TERMS OF REFERENCE

FOR THE

COASTAL PELAGIC SPECIES STOCK ASSESSMENT REVIEW PROCESS

2026

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1. SUMMARY OF MAJOR CHANGES FROM THE 2024 TERMS OF REFERENCE

The major changes in this version of the Terms of Reference (TOR) relative to the 2024 TOR include: 1) re-organization of content to reflect standardized National guidance and align with the Council's groundfish stock assessment TOR, 2) clarity of required elements for different assessment types, 3) removal of outdated requirements, including those originally intended for the groundfish TOR but retained as an artifact for Coastal Pelagic Species (CPS), 4) improvements to facilitate better coordination between the Stock Assessment Teams (STATs), Council Staff, and the Council's Scientific and Statistical Committee CPS Subcommittee (SSC-CPSSC) .

2. INTRODUCTION

The purpose of this document is to outline the guidelines and procedures for the Pacific Fishery Management Council's (Council's) CPS stock assessment and review (STAR) process and to clarify expectations and responsibilities of the various participants. This document applies to assessments of species managed under the Pacific Coast CPS Fishery Management Plan (FMP). The STAR process has been designed to provide for peer review as referenced in the 2006 Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act (RMSA), which states that "the Secretary and each Regional Fishery Management Council may establish a peer review process for that Regional Fishery Management Council for scientific information used to advise the Regional Fishery Management Council about the conservation and management of the fishery (see Magnuson-Stevens Act section 302(g)(1)(E))." National Standard 2 (NS2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (published July 19, 2013) provides guidance and standards to be followed when establishing a peer review process pursuant to MSA section 302(g)(1)(E) including guidance on the timing, scope of work, peer reviewer selection and process transparency. The STAR process follows these standards and is fully compliant with NS2. An overview of the STAR process for CPS, including the timing and participation by Council and panel bodies is provided in Appendix E.

Parties involved in the STAR process are Council members, Council staff, members of Council advisory bodies, including the SSC, the CPS Management Team (CPSMT), the CPS Advisory Subpanel (CPSAS), the National Marine Fisheries Service (NMFS), state agencies, and interested persons. Reviews, conducted through the STAR process, are key elements in an overall procedure designed to investigate the technical merits of stock assessments and other relevant scientific information. The STAR process covers a range of review types and levels of stock assessments (benchmark, update, catch-only and catch report). The review of stock assessments requires a routine, dedicated effort that simultaneously meets the needs of NMFS, the Council, and others. Program reviews, in-depth external reviews, and peer-reviewed scientific publications are used by Federal and state agencies to provide quality assurance for the basic scientific methods that are employed to produce stock assessments. The time frame and resources required for such reviews limits the number of assessments that can be reviewed yearly, thus requiring prioritization of stock assessments and choosing a balance of assessment types to review each cycle.

This current version of the TOR reflects recommendations from previous participants in the STAR process, including STAR panel members, the SSC, STATs, Council staff, and Council advisory groups. The SSC has developed a separate TOR for reviewing new methods that might be used in stock assessments. Nevertheless, no set of guidelines can be expected to deal with every contingency, and all participants should anticipate the need to be flexible and address new issues as they arise. .

Stock assessments are conducted to assess the abundance and trends of fish stocks and provide the fundamental basis for management decisions regarding appropriate harvest levels. In most cases, stock assessments use statistical population models to integrate and simultaneously analyze survey, fishery, and biological data. Environmental and ecosystem data may also be integrated in stock assessments. Hilborn and Walters (1992) define stock assessments as "the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices." In this document, the term "stock assessment" includes activities, analyses, and reports, starting with the collection and collation of data and continuing through to scientific recommendations presented to the Council and its advisors. To best serve their purpose, stock assessments must attempt to identify and quantify major uncertainties, balance realism and parsimony, and make best use of the available data. Data availability produces a continuum of approaches as outlined below.

Stock assessment products are assigned to one of three categories based on the amount and kind of information available, model diagnostics, and subsequent uncertainty associated with the stock assessments. Assignments are made by the SSC based on the recommendations from the STAR panels. Detailed definitions of the three categories are provided in Appendix D. Category 1 includes the most robust assessments that have the smallest number of pre-specified parameters leading to a better characterization of uncertainty. Category 2 can be used to categorize benchmark assessments that are constrained by data quality or compatibility with tractable model assumptions, resulting in more fixed parameters and unrealistically small variance around key management quantities. They may include and/or make unusual simplifying assumptions (e.g., no recruitment deviations). Category 3 is primarily for assessments with the largest number of fixed parameters and underestimates of uncertainty associated with assessment results.

