indices to inform management between assessments, such as through assessment prioritization scoring, scientific uncertainty buffers, or other approaches.

D. Port-level Linkages Between Fisheries using Network Analysis

Dr. Jameal Samhouri (NOAA, Northwest Fisheries Science Center) provided an overview of the network analysis approach that has been developed to describe West Coast port groups. An initial set of network diagrams was included in the 2021 CCIEA report. The methods have since been revised and additional work was done in response to feedback following a presentation to the SSC-ES in January 2021 and the SSC in March. In addition to a PowerPoint provided at the SSC-ES meeting, Dr. Samhouri provided the SSC-ES with two publications (Fuller et al. 2017; Fisher et al. 2021) that use similar methods.

Dr. Samhouri presented a number of different networks that were responsive to suggestions made by the SSC-ES in January including:

(1) vessel-level networks with scaling of nodes based on the median proportion of revenue a fishery contributes to vessels in that fishery, alternative minimum revenue thresholds for determining which vessels to include, and different methods of determining edge weights based on the amount and evenness of revenue, or the number of vessels, associated with each fishery pair;

(2) aggregate port-level and state-level networks with fisheries node inclusion determined by a minimum proportion of port or state revenue and node scaling based on relative total revenue; and

(3) time series of vessel-level network diagrams for two ports showing how networks have changed between 2004 and 2019.

Dr. Samhouri discussed work published in Fisher et al. 2021, illustrating how network characteristics of edge density, centrality and modularity influence the response of participants in a network to a shock. The example focused on HAB-related crab closures in California and suggests that fishers in denser networks are more likely to move to other fisheries while those in less dense networks are more likely to cease fishing. The analysis also shows that for centralized networks impacts vary depending on the centrality of the fishery subject to a shock.

The SSC-ES appreciates the responsiveness of the analysts to its comments and suggestions and finds the new analyses and network diagrams useful. The networks provide a visual description of the fisheries/species groups of importance to particular port groups and the degree to which they are connected by cross-participation and movement of fishers between them. Fisheries are defined by the same species groupings used in the diversification indices in the annual CCIEA report (rather than by métier as was done in the earlier work by Fuller et al. 2017). The network diagrams complement the diversification indices by providing information about the characteristics of fishery diversification strategies and how they vary across ports.

The network analysis has the potential to contribute to our understanding of how shocks to fisheries may impact particular communities (defined by port group) and potentially reverberate across fisheries. This may be apparent to some degree from simply viewing the network diagram, but quantitative network metrics may provide additional insight into overall stability of networks, and potentially resilience or vulnerability of fishers in a port to shocks to fisheries. These metrics include edge density, centrality, and

modularity. Of these, edge density appears to have the clearest relationship to resilience. Networks with high edge density suggest that fishers have greater ability to move effort between fisheries and thus substitute for lost revenue from a fishery that is closed or has a poor year. The effects of centrality and modularity of networks appears to be very context dependent. For example, if the central fishery is closed in a network with high centrality, the impact would be great while it would be small if a non-central fishery was closed. Networks with high modularity would have increased impacts within a module but less outside it. More analysis will be needed to get a better general sense of how and when centrality and modularity mediate impacts of fishery shocks and affect the resilience of fishing communities.

There was some confusion about the scaling of the nodes in the network diagrams that was clarified after the meeting. The scaling of nodes for the vessel level network is based on the median percent of individual vessels' revenue that the fishery contributed to the fishers that participated in it. The node is large if the fishery provides a large proportion of individuals' revenue to at least half of the fishers involved in that fishery. Even a fishery that contributes a relatively small share of revenue at the port level might be shown as a large node. For example, in the 2019 crab year (Nov 2019-Oct 2020) tuna in Astoria only contributed about 2% of total revenue as compared to 15% for non-DTS groundfish but it had a node similar in size to crab which contributed 33% while non-DTS groundfish had a small node. This approach to node scaling has the advantage of showing relative importance of each fishery to those who fish in it, but it does not necessarily reflect the overall importance of the fishery to the port. If this approach to scaling nodes is used, it needs to be clearly explained, or it may lead to confusion. It would be useful to provide some supplementary information about port level revenue such as a pie chart showing the proportion each fishery contributes to port revenue. In contrast, for the aggregate port or state networks, both fishery inclusion and node scaling are based on the proportion of revenue the fishery contributes to the port or state's total revenue. This approach highlights fisheries that contribute a large proportion of total revenue yet it may exclude fisheries that are very important to a subset of fishers. Both approaches have strengths and weaknesses and the SSC-ES sees merit in both. Whichever approach is used, the methods used for fishery inclusion, scaling of nodes, and defining edge weights should be clearly explained.

