RESEARCH AND DATA NEEDS - PRELIMINARY PRIORITIES

The Scientific and Statistical Committee (SSC) provides the following preliminary research and data needs recommendations for consideration by the Pacific Fishery Management Council (Council).

The Council's priority high-level science and management challenges were adopted in November 2024 (Agenda Item D.3). Advisory body feedback was provided based on briefing book materials, including key topics associated with recent challenges. The Council also encouraged engagement between the SSC and other advisory bodies when identifying and prioritizing research and data needs.

The SSC then conducted an exercise to identify and compile preliminary research and data need recommendations which could be pursued for potential solutions under each of these challenges, including additional outreach with Council advisory bodies where possible. These preliminary recommendations provide a more concise set of research and data needs as desired under the framework for this review cycle, to more effectively communicate outcomes of the process. Items are provided below with no inherent order or implied ranking.

Science and Management Challenges

1. **Data collection**: Data collection is required to conduct stock and ecosystem assessments, evaluate policies, and support management. It is necessary to continue and expand existing data collection efforts, develop new data streams (e.g., to support indices of abundance or life history parameter estimation) and improve access to relevant databases. Community-based participatory research programs can aid in this effort.

Preliminary Research and Data Needs

- Age structures
  - Investigate and improve age estimation and age validation methods for federally-managed groundfishes and coastal pelagic species (CPS) (e.g., FT-NIRS).
  - Develop robust stock-specific sampling procedures for age structures and other biological data.
- Indices of abundance
  - Maintain complete spatial and temporal coverage of the existing shelf-slope trawl surveys to continue generation of fishery-independent indices for groundfish stock assessment models.
  - Develop a fishery-independent survey method to inform stock assessments for midwater groundfish species.
  - Explore and expand fishery-independent nearshore survey methods for CPS stocks.

    - Continue research to further improve the acoustic-trawl methods for estimating biomass and survey age and length compositions by studying the vertical distribution of CPS, improving estimates of target strength, implementing net monitoring devices, reviewing the sampling scheme, testing the efficiency and suitability of the trawl component of the survey, and evaluating fish avoidance.
    - Develop new approaches for using citizen science and improve fishery-dependent data usage to inform stock assessments.
    - Develop coastwide fishery-independent surveys of nearshore and/or hard substrate (untrawlable) habitats to inform groundfish stock assessments as well as to improve life history parameters (e.g., growth, natural mortality) and research to locate older female rockfish.

- Catch (landings and discards)
    - Improve historical catch and discard time series, including the development of uncertainty measures and a process for archiving and updating estimates on the Pacific Fisheries Information Network (PacFIN).
    - Collect finer-resolution measures of effort (e.g., location, attributes of gear used) for landings to support economic and fishery analyses.
    - Improve estimates of discards and discard mortality from commercial and recreational fisheries, including the effects of barotrauma, descending devices, mark-selective fisheries, and catch-and-release practices.
    - Double index tagging (DIT) of all salmon exploitation rate indicator stocks and electronic sampling in salmon fisheries.
    - Collect highly migratory species (HMS) landings, effort, composition and bycatch data as indicated by Regional Fisheries Management Organization (RFMO) management plans, particularly the Western Pacific Fisheries Management Commission and the Inter-American Tropical Tuna Commission, to support stock assessments.
    - Conduct experimental fisheries to support management of HMS fisheries and reduce bycatch.
- Ecosystem monitoring
    - Investigate new data sources such as historical ecosystem variability and fishery-dependent data, improving location data of catch and effort, krill concentrations and California Cooperative Oceanic Fisheries Investigations (CalCOFI) larval data.
    - Evaluate existing ecosystem monitoring programs and incorporation of new data streams. Evaluations should consider the importance of existing programs, impacts of reductions or removal of specific programs, and cost-effective alternatives. Evaluations should also consider new variables such as stomach content data and data collected from sources such as marine reserves and marine protected areas.

2. **Stock assessment methodologies**: Routine methodological development and advancement are required to improve the best scientific information available for stock status determinations. This will include the development and testing of data-limited and data-moderate assessments, dynamic reference points, and methods to account for large spatial closures.