3. STOCK ASSESSMENT REVIEW PROCESS GOALS AND OBJECTIVES

The goals and objectives of the CPS STAR process are to:

1) Provide an independent review of stock assessments to ensure that stock assessments represent the best scientific information available and to facilitate the use of this information by the Council to adopt overfishing limits (OFLs), ABCs, ACLs, harvest guidelines (HGs), and annual catch targets (ACTs);
2) meet the mandates of the MSA and other legal requirements;
3) follow a detailed calendar and fulfill explicit responsibilities for all participants to produce required reports and outcomes;
4) increase understanding and acceptance of stock assessments and peer reviews by all members of the Council and interested members of the public;
5) identify research needed to improve assessments, reviews, and fishery management in the future; and
6) use assessment and review resources effectively and efficiently.

4. STOCK ASSESSMENT REVIEW PROCESS

4.1 Overview

Stock assessments for CPS apply statistical models that are age- or size-structured to "data-rich" stocks, meaning the available data are adequate to produce estimates of year-class strength and

there is information from surveys or fisheries to resolve trends in biomass and estimate stock status. The models produce annual estimates of age-specific abundance and biomass that are compared to the available observational data to find sets of parameters that best-fit the available data.

The following table summarizes some of the key differences between the various types of assessment

	Benchmark assessment	Update assessment	Catch-only projection
Review Body	STAR panel	SSC-CPSC	SSC-CPSC
Review Duration	3-4 days	1 day	< 1 day
Assessment Flexibility	Complete	Restricted (See Section 4.3)	No model updates

4.2 Benchmark Assessments

The least restricted assessment type is a **"benchmark assessment,"** in which all assumptions and datasets incorporated can be revisited. This contrasts to other assessment types where there are restrictions on the aspects of the assessment that may be changed. A benchmark assessment can be applied to a stock that has not been previously assessed or re-applied to a previously assessed stock, in which case the benchmark assessment involves a re-examination of the underlying assumptions, data, and model parameters previously used to assess the stock. Benchmark assessments are reviewed by a STAR panel.

During interim periods, new data collection efforts, research surveys, and/or analytical methods in support of stock assessments may be reviewed through the Council's Methodology Review Process for CPS (COP 26). This process provides an independent peer review process of new methods in advance of the STAR process to ensure BSIA is used in stock assessments. Given the frequency of CPS assessments, interim periods are short and there may be a need to delay delivery of a stock assessment if a methodology review is required. Both the methodology review and the departure from the assessment schedule would need to be approved through Council processes. Alternatively, STAR panels for benchmark assessments may evaluate changes in data or methods provided they are specific to the benchmark and can be reviewed sufficiently in the timeframe provided.

4.3 Update Assessments

Resource limitations constrain the number of benchmark assessments that can be conducted and reviewed during an assessment cycle. An "update assessment" may be preferable when more current information is desired for a particular stock and yet there are other priorities for benchmark assessments. An update assessment reruns an approved benchmark assessment model using the same model structure with the data series extended to include new data and some limited minor alterations (described in section 7). Update assessments are reviewed by the SSC-CPSSC rather than by a STAR panel.

An update assessment is generally restricted to the addition of new data that have become available since the last benchmark assessment and some limited minor alterations. It must carry forward the fundamental structure of the last benchmark assessment reviewed and endorsed by a STAR panel, the SSC, and the Council. Assessment structure here refers to the population dynamics model,

data sources used as inputs to the model, the statistical platform used to fit the model to the data, and how the management quantities used to set harvest specifications are calculated. In particular, when an update assessment is developed, with the exceptions noted below, no substantial changes should be made to the assessment. If substantial changes to the model are contemplated by the STAT, a benchmark assessment may be recommended for the next year.

