Scientific and Statistical Committee's Ecosystem-Based Management Subcommittee Report

Pacific Fishery Management Council
Online Meeting

August 5, 2024

The Scientific and Statistical Committee's Ecosystem-Based Management Subcommittee (SSC-ES) met via webinar August 5, 2024 to review the California Current Integrated Ecosystem Assessment (CCIEA) Team's draft report on Fishery Ecosystem Plan (FEP) Initiative 4 (hereafter "the report"), prepared in response to a request from the Pacific Fishery Management Council (PFMC) in March 2024 that directed the Ecosystem Workgroup (EWG) to work with National Marine Fisheries Service Science Center staff to further develop the methodological framework for risk tables and apply it to groundfish. The report also responds to previous SSC feedback from November 2023 on the development of risk tables for use by the PFMC. Kristin Marshall chaired the meeting and subcommittee participants are listed in Appendix A.

A. Further development of risk tables and their application to groundfish in support of FEP Initiative 4

Background, revised evaluation rubric, and updated sablefish and petrale sole tables

Mary Hunsicker and Jameal Samhouri (Northwest Fisheries Science Center, NWFSC) presented an overview of the report, including background on the initiative, a discussion of the potential pathways for translating risk tables into management advice, revised evaluation rubric, and updates to the sablefish and petrale sole risk tables.

In the September 2023 SSC-ES/Groundfish Subcommittee (GFSC) meeting, four potential pathways were recommended for incorporating risk tables into the setting of groundfish Acceptable Biological Catch (ABC): 1) the selection of scientific uncertainty (sigma) by the SSC when an assessment is conducted; 2) the selection of the risk policy (P*) set by the Council; 3) the setting of either/both sigma or P* in between new stock assessments (e.g., the time-varying penalty on sigma); or (4) developing a different process for the SSC to set the ABC directly and using the risk table to inform that decision. The report explores how the risk tables could be applied to pathways 1-3, and recommends moving forward with pathway 1. The report proposes that risk tables could modify the table in Appendix D from the Terms of Reference (TOR) for the groundfish stock assessment review process to provide an extended set of criteria for the SSC to select from a wider array of potential values of sigma and allows for multiple directions of change, including recommended increases, decreases, or no change in sigma. The SSC-ES agrees that adjusting sigma would likely be the most straightforward approach in the near term, but recommends that all pathways continue to be considered by the PFMC.

Some concern has been expressed that the proposed process of adjusting sigma or P* does not create much ability to increase ABCs for category 1 stock assessments such that the use of risk tables will generally tend to create more conservative harvest specifications. It was noted, however, that this is a consequence of the Council's tendency to use high P* (which limits the ability to reduce buffers in favorable situations) in combination with the MSA's prohibition on exceeding the overfishing limit (OFL) and not a fault of the risk table framework. A recent review of harvest control rules and ABC buffers used by the U.S. Fishery Management Councils compares

buffers across regions (Free et al. 2023). It would be useful to explore, and note in the CCIEA team's report, where the PFMC falls relative to the risk tolerance of other Councils.

The SSC-ES discussed bias, precision (or uncertainty), and the imperfect match between risk tables as applied in the North Pacific Fishery Management Council and the PFMC's P*/sigma process. Incorporating the effects of unmodeled ecosystem factors via sigma implies that there might be some unaccounted for bias in the assessment, whereas sigma is intended to measure only precision. The SSC-ES recommends that when a risk table suggests bias in the assessment model, this bias should be addressed in the next assessment. In its 2023 report, the SSC-ES made a similar recommendation, noting that the risk tables could be a method for identifying new information that could be used in future assessments.