Preliminary Research and Data Needs

- Explore use of a multi-species approach to estimate catch-per-unit-effort (CPUE) for nearshore groundfish species.
- Investigate the mechanism for skewed sex ratios and identify appropriate means to model these mechanisms in groundfish stock assessments (e.g., age-varying natural mortality, dome-shaped selectivity; black and canary rockfishes).
- Develop methods to assess currently unassessed stocks of groundfish and CPS that occur off the US West Coast (e.g., the southern subpopulation of Pacific sardine, jack mackerel).
- Examine methods for constructing groundfish decision tables.
- Develop methods to explicitly consider bias, uncertainty, and risk in salmon management.
- Examine how to model spatially-varying life history characteristics such as growth within a stock (e.g., "coastwide" fleets, fleets-as-areas, spatially-explicit and independent models).
- Accommodate use of genetic stock identification, parentage based tagging, and other techniques in salmon stock assessments.
- Continue research on methods of inclusion and accounting for long-term closed areas in assessment models.
- Develop joint stock assessments for transboundary stocks.

3. **Life history and stock structure**: Regular collection and evaluation of scientific information is needed to parameterize life history traits, inform the degree of population connectivity and ensure appropriate spatial scales for management actions.

Preliminary Research and Data Needs

- Improve meta-analyses for natural mortality and steepness, including an exploration of alternative stock-recruitment relationships, for groundfish stock assessment models.
- Continue to improve estimates of biological parameters (e.g., growth, fecundity) for federally-managed species.
- Improve the identification of stock structure and boundaries including in response to changing environmental conditions, community compositions, fishing pressure. (e.g., groundfish stock definition, Pacific sardine).
- Develop key physical and biological indicators for managed species, variability in stock availability, and changes in movement in distribution of species.
- Track dynamics of natural- and hatchery-origin salmon separately, accounting for different release practices.
- Evaluate the impacts of hatchery-origin salmon on natural-origin dynamics.
- Identify and quantify freshwater habitat factors which limit the productivity of salmon stocks.
- Investigate the effects of nest guarding on reproductive output (e.g., lingcod, cabezon).

4. **Evaluating fishery impacts**: Many federally-managed fisheries rely on the evaluation of fishery impacts associated with trip limits, bag limits, season or area closures, incidental mortality, and other factors. These require research and data to inform a number of assumptions utilized in estimation.

Preliminary Research and Data Needs

- Evaluate competing ocean uses that may impact federally-managed fisheries, including offshore wind energy, aquaculture, marine carbon removal, and deep-sea mineral extraction/mining. As investment and industrial use associated with other ocean uses may provide a range of positive and negative impacts to existing infrastructures and users, consider the implications to fisheries and fisheries infrastructure.
- Improve location data of catch and effort for commercial and recreational fisheries.
- Improve estimates of natural salmon stocks contributions in ocean fisheries, fisheries-related mortality, and escapement.
- Develop a framework for regular evaluation of salmon forecast and harvest models' performance, and develop and refine forecast and harvest models for west coast salmon stocks, including investigating the precision and accuracy of forecasts.
- Complete documentation for salmon management models (e.g., FRAM).
- Develop a method to quantify the uncertainty of the outputs of FRAM (salmon).
- Incorporate movement between spatial areas over time into planning models for salmon.

5. **Ecosystem dynamics**: The effects of a changing ecosystem raise challenges for fishery science and management. Continued efforts to account for ecosystem change can involve approaches such as collecting diet data, developing ecosystem models, evaluating the use of ecological indicators in stock assessments and identifying environmental thresholds.

Preliminary Research and Data Needs

- Evaluate methods to capture environmental and ecosystem variability in stock assessments, including temporal or spatial changes in recruitment, growth, maturity, fecundity, mortality, and other life history traits.
- Develop and evaluate environmental or biological indicators that help to inform or forecast recruitment.
- Develop ecosystem indicators, including indices of overall productivity in the California Current Ecosystem, and connect indicators to stock assessments and biologically- or socially- meaningful reference points.
- Develop an alternative to the temperature-recruitment relationship (E_{MSY}) based on the California Cooperative Oceanic Fisheries Investigations (CalCOFI) temperature time series for Pacific sardine for the CPS Fishery Management Plan (FMP) under Science and Management.
- Monitor, model, and predict the impacts of changing ocean conditions and variability on fisheries, due to changes in distributions and predator/prey relationships.
- Evaluate the role of federally-managed resources in the ecosystem (e.g., predator-prey relationships, competition, disease, and behavior), including development of climate-productivity relationships.