1) the particular sources of data used. It is not uncommon that data sources are updated to correct data entry errors or include additional historical data. It is acceptable to use the most up-to-date data and/or corrected from the sources used in the original assessment, including changing the parameter time blocks to extend time periods for the end of the model. Partially omitting data (determined to be unreliable, subject to changes in selectivity, not enough data to reliably model, etc.) can be considered as long as the update assessment clearly documents and justifies the scientific need for such changes and provides a step-by-step transition (via sensitivity analysis) from the last benchmark assessment to an update assessment under review.
2) the software used in programming the assessment. It is acceptable to use a newer version or version with bug fixes. A comparison should be provided to illustrate that the newer software version produces adequately similar results when used with the same model files as in the benchmark assessment.
3) the assumptions and structure of the population dynamics model underlying the stock assessment. It is acceptable to use updated parameter priors and/or improved estimates of parameters such as steepness, natural mortality rate, or survey catchability due to new research or updated meta-analyses. A comparison of model results should be provided while using previous benchmark and new priors or parameters. It is also allowed to follow a model selection process or data weighting process used in the original assessment rather than using the model selected in the original benchmark assessment.
4) the statistical framework for fitting the model to the data and determining goodness of fit.
5) the analytical treatment of model outputs in determining management reference points.

The above list of exceptions is not meant to be exhaustive, and other alterations can be considered if warranted. Alterations are allowed when there are clear and straightforward improvements in the input data or methods and/or how they are processed and analyzed for use in the model. Ideally, corrected and updated data or methods used to process and analyze data would be reviewed by the SSC prior to being used in assessments. If substantial changes to the model are contemplated by the STAT, a benchmark assessment may be recommended for the next year.

4.3.1 Review of Update Assessments

Update assessments are reviewed by members of the SSC CPS subcommittee. The STAT is responsible for producing the update assessment document and submitting it to Council staff. The document should follow the outline in Appendix A and include an Executive Summary based on the template in Appendix B. The STAT, however, can reference the last benchmark assessment (or other relevant documentation) for a description of methods, data sources, stock structure, etc., given that they have not been changed. Any new information in the assessment must be presented in sufficient detail for the CPS subcommittee to determine whether the update meets the Council's requirement to use the best available scientific information.

The document must include a bridging exercise to illustrate the model performance with and without the most recent data (new to the update assessment) and discuss whether the new data and

update assessment results are sufficiently consistent with those from the last benchmark assessment. The assessment document should include a detailed step-by-step transition from the last benchmark assessment to the update under review.

In addition to the update assessment document, Council staff will provide the SSC-CPSSC with a copy of the last benchmark stock assessment reviewed via the STAR process and the associated STAR panel report. The chair of the SSC-CPSSC designates a lead reviewer from the subcommittee members for each update assessment to document the meeting discussion, produce a review report, and ensure that each review is conducted according to the TOR. CPSMT and CPSAS advisors, as well as Council staff, also participate in the review.

The review of update assessments is not expected to require additional model runs or extensive analytical requests during the meeting, although changes in assessment outputs may necessitate some model exploration. The review focuses on two main questions:

1) Does the assessment meet the criteria of a stock assessment update?
2) Can the results of the update assessment form the basis of Council decision-making?

If the answer to either of these questions is negative, a benchmark assessment would typically be recommended for the next year.

Shortly after the review, the SSC-CPSSC issues a report that includes: 1) comments on the technical merits and/or deficiencies of the update assessment; 2) explanation of areas of disagreement between the subcommittee and STAT (if any); and 3) recommendations on the adequacy of the update assessment for use in management. The report may also include subcommittee recommendations for modifications that should be made when the next benchmark assessment is conducted.

The report is reviewed by the full SSC at the appropriate Council meeting. If the SSC-CPSSC review concludes that it is not possible to use the update assessment, the SSC is responsible for evaluating all model runs examined during the review meeting and providing recommendations on an appropriate OFL to the Council.

4.4 Catch-Only Projections

In some cases, only recent fisheries catch information are added to an existing, approved assessment to generate catch-only projections for the stock. Catch-only projections are reviewed by the SSC-CPSSC rather than by a STAR panel.

Assessments of this type do not include the most recent survey abundance index estimates. Projections with only catches revised will have no new data to inform the stock-recruitment relationship in the model. All projections become more uncertain as the projection period increases. This is particularly an issue for short-lived CPS species, for which recruitment is highly variable, and predictive power of catch-only projections is particularly low. Additional requests can also be made to the STAT if the amount of uncertainty associated with assessment results (e.g., due to highly variable recruitment) should be evaluated further.