The SSC-ES is supportive of including port-level network analyses in future CCIEA reports. The following observations and comments arose in discussion and may be helpful to the analysts in preparing future network analyses:

- It should be made clear in any publications and presentations that the analysis reflects revenue by "crab years" (Nov-Oct) as opposed to calendar years for all fisheries.
- Node size and edge weights are comparable within ports but not across ports. While Dr. Samhouri noted that this could be changed to allow comparison across ports, it could be problematic to do so given large differences in absolute revenue and fleet sizes for different fisheries in different ports.
- In contrast to edge weights based only on the number of vessels in fishery pairs, revenue connectivity edges have edge weights that are higher when revenue is higher but also more evenly distributed between the nodes. This may provide more insight into what will happen when a shock happens to one or the other (e.g., more impacts are likely if revenue is more evenly distributed than if one node dominates). While more complex than edges based on the number of vessels, this may be more useful for understanding impacts of shocks. The analysis of network metrics (modularity and centrality) has been based on the revenue connectivity definition and may be less applicable when edges are based on vessel numbers only.
- For the aggregate port level diagrams Dr. Samhouri showed on slide 19, the scaling of nodes was based on the ratio of port revenue for that fishery relative to the revenue from the fishery with the highest revenue for that port. It was discovered after the meeting that there was an error in the

diagram for Fort Bragg caused by one tuna fish ticket that had a misplaced decimal point. Tuna should not have had a large node in that diagram and other fisheries should have been included.

- For aggregate level networks, the 10% of total port revenue cut-off results in very few fisheries for some ports. An alternative might be a cut-off based on absolute revenue (e.g., over $100K) or a smaller percent of revenue. Supplementary diagrams at the end of the PowerPoint showed aggregate networks including fisheries that includes at least 5% of revenue which substantially increased the numbers of fisheries included. This lower cut-off might be preferable for aggregate networks.
- For Washington fish tickets reported Port may mean different things for groundfish, salmon and shellfish and this should be checked.
- It was suggested that it would be worth considering the vulnerability of the species themselves and tying that to the vulnerability of the networks (e.g., in a network with mostly species impacted by upwelling will be more vulnerable than one that has species that are not impacted by upwelling.
- It was suggested that it might be useful to go back before 2004 for time series analysis and to combine groups of years and look at changes over longer time periods or networks.
- Most of the SSC-ES members that commented found vessel level analysis more useful than the aggregate port-level analysis. The aggregate networks did not provide substantial information that could not be provided with a simple bar chart of share of revenue by fishery for each port. However, the SSC-ES assumed at the time that node scaling for vessel level networks already reflected the relative proportion of port revenue, which it did not.
- It was suggested that a network analysis could provide insight on community impacts when developing a groundfish rebuilding plan that largely affects a portion of the fishery. Doing so might require different exclusion criteria to focus the network on the groundfish fishery similar to the approach used by Fisher et al. (2021) for crab.