6. **Harvest policy**: Improved methods are needed to evaluate harvest policies, including harvest control rules and reference points, which are integral to Council decision-making, especially during periods of nonstationary environmental conditions.

Preliminary Research and Data Needs

- Conduct simulation studies and/or management strategy evaluations (MSEs) that evaluate effects of alternative harvest policies and stock-recruitment relationships on biological reference points.
- Develop a management strategy evaluation to test survey-based projections method for Pacific sardine and other CPS.
- Incorporate ecosystem-based fishery management (EBFM) and social science considerations into MSEs.
- Investigate alternative approaches to time-area management for salmon.
- Evaluate effectiveness of standardized bycatch reporting methodologies in all FMP fisheries.
- Develop management strategies that are robust to forecast errors.
- Improve ability to quantify scientific uncertainty to inform the magnitude of uncertainty buffers as part of the harvest specification process.
- Re-evaluate the harvest control rule for Pacific sardine to reflect the most up-to-date understanding of environmental drivers of recruitment, including the apportionment of biomass within U.S. waters.
- Develop ecosystem-based models that incorporate environmental variation and anthropogenic disturbances (e.g., potential harvest control rules for Sacramento River Winter Chinook, harvest control rule for Pacific sardine based on temperature recruitment relationship, environmental drivers on sablefish).
- Review and improve the adaptiveness of our management process to external change. These changes may include environmental, economic, or social aspects.

7. **Economics**: Data and analytical tools are needed to develop and evaluate fishery management policies that aim to ensure the economic viability of recreational, Tribal, and commercial fisheries, including post-harvest sectors and infrastructure.

Preliminary Research and Data Needs

- Conduct regular commercial cost-earnings surveys in all federally-managed fisheries, including the Economic Data Collection (EDC) program for catch share fisheries, which includes first receivers and the survey of all groundfish catch share quota owners.
- Conduct periodic recreational angler and charter boat (CPFVs) surveys and develop recreational valuation, behavior, and impact models.
- Maintain and update the regional input-output model for Pacific Coast Fisheries (IO-PAC).
- Develop data sources and analyses of seafood markets and supply chains relevant to U.S. West Coast fisheries.
- Improve location data of catch and effort for commercial and recreational fisheries and develop measures of effort associated with landings (e.g., days at sea.
- Develop models of fleet dynamics for commercial harvesters and recreational charter boats that can be used to conduct retrospective and prospective evaluations of regulations on fishing behavior and outcomes, including economic and social effects of alternative capacity management programs and bycatch.
- Conduct value of information and cost-effectiveness analysis of data collection and fishery monitoring programs for FMP species.

- Quantify impacts to fishing and processing sectors that result from volatility in year to year catch limits.

8. **Social science**: Data and analytical tools are needed to develop and evaluate fishery management policies intended to address social and cultural objectives of participants in fisheries and fishing communities.

Preliminary Research and Data Needs

- Maintain, further develop, and validate community-level indicators of engagement, dependence, and vulnerability related to commercial and recreational fishing needed to identify and characterize fishery-dependent communities and their impacts on them.
- Conduct periodic surveys of fishing communities and participants to collect information on social, demographic, and economic characteristics suitable for use in social impact analyses for each FMP.
- Investigate how the viability and resilience of coastal communities are affected by changes in ecosystem structure and function, including through the connection of ecosystem indices to socially meaningful reference points.
- Improve understanding impacts of fishing fleet behavior on fishing communities.

9. **Habitat science and spatial management**: Ongoing and emerging uses of marine, estuarine, and freshwater resources are diverse, potentially conflicting, and likely to impact fished stocks and their habitats, as well as the surveys used to inform science and management. Continued development of the models used to designate essential fish habitat and otherwise inform spatial management are needed, including those for transboundary stocks.

Preliminary Research and Data Needs

- Quantify spatiotemporal variation in habitat use for all life stages of federally-managed species to inform essential fish habitat (EFH) and habitat area of particular concern (HAPC) designations, marine spatial planning, and environmental impact assessments.
- Identify environmental (e.g., spatially-refined indices of ecosystem state) and ecological (e.g., occurrence of structure-forming invertebrates) sources of variation in the distributions of federally-managed species.
- Evaluate impacts of non-fishing activities (e.g., offshore development, freshwater operations) on habitat use by federally-managed species.
- Evaluate fishing effects on habitat and ecological responses to spatial closures.

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