Table 1. Example of the table to be included in catch-only projections. Annual catch target (ACT) and annual catch limit (ACL) values, updated catch values, summary age 1+ biomass, and spawning output are shown.

Fishing year*	USA ACT	USA ACL	USA Catch	Mexico Catch	Canada Catch	Summary biomass (age 1+)	Spawning Output
2017-18	4,000	8,000	372	6,032	0	57,213	30,724
2018-19	4,000	7,000	655	33,070	0	40,954	28,069
2019-20	4,000	4,514	705	48,025	0	77,066	31,763
2020-21	4,000	4,288	764	48,025	0	48,856	42,270
2021-22	4,000	4,288	764	48,025	0	27,369	25,874

See Appendix C for a table indicating which elements should go in a catch-only projection, Appendix A for a detailed description of elements, and Appendix B for a detailed description of executive Summaries.

4.5 Catch Reports

In certain cases, only limited new data are available to inform the assessment. In such cases, it is appropriate for the CPSMT to provide a catch report, which documents recent removals and compares them to the ACLs established for the stock. For a catch report, if the estimated removals of a species are near the value projected by the previous assessment/rebuilding analysis, the STAT does not need to conduct model runs since no new insight would be obtained by rerunning the assessment model. The state data stewards should verify and provide updated catch information no later than 8 weeks prior to the date the catch report is due. No changes to catch values will be allowed after submission, except with the approval of the CPSMT chair.

The report should be brief and provide enough details on how total catches were estimated. It should provide only essential information about the stock and refer to the last assessment (or other relevant documentation) for full description of methods, data sources, model structure, etc. used to estimate the status of the stock and generate projections.

5. Roles and Responsibilities of Stock Assessment Review Process Participants

5.1 Shared Responsibilities

All parties have a stake in assuring adequate technical review of stock assessments. NMFS, as the designee of the Secretary of Commerce, must determine that the best scientific information available (BSIA) as defined by criteria described under National Standard 2 of the MSA has been

used when it approves fishery management recommendations made by the Council. Similarly, the Council uses advice from the SSC to determine that the information on which it bases its recommendations represents the BSIA. The STAT and STAR panel reviewers should be aware of the NS 2 and these TOR and strive to create a final assessment that reflects BSIA. These BSIA criteria include relevance, inclusiveness, objectivity, transparency, timeliness, verification, and validation. BSIA may be hindered by implicit bias. In order to increase awareness of implicit bias in the course of the review, each panel member is encouraged to participate in training (https://implicit.harvard.edu/implicit/). Scientists and fishery managers providing technical documents to the Council for use in management need to assure that their work is technically correct.

The Council and NMFS share primary responsibility to create and foster a successful STAR process. The Council oversees the process and involves its standing advisory bodies, especially the SSC. A staff member from a NMFS Science Center will be assigned as the Point of Contact (POC) to facilitate and assist Council staff in overseeing individually hosted STAR panels. Together, NMFS and the Council consult with all interested parties to plan and prepare the TOR and develop a calendar of events with a list of deliverables for final approval by the Council. NMFS and the Council share fiscal and logistical responsibilities, and both should ensure that there are no conflicts of interest in the process.[1]

5.2 STAR Panel Responsibilities

The role of the STAR panel is to conduct a detailed technical evaluation of benchmark stock assessments. The specific responsibilities of the STAR panel are to:

1) be familiar with the TOR, the *Accepted Practices Guidelines*, and most recent Methodology Review reports;
2) read all provided materials ahead of the review, including draft stock assessment documents, data inputs, and analytical models, along with other pertinent information (e.g., previous assessments and STAR panel reports, when available) before the STAR panel;
3) during the review panel meeting, discuss the technical merits and deficiencies of the input data and analytical methods, read additional provided material, , provide suggestions on improvements to the model, , and, when possible, suggest new tools or analyses to improve future assessments;
4) develop STAR panel reports for all reviewed assessments to document meeting discussion and recommendations; and
5) if technical disagreement(s) with the STAT arise, resolve them in a respectful manner.