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Appendix A. Meeting Participants

SSC Ecosystem Subcommittee Members Present

Dr. Kristin Marshall (Subcommittee Chair), National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. John Field, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Marisol Garcia-Reyes, Farallon Institute, Petaluma, CA
Dr. Michael Harte, Oregon State University, Corvallis, OR
Dr. Dan Holland, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Galen Johnson, SSC Chair, Northwest Indian Fisheries Commission, Olympia, WA
Dr. André Punt, University of Washington, Seattle, WA
Dr. William Satterthwaite, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Ole Shelton, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Cameron Speir, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA

CCIEA Team Members Present

Dr. Eric Bjorkstedt, National Marine Fisheries Service Southwest Fisheries Science Center, La Jolla, CA
Dr. Toby Garfield, National Marine Fisheries Service Southwest Fisheries Science Center, La Jolla, CA
Dr. Chris Harvey, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Ms. Roxanne Robertson, Humboldt State University, Arcata, CA
Dr. Jameal Samhouri, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Jarrod Santora, National Marine Fisheries Service Southwest Fisheries Science Center, La Jolla, CA
Dr. Nick Tolimieri, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA

Others Present

Mr. Kelly Andrews, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Ms. Marlene Bellman, Northwest Indian Fisheries Commission, Olympia, WA
Ms. Anna Bolm, Oregon State University, Corvallis, OR
Mr. Alan Byrne, Idaho Department of Fish and Game, Boise, ID
Mr. Jon Carey, National Marine Fisheries Service West Coast Region, Lacey, WA
Ms. Susan Chambers, West Coast Seafood Processors Association, Charleston, OR
Dr. Kit Dahl, Pacific Fishery Management Council, Portland, OR
Mr. John DeVore, Pacific Fishery Management Council, Portland, OR
Dr. Jeff Dorman, Farallon Institute, Petaluma, CA
Dr. Michael Drexler, Ocean Conservancy, St. Petersburg, FL
Ms. Robin Ehlke, Pacific Fishery Management Council, Portland, OR
Ms. Jennifer Fisher, National Marine Fisheries Service Northwest Fisheries Science Center, Newport, OR
Mr. Craig Foster, Oregon Department of Fish and Wildlife, Clackamas, OR
Dr. Tommy Garrison, Columbia River Inter-Tribal Fish Commission, Portland, OR
Ms. Grace Ghrist, California Department of Fish and Wildlife, Santa Rosa, CA
Dr. Owen Hamel, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Ms. Ashton Harp, Northwest Indian Fisheries Commission, Forks, WA
Mr. Brian Hoffman, Hoh Indian Tribe, Port Angeles, WA
Dr. Diego Holmgren, Tulalip Tribe, Everett, WA
Ms. Helen Killeen, University of California, Davis, CA

Ms. Gway Kirchner, The Nature Conservancy, Newport, OR
Mr. Hap Leon, Makah Tribe, Neah Bay, WA
Dr. Laura Lilly, Scripps Institution of Oceanography, La Jolla, CA
Mr. Pete McHugh, California Department of Fish and Wildlife, Santa Rosa, CA
Dr. Oliver Miler, Northwest Indian Fisheries Commission, Olympia, WA
Ms. Rebecca Miller, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Tommy Moore, Northwest Indian Fisheries Commission, Olympia, WA
Ms. Kandice Morgenstern, California Department of Fish and Wildlife, Santa Rosa, CA
Mr. Corey Niles, Washington Department of Fish and Wildlife, Olympia, WA
Dr. Michael O'Farrell, National Marine Fisheries Service Southwest Fisheries Science Center, Santa Cruz, CA
Dr. Kiva Oken, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Ms. Tiffany Petersen, Makah Tribe, Neah Bay, WA
Ms. Corey Ridings, Ocean Conservancy, Santa Cruz, CA
Ms. Michele Robinson, Oceanbeat Consulting, Olympia, WA
Mr. Gordon Rose, Northwest Indian Fisheries Commission, Olympia, WA
Ms. Mindy Rowse, National Marine Fisheries Service Northwest Fisheries Science Center, Seattle, WA
Dr. Jason Schaffler, Muckleshoot Indian Tribe, Auburn, WA
Dr. Casey Schmidt, Suquamish Tribe, Bainbridge Island, WA
Ms. Kate Self, Columbia River Inter-Tribal Fish Commission, Portland, OR
Mr. Jeremiah Shrovnal, Washington Department of Fish and Wildlife, Olympia, WA
Dr. Julie Thayer, Farallon Institute, Petaluma, CA
Dr. Theresa Tsou, Washington Department of Fish and Wildlife, Olympia, WA
Mr. Kyle Van de Graaf, Washington Department of Fish and Wildlife, Olympia, WA
Ms. Lynn Langford Walton, All Gear Group, Centralia, WA
Mr. Verner Wilson, Friends of the Earth, Seattle, WA

