

SUMMARY REPORT FROM
“SALMON ECOSYSTEM INDICATORS” WORKSHOP¹

Held July 18-20, 2023, in Seattle, WA + online participants.

Overview

In the West Coast region, several groups including NOAA Fisheries, the Pacific Fishery Management Council (PFMC), and academic partners have summarized sets of ecosystem indicators into “stoplight tables” designed to rapidly convey whether ecosystem conditions are good, fair, or poor for Pacific salmon production. Indicators and stoplight tables are visible and sought-after products, but the approaches to developing and communicating these products have varied. Further, they have not consistently accounted for issues such as indicator redundancy, or for nonlinearity and non-stationarity of indicator/response relationships. These issues put constraints on applying indicators and stoplight tables for contextual information, or to support more quantitative applications as covariates in various types of models, including ecosystem-based forecasts.

The NOAA California Current Integrated Ecosystem Assessment (IEA) program hosted a 3-day workshop to bring together salmon experts who have developed, reviewed, and/or applied these tools, or are interested in applying them, in order to share and co-develop a more cohesive set of principles and practices for making them more informative, robust, interpretable, and useful. Workshop members included state and Science Center staff with IEA and salmon science expertise, as well as representatives of the PFMC’s Habitat Committee, Ecosystem Workgroup, Salmon Technical Team, and CPS Management Team. Our intent was to develop both conceptual and real-world improvements for indicators and stoplight tables related to select West Coast salmon stocks, and to make progress in developing robust ecosystem indicators and indices that can be applied to support salmon management.

The main objectives of the workshop were to:

1. Initiate supportive collaborations among scientists working with salmon indicator data
2. Develop best practices for generating salmon indicator stoplight tables
3. Propose and test conceptual and quantitative improvements to stoplight tables
4. Make workshop outputs sharable and generalizable to a wider range of salmon stocks
5. Identify ways these products can be more useful to salmon managers

Day 1 focused on getting everyone up to speed on the general issues, and included talks by Chris Harvey, Brian Burke, and Correigh Greene to outline the relevance of the topic to the PFMC, history of stoplight tables to summarize large numbers of indicators, and best practices in developing stoplight tables, respectively. During follow-up discussion, state agency representatives described ways in which they have used indicators and stoplight tables in recent years, including use of environmental covariates in some forecast models and justification for

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precautionary harvest management of California Chinook salmon fisheries. Attendees noted that stoplight tables have multiple audiences, so changes in stoplight tables addressing methodological issues should be balanced against continuing to serve audiences that have come to expect certain stoplight table formats. We then used breakout groups to brainstorm broad categories and specific suggestions for best practices for indicator and stoplight table development and application.

Presentations and discussions on Day 2 focused on statistical methodology for improving stoplight tables to overcome issues like indicator redundancy and cross-correlation, nonlinearity, non-stationarity, and the potential presence of thresholds. In addition, Correigh Greene discussed potential workflow for improving understanding of habitat indicators for California stocks, and Brian Burke outlined a simulation methodology for testing the robustness of stoplight tables to nonlinearity, nonstationarity, and cross-correlation. We also continued discussions of recommendations for best practices that could be implemented in future ecosystem status reports.

On Day 3, discussions shifted to reporting and future work, with several plenaries on salmon indicator dashboards for reporting annual changes in salmon stocks, updating of indicators for 5-year status reviews, and websites summarizing indicators for Columbia and Sacramento River systems. At the end, a group discussion focused on development of a broader suite of indicators at multiple life stages for Snake River spring/summer runs.

Workshop attendees agreed on several outcomes of the workshop. First and foremost, the entire group appreciated the stronger collaborative connections among participants which will continue in the future. In addition, the group anticipated several written and analytical products, including:

- A 5-page white paper highlighting the workshop proceedings
- Improvements to the stoplight tables in the upcoming California Current ecosystem status report, building on recommendations from the SSC-Ecosystem Subcommittee topic review in September 2022
- A NOAA technical memorandum detailing methodologies of existing stoplight charts and guidelines for new ones
- Research papers on several key findings from empirical or simulated datasets.

The workshop also pointed to several additional avenues for evaluation this fall as NMFS prepares updates to existing stoplight tables. Updates to stoplight charts are planned to be completed by the end of November in order to be potentially useful in risk assessments and upcoming reviews of assessment and management of Klamath and Sacramento River Fall Chinook stocks.