The CCIEA Team's report recommends changing the name of the tables to reflect their renewed focus on scientific uncertainty rather than risk (with a suggested name of Climate and Ecosystem Adaptive Scientific Uncertainty Buffers [CEASUB] tables). CEASUB tables redefine the two categories (columns) of the tables related to stock assessments and reduce the number of levels (rows) from four to three. The redefined stock assessment categories ('Assessment data inputs' and 'Assessment model fits and structural uncertainty') better reflect the data used in the assessment models and how well the model fits the data. The reduction in the number of levels in the tables is intended to reduce the complexity of synthesizing the qualitative ratings for each of the categories and to reflect "favorable", "neutral", and "unfavorable" conditions. For each of the categories, the report provides an updated rubric to help determine the appropriate level designation. The SSC-ES supports these changes.

The report includes a retrospective analysis demonstrating how a CEASUB table could have affected the harvest specifications from the 2023 assessments for sablefish and petrale sole. These updated tables only used data that would have been available at the time of the stock assessments. For sablefish, ecosystem and environmental conditions were neutral (Level 2) and the data inputs and assessment model fit categories were unfavorable (Level 3). For petrale sole, all three categories were favorable (Level 1).

The SSC-ES did not fully support the risk levels chosen for the assessment-related columns for sablefish. The sablefish data and model fit categories were both designated Level 3, which the SSC-ES questioned because stock assessments for sablefish are typically one of the most data- and information-rich. However, the 2023 model does not use length data, so the lack of available age data for the most recent two years means that the model has no compositional data informing it over that period. That may provide sufficient evidence for a Level 3 designation in the assessment data inputs category or in the structural uncertainty category, but not both. Discussions with the CCIEA Team during the meeting highlighted some of the challenges in designating levels and reinforced the role for review in the development of future CEASUB tables. The SSC-ES supported the report's recommendation to leave the process of combining the risk table category scores to the discretion of the SSC (and GFSC/stock assessment review [STAR] panels) during their determination of sigma without using a strictly formulaic approach, although concerns were raised that without a defined methodology the process would rely on expert judgment and may be less repeatable.

Worked retrospective examples of groundfish harvest specifications

Abigail Golden (NWFSC) presented a retrospective analysis included in the draft report showing how the proposed tables would affect buffers between OFLs and ABCs in general and how they

would have affected harvest specifications (annual catch limits [ACLs]) resulting from 2023 assessments for sablefish and petrale sole. An analysis of how ACLs for a category 2 assessment (shortspine thornyhead) would have been impacted by changes to sigma and P* was also included, but without an associated risk table evaluation and resulting recommendations for sigma. These analyses focus on changes to buffers and ACLs that would have been associated with changes to sigma or P* over ranges of sigma from 0.25 to 0.75 for sablefish and petrale sole, 0.75 to 1.5 for shortspine thornyhead, and P* from 0.25 to 0.50. The sablefish risk table led to a recommendation to increase the sigma from the default of 0.5 to 0.75 with a P* to 0.45, which would reduce the 2025 ACL from 36,545 mt to 35,333 mt. For later years, ACLs would be reduced more relative to the OFLs for those years as the higher sigma is used to calculate time-varying buffers. In contrast, the table constructed for petrale sole led to a recommendation to reduce sigma from 0.5 to 0.25 with a P* of 0.45, which would increase in the ACL from 2,403 mt to 2,485 mt.

The SSC-ES finds the retrospective analysis useful in illustrating how risk tables would be applied and how they would affect groundfish harvest specifications. The calculations and figures appear to be correct and the retrospective analysis is an accurate representation of how harvest specifications would have been impacted. It is important, however, to note that changes in catch specifications for earlier years will change the OFLs for later years. The latter effect can be seen in Figures 4 and 5, but not Figure 2; although in all of these figures the analysts should consider re-scaling the y axis to start at zero. The SSC-ES is not expressing concurrence with the overall risk or uncertainty recommendation or specific adjustments to sigma and ABCs that were shown, but the analysis effectively illustrates how the process could have been applied.