STAR panels include a chair appointed by the SSC and up to three other experienced stock assessment analysts knowledgeable of the specific modeling approaches being reviewed. Details of the chair's responsibilities are provided below. Of these other members, at least one should be

[1] The final NS2 guidelines state: a "[A] conflict of interest is any financial or other interest which conflicts with the service of the individual on a review panel because it: (A) Could significantly impair the reviewer's objectivity; or (B) Could create an unfair competitive advantage for a person or organization; (C) Except for those situations in which a conflict of interest is unavoidable, and the conflict is promptly and publicly disclosed, no individual can be appointed to a review panel if that individual has a conflict of interest that is relevant to the functions to be performed. Conflicts of interest include, but are not limited to, the personal financial interests and investments, employer affiliations, and consulting arrangements, grants, or contracts of the individual and of others with whom the individual has substantial common financial interests, if these interests are relevant to the functions to be performed."

independent, for instance, appointed from the Center for Independent Experts (CIE) and at least one should be familiar with West Coast stock assessment practices. It is preferred for the total of reviewers be an odd number (greater than 1). Selection of STAR panelists should be based on expertise, independence, and a balance between outside expertise and in-depth knowledge of West Coast fisheries, the data sets available for those fisheries, and the modeling approaches applied to CPS. Expertise in ecosystem models or processes, and knowledge of the role of CPS in the ecosystem is also desirable, particularly if the assessment includes ecosystem models or environmental processes. CIE panelists have their own contractual responsibilities.

Selected reviewers should not have financial or personal conflicts of interest with the scientific information, subject matter, or work product under review, either current to the meeting, within the previous year (at minimum), or anticipated. STAR panel members who are federal employees should comply with all applicable federal ethics requirements. Reviewers who are not federal employees will be screened for conflicts of interest either through existing financial disclosure processes used by the SSC and CIE, or under the NOAA Policy on Conflicts of Interest for Peer Review Subjects.

Reviewers should not have contributed or participated in the development of the work product or scientific information under review, and reviewer responsibilities should rotate across the available pool of qualified reviewers, when possible.

STAR panel meetings also include advisors from the CPSMT and the CPSAS, with responsibilities as laid out in these TOR, and a Council staff member to advise the STAR panel and assist in recording meeting discussions and results. The STAR panel, STATs, the CPSMT and CPSAS advisors, and the public are all legitimate meeting participants who should be accommodated in discussions.

It is the responsibility of the STAR panel chair y to coordinate discussion and public comment so that the assessment review is completed on time. The STAR panel should thoroughly evaluate each analytical approach, comment on the relative merits of each, and, when conflicting results are obtained, identify the reasons for the differences. The STAR panel should work with the STATs to come to agreement on a base model that will be reviewed by the SSC to determine its merits for supporting management advice. The STAR panel reviewers are encouraged to convey issues they are concerned with to the STAT during the two-week review period prior to the STAR panel to make them aware and provide as much lead time as possible for the STAT to address them.

The STAR is by design a transparent process. STAR panel meetings are open to the public and are announced on the Council's website, through Council meeting notices, and in the *Federal Register* prior to the STAR panel meeting. The Council posts background materials on an accessible website prior to the meeting and makes hard copies available upon request. The panel chair should schedule the meeting to provide an adequate review and to give the STAT adequate time to respond to requests for additional analyses/ information.

Contested assessments, in which alternative assessments are brought forward by competing STATs using different modeling approaches and assumptions, would typically require additional time (and/or panel members) to review adequately, and should be scheduled accordingly. Historically, the occurrence of contested assessments has been rare; however, there are mechanisms in place to accommodate them within the STAR process. In all cases, competing

assessment models should not be proposed to the SSC if they have not undergone a STAR panel review.

The decisions and guidelines documented in endorsed methodology-review panel reports are used to inform the *Accepted Practices Guidelines for Stock Assessments*. The *Guidelines* are intended to provide STATs with approved approaches that may be used for dealing with certain stock assessment data and modeling issues. STATs may diverge from the *Guidelines* if they provide adequate justification for doing so. Accepted practices endorsed by the SSC should not be re-evaluated during the STAR panel unless there have been changes in the approach or method previously reviewed, or under other extenuating circumstances.