3. Fishery Ecosystem Plan Initiatives

The Scientific and Statistical Committee (SSC) received a presentation from Dr. Kit Dahl (PFMC Staff) on the Fishery Ecosystem Plan (FEP) Initiatives and draft updates to the FEP appendix proposed by the Ecosystem Workgroup (EWG). The SSC reviewed the nine proposed FEP initiatives and provided comments. The SSC is generally supportive of the appendix and commends the EWG on their work thus far on the revised FEP.

Proposed initiative 2.1, Ecosystem and Climate Information for Species, Fisheries, and Fishery Management Plans (FMPs), is a particularly promising direction for future work. Previous initiatives and the California Current Integrated Ecosystem Assessment (CCIEA) program and annual report have generated a large amount of ecosystem and climate information. However, more focus on how to make use of this information when considering specific management actions is needed. Proposed initiative 2.1 offers an opportunity to develop pathways and processes to do this. The SSC notes that the incorporation of ecosystem information in decision making is a long-term goal and this initiative should be considered a first step in a longer process.

The work described in proposed initiative 2.2, Science Policy and Planning for Understanding the Effects of Oceanographic Conditions and Recruitment on Council-Managed Finfish Species, may

be better conducted once better oceanographic models and data sources are available. For example, the ongoing National Oceanic and Atmospheric Administration's Climate and Fisheries Initiative should produce operational ocean models that would be useful for modeling fish populations on the West Coast.

Proposed initiative 2.6., Supporting Fishery and Fishing Community Resilience Initiative, may be an extension of the work completed during the Climate and Communities Initiative rather than a new initiative. The SSC also notes that there is ongoing work at the Northwest and Southwest Fisheries Science Centers validating resilience indicators and evaluating resilience of West Coast fishing communities. Some elements of initiative 2.6 may duplicate this work.

Proposed initiative 2.8, Assess Flexibility in Fisheries Management Process Initiative, would work to identify ways to increase "flexibility" in how the Council makes decisions, under the assumption that the ability to change regulations more quickly is unambiguously good. However, work on this initiative should also consider ways in which this flexibility may have negative as well as positive effects on fishery stakeholders. Reducing the time it takes to complete the regulatory process may reduce opportunities for public participation in the Council process. More frequent changes in regulations may also reduce operators' ability to plan for future conditions and reduce the ability to buffer against uncertainty.

Work on proposed initiative 2.4, Cross-FMP Essential Fish Habit (EFH) Initiative, may be more productive once EFH has been defined for individual species within each FMP and is therefore a low priority relative to other proposed initiatives.

SSC Notes:

The CCIEA has proposed a broad strategic review of salmon indicators for review by the SSCES in September. The goal of this review is to determine how best to present the salmon indicators in the annual report to stakeholders and to potentially use them in management. This is similar to the goals of 2.1 and indicates some broad interest in this type of work.

One aspect to consider in initiative 2.1 is whether releasing the CCIEA report in March is the best time for applying that information to management.

Tracking FEP goals and progress as in Proposed initiative 2.7, Developing Indicators to Assess Progress Towards FEP Goals and Objectives Initiative, would be beneficial. This exercise would provide some structure to the larger process.

C. Administrative Matters, Continued

7. Future Council Meeting Agenda and Workload Planning

The Scientific and Statistical Committee (SSC) discussed workload planning and has the following updates to our November 2021 statement under this agenda item.