The analyses presented here assumed full attainment of ACLs. In cases where there is substantial under-attainment of ACLs and catch-only projections are used to update harvest specifications, OFLs may increase (or not decrease as quickly as predicted for stocks like the sablefish example in the report, where ACLs are projected to be high as the stock is fished down toward the biomass target). It was noted, however, that risk tables and buffer adjustments are less likely to get applied to stocks with low attainment, which are also less likely to get assessed.

Section 6 of the draft report discusses using risk tables to adjust ACLs while the rest of the report discusses adjusting ABCs. The report should strive for consistency in referring to either ABCs or ACLs and describe the justification for using one or the other in each of the analyses.

Proposed implementation in groundfish harvest specifications process

Kiva Oken (NWFSC) presented a proposed process from the report that would integrate the development of CEASUB tables with the existing groundfish stock assessment development and review process.

The SSC-ES agrees with the CCIEA Team's recommendation to include ecosystem scientists as part of the stock assessment teams (STATs) to: promote the identification of relevant data sources; participate in stock-specific discussions early on in the stock assessment process; and contribute to the ecosystem column of the CEASUB tables. As part of this proposal, CEASUB tables would be drafted and finalized along with stock assessments and reviewed by STAR panels. There was some discussion of reviewing CEASUB tables separately (e.g., during the November Council meeting) but the SSC-ES identified greater utility in linking the review of ecological considerations to stock assessments reviews.

The SSC-ES discussed the potential need identified in the report for prioritization to select which stocks would have CEASUB tables developed. The SSC-ES agreed that input from advisory bodies as described in the report would be helpful. If advisory bodies did not have the capacity to contribute within the time period identified, this could be done by NMFS. Factors already included in the stock assessment prioritization framework, such as attainment and life history information about the stock, may be sufficient. However, a public comment at the SSC-ES meeting urged the meeting participants to consider a broader range of factors when prioritizing species for CEASUB tables.

Recommendations for the 2025 stock assessment cycle

The SSC-ES recommends moving forward with the approach described in the report to develop a CEASUB table for selecting sigma for the sablefish benchmark assessment scheduled for 2025. At least one additional benchmark stock assessment could be identified for CEASUB table development, if appropriate data sources exist and workload allows.

There is not full agreement amongst SSC-ES members that adjustments to sigma should be limited such that they do not result in a sigma smaller (or greater) than the default sigma for the stock assessment category that is lower (or higher), though doing so might require a change to the groundfish TOR. If those limitations are accepted, a proposal was made for category 1 assessments to use the old default sigma of 0.36 (historical precedent and reflecting a lack of concern about projection uncertainty) in cases where the risk table evaluation was favorable (e.g., a score of 1) and increasing sigma to 0.75 when indications are unfavorable (e.g., score of 3). This would reflect the midpoint between a typical category 1 and category 2 sigma. A favorable evaluation of a category 2 assessment would result in reducing sigma to 0.75, thereby converging with the sigma chosen for an unfavorable evaluation of a category 1 assessment. Alternatively, it was suggested that sigma might be adjusted to ⅓ of the difference between the default and the next category default (e.g., 0.67 for unfavorable category 1 and 0.83 for favorable category 2). The SSC-ES did not make a specific recommendation on this and recommends the full SSC take this up in September 2024. An amendment to the groundfish TOR for 2025 stock assessments may be needed to document any recommendations of the full SSC and adopted by the Council.

If the SSC is unable to use a CEASUB table to select the degree of scientific uncertainty following a stock assessment in 2025, the SSC-ES sees value in the GMT using this information to make P* recommendations (pathway 2). Information in the ecosystem column of CEASUB tables could apply to sigma or P*, just not both in the same cycle to avoid double-counting of the information.

Recommendations for further developing other pathways for risk tables

The SSC-ES recommends the initial use of CEASUB tables to set sigma when a stock assessment is adopted but encourages continued exploration of other approaches to using risk tables or other ecosystem information inputs to adjust harvest specifications, both for new assessments and for setting harvest specifications for stocks that were not assessed in the most recent cycle. In future biennia, CEASUB tables could be used to inform the rate at which sigma increases through time or change sigma (e.g., “reset the clock”) when benchmark or update assessments are unavailable but environmental or ecological conditions are favorable or unfavorable for a given stock. During the meeting, the report authors noted that adjusting the rate (or slope) of sigma could pose workload and communication challenges, and that the same result could be achieved by manually

adjusting sigma up or down (i.e., resetting sigma to the desired value based on the risk table). The SSC-ES agreed that this could be a suitable approach, and recommends revisiting in the future how/if CEASUB tables could be used to update harvest specifications by updating the environmental and ecosystem column only, without a new stock assessment.

B. Discussion on potential uses of climate and ecosystem adaptive catch advice for salmon

In March 2024, the Council tasked the EWG to work with NMFS and the appropriate advisory bodies to broaden the application of risk tables to Sacramento and Klamath River fall Chinook salmon. The SSC-ES discussed potential ways that a risk table framework could be applied to salmon management in the context of this request.

An analogous approach to using risk tables for groundfish ABC buffers could be developed for salmon management if a buffer was used in pre-season abundance forecasts. In a recent publication provided as background reading, Satterthwaite and Shelton (2023) quantify bias and accuracy of PFMC-managed Chinook and coho salmon abundance forecasts and provide a retrospective example of how bias correction and buffers would have performed for Sacramento River Fall Chinook (SRFC).

The SSC-ES discussed the potential applicability of a P*/sigma approach for salmon management. Unlike the groundfish and coastal pelagic species (CPS) management processes, uncertainty associated with salmon forecast models is not quantified or communicated within the PFMC process. Some aspects of salmon biology and harvest management make managing those stocks different than other Council-managed stocks, so it may not be a direct translation to use the same P*/sigma process used in other FMPs. However, if that approach was taken, then a risk table framework could also be used to incorporate environmental and ecosystem conditions into the decision-making process. More fundamentally, the SSC-ES recommends improving the documentation of salmon forecasts and quantifying and accounting for the substantial uncertainty associated with abundance forecasts as described in Satterthwaite and Shelton (2023) into salmon management.

The SSC-ES also discussed the potential to incorporate more environmental indicators into salmon management by including them as covariates to abundance forecast models. In a groundfish context, the SSC-ES previously recommended considering a risk table framework as a way to identify environmental indicators that could be explored in future stock assessment cycles. The Habitat Committee suggested building a risk table framework for salmon by working from existing stop light tables for these two stocks. The SSC-ES agrees this would be a useful way forward and notes that the first step would be to ensure pre-season abundance forecast models have formal documentation. Meeting participants discussed that while explorations of incorporating environmental indicators in the SRFC forecast model a decade ago did not lead to the inclusion of those covariates, there would be value in revisiting those analyses in light of new data, poor recent performance of the adopted model, availability of recently-developed indicators based on refined mechanistic hypotheses, and advancing scientific practices for evaluating forecast performance in light of non-stationarity.

Another potential pathway to incorporate environmental and ecosystem conditions into salmon management discussed by the SSC-ES is to use environmental conditions in the determination of year-specific escapement goals. This path is less straightforward and requires further consideration in the context of the goals of salmon management. For example, anticipated poor river conditions might lead to a lower escapement goal due to minimal increases in production at higher escapement

or concern about heightened density-dependent effects, or might argue for a higher escapement goal to minimize the risks posed by very low recruitment.

References

Free, C.M., Mangin, T., Wiedenmann, J., Smith, C., McVeigh, H. and Gaines, S.D., 2023. Harvest control rules used in US federal fisheries management and implications for climate resilience. Fish and Fisheries, 24(2), pp.248-262.

Satterthwaite, W.H. and Shelton, A.O., 2023. Methods for assessing and responding to bias and uncertainty in US West Coast salmon abundance forecasts. Fisheries Research, 257, 106502.

Appendix A. SSC Subcommittee Meeting Participants

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