The SSC recommends two meetings to discuss proposed changes to two separate Stock Assessment Terms of Reference (TOR) for Groundfish and Coastal Pelagic Species (CPS). The

SSC Groundfish Subcommittee proposes to meet via webinar in April to discuss the Groundfish TOR and the SSC CPS Subcommittee proposes to meet via webinar in April or early May to discuss development of the CPS TOR. Members of the Groundfish and CPS management teams and advisory subpanels are encouraged to participate in these meetings. The revisions to the TOR for groundfish stock assessments is scheduled for final review by the Council in June 2022, while review of the CPS TOR is slated for initial review in June and final review in November.

The 7th National Meeting of the Scientific Coordination Subcommittee of the Council Coordination Committee (SCS7) is scheduled for August 15-17 in Sitka, Alaska. The meeting will generally explore fishery management adaptations to a changing climate. Dr. André Punt has been invited to be a keynote speaker and other SSC members anticipated to attend include Drs. Kristin Marshall, Melissa Haltuch, Galen Johnson, Theresa Tsou, and possibly Dan Holland. The SSC will keep the Council apprised of the plans for the SCS7 meeting as they are decided.

The SSC recommends continuing to convene the annual SSC Ecosystem Subcommittee meeting with the California Current Integrated Ecosystem Assessment (IEA) team to review additions to the IEA report in September. The SSC also recommends inviting the SSC Salmon Subcommittee, Salmon Technical Team, and Salmon Advisory Subpanel to the September SSC Ecosystem Subcommittee meeting since one of the recommended topics is specifically relevant to salmon management. The salmon topic could be scheduled in the afternoon so that those attending for that topic need only attend a half day.

The SSC recommends holding the annual Salmon Methodology Review in mid-October.

The SSC Groundfish Subcommittee is planning a number of additional meetings and workshops over the next several months. The SSC Groundfish Subcommittee is planning a workshop to discuss alternative harvest control rules for spiny dogfish to reflect its lower productivity and the finding from the most recent assessment that the spawning potential ratio 50 percent harvest rate may not be sustainable. Dates for that workshop are yet to be determined.

The SSC Groundfish Subcommittee is planning to meet in late June or early July to review the Template Model Builder implementation of a species distribution model to generate biomass indices along with a workshop on the treatment of indices for hook-and-line survey data. In order to accommodate Washington Department of Fish and Wildlife (WDFW) field work schedules, WDFW hook-and-line survey data and index development will be discussed at a subsequent fall meeting. The fall meeting will build on the recommendations from the early summer meeting. Pairing the Template Model Builder methodology review with the hook-and-line data and index development workshops will reduce the number of meetings and reports and provide time for proponents to work on requests while other topics are discussed.

The SSC Groundfish Subcommittee proposes a planning meeting in late July or early August to coordinate aging prioritization and catch estimation to inform the groundfish stock assessments prioritized for review in 2023.

The SSC Groundfish Subcommittee proposes conducting a workshop in late August to explore approaches for modeling large closed areas and other regulation changes in upcoming groundfish stock assessments.

The SSC Groundfish Subcommittee recommends a meeting in late September to discuss the integration of remotely operated vehicle (ROV) survey data in assessments and to review Oregon Department of Fish and Wildlife's proposed acoustic/ROV survey methodology for semi-pelagic rockfish, with the participation of a Center of Independent Experts scientist on acoustic abundance estimation methods. The outcomes of the three aforementioned methodology review and workshop meetings will inform the groundfish stock assessment accepted practices.

SSC Notes:

From the SSC's November C.10 workload planning report: The SSC supports the idea of the Council engaging with the Climate Change Adaptation Tools for California Current Fisheries project presented by Dr. Piers Chapman under open comment (Agenda Item B.1.b, Supplemental Public Presentation 1). Members of the SSC Ecosystem Subcommittee could attend meetings or workshops with the research team in order to support the development of their decision support tools at the request of the Council.

Dr. Martin Dorn might be a good person to invite for the Proposed Workshop to Develop Alternative Harvest Control Rules for Spiny Dogfish.

Proposed Workshops and SSC Subcommittee Meetings for 2022							
Workshop/Meeting		**Potential Dates**	**Sponsor/ Tentative Location**	**SSC Reps.**	**Additional Reviewers**	**AB Reps.**	**Council Staff**
1	GFSC Meeting to Review Proposed Changes to the TORs	April TBD	Council/Webinar	Groundfish Subcommittee Members	Science Center Assessment Staff	GMT GAP	DeVore
2	CPSSC Meeting to Review Proposed Changes to the TORs	April/early May TBD	Council/Webinar	CPS Subcommittee Members	Science Center Assessment Staff	CPSMT CPSAS	Doerpinghaus
3	Proposed Workshop to Develop Alternative Harvest Control Rules for Spiny Dogfish	TBD	Council/Webinar	Groundfish Subcommittee Members	TBD	GMT GAP	DeVore
4	Proposed Workshop to Develop Methods for Constructing Abundance Indices Based on Hook-and-line Surveys/ sdmTMB Model Review	late June/early July TBD	Council/Webinar	Groundfish Subcommittee Members	TBD	GMT GAP	DeVore
5	Aging Prioritization and Catch Estimation Meeting for 2023 Stock Assessments	late July/Aug TBD	Council/Webinar	Groundfish Subcommittee Members	NA	GMT GAP	DeVore

6	Proposed Groundfish Subcommittee Meeting to Explore Approaches to Deal with Large Closed Areas and Other Regulation Changes in Stock Assessments	late Aug TBD	Council/TBD	Groundfish Subcommittee Members (Budrick - chair)	TBD	GMT GAP	DeVore
7	7th National Meeting of the Scientific Coordination Subcommittee of the Council Coordination Committee	Aug 15-17, 2022	NPFMC/ Sitka, AK	Punt, Marshall, Haltuch, Holland?, Johnson, Tsou	NA	NA	DeVore
8	Proposed Workshop to Develop Methods for Constructing Abundance Indices Based on WA Hook-and-line Surveys	Fall TBD	Council/TBD	Groundfish Subcommittee Members (Hamel & Haltuch - co-chairs)	TBD	GMT GAP	DeVore
9	Proposed Methodology Review for the ODFW Acoustic/ROV Survey and Workshop for Using ROV Data in Stock Assessments	Sept 26-30, 2022	Council/Portland	Groundfish Subcommittee Members (Budrick - chair)	CIE for ROV and Acoustics	GMT GAP	DeVore
10	Ecosystem Subcommittee/CCIEA Team Meeting	Sept 2022 TBD	Council/Boise	Ecosystem Subcommittee Members	CCIEA Team	EWG EAS STT SAS	DeVore Dahl Ehlke
11	Salmon Methodology Review	Oct 2022 TBD	Council/TBD	Salmon Subcommittee Members	TBD	STT MEW	Ehlke

SSC Subcommittee Assignments

Salmon	Groundfish	Coastal Pelagic Species	Highly Migratory Species	Economics	Ecosystem-Based Management
Alan Byrne	**John Budrick**	**André Punt**	**John Field**	**Cameron Speir**	**Kristin Marshall**
John Budrick	Fabio Caltabellotta	John Budrick	Fabio Caltabellotta	Dan Holland	John Field
Owen Hamel	John Field	Alan Byrne	Dan Holland	André Punt	Melissa Haltuch
Galen Johnson	Melissa Haltuch	John Field	Kristin Marshall		Dan Holland
Steve Munch	Owen Hamel	Owen Hamel	André Punt		Galen Johnson
Will Satterthwaite	Kristin Marshall	Steve Munch			André Punt
Jason Schaffler	André Punt	Will Satterthwaite			Will Satterthwaite
Ole Shelton	Jason Schaffler	Tien-Shui Tsou			Ole Shelton
Cameron Speir	Tien-Shui Tsou				Cameron Speir
Tien-Shui Tsou					

Bold denotes Subcommittee Chairperson

PFMC
03/18/22