5.2.1 STAR Panel Requests for Additional Analyses

STAR panel meetings are intended as technical reviews of complete assessments rather than workshops for constructing the assessments. In the course of a meeting, the panel may ask the STAT for a reasonable number of sensitivity runs, request additional details on the proposed base model presented, or ask for further analyses of alternative runs. However, it is not unusual for the review to identify technical problems that would result in changes to the assessment results. Resolving technical issues to the mutual satisfaction of the STAR and STAT is an important task of the STAR process. The STAR panel is not authorized to conduct an alternative assessment representing its own views that are distinct from those of the STAT, nor can it impose an alternative assessment on the STAT. Similarly, the STAR panel should not impose their preferred methodologies when this is a matter of professional judgement. Rather, if the panel finds an assessment to be inadequate, it should document its opinion and suggest potential remedial measures for the STAT to take to rectify perceived technical shortcomings of the assessment. Differences of opinion often may best be addressed by future research, and thus are appropriate to include in the "Future Research Recommendations" sections of the assessment and STAR panel report.

The STAR panels are expected to be judicious in their requests of the STATs. Requests for large changes in data or analytical methods used may often require a significant amount of time to complete and may result in changes to the assessment that cannot be adequately evaluated during the STAR panel meeting. Therefore, judiciousness should be exercised in recommending or requesting such changes. In many cases, such changes should be relegated to future research recommendations and/or methodology review. If the STAR panel agrees that the assessment results strongly indicate that the parameters of the harvest control rules are inappropriate, it should identify this in its report and recommend further analysis to support a change to more appropriate values.

STAR panel requests to the STAT for additional model runs or data analyses must be clear, explicit, and in writing. These requests and recommendations should be listed within the STAR panel's report, along with rationale and the STAT response to each request.

To the extent possible, analyses requested by the STAR panel should be completed by the STAT during the STAR panel meeting. In situations where a STAT arrives with a well-constructed, thoroughly investigated assessment, it may be that the panel finishes its review earlier than scheduled If follow-up work supplementary to the selection of a base model is required by the STAT after the review meeting (such as sensitivity analysis or diagnostics), this should be completed before the briefing book deadline for the Council meeting at which the assessment is

scheduled for review. Any work following the STAR panel should not be substantial, focused on incorporating needed elements in the final assessment report.

For some stocks selected for benchmark assessments, the available data may prove to be insufficient to support a Category 1 assessment (Appendix D). It is the responsibility of the STAR panel, in consultation with the STAT, to consider the strength of inferences that can be drawn from analyses presented and identify major uncertainties. The STAR panel should review the appropriateness and reliability of the methods used to draw conclusions about stock status and/or exploitation rates, and either recommend or reject the analysis on the basis of its ability to provide useful information into the management process. If the STAR panel agrees that important results have been generated, it should forward its findings and conclusions to the SSC and the Council for consideration in setting OFLs, ABCs, ACLs, and HGs. A key section of the assessment is on research needed to improve the assessment. Highlighting research priorities should increase the likelihood that future stocks assessments can be raised to Category 1.

5.2.2 Uncertainty in Stock Assessments

The STAR panel review focuses on technical aspects of benchmark stock assessments The panel should strive for a risk-neutral perspective in its deliberations and discuss the degree to which the accepted base model describes and quantifies the major sources of uncertainty in the assessment. Confidence intervals for model outputs, as well as other measures of uncertainty that could affect management decisions, should be provided in completed stock assessments and the reports prepared by STAR panels. The STAR panel may also provide qualitative comments on the probability of results from various model runs, especially if the panel does not consider the probability distributions calculated by the STAT to capture all major sources of uncertainty. However, as a scientific peer review body, the STAR panel should avoid matters of policy. Assessment results from model runs that are technically flawed or questionable based on scientific grounds should be identified by the panel and excluded from the alternatives upon which management advice is to be developed. The meeting length and agenda should provide the STAT with adequate time to respond to requests for additional analyses including those needed for information category designation, and the associated sigma value should be determined at the STAR panel.

5.2.3 Determination of assessment model uncertainty

Uncertainty should be based on the OFL uncertainty (s_{final}), to correspond to the adopted approach for addressing scientific uncertainty (Wetzel and Hamel 2023; Privitera-Johnson and Punt 2020). The baseline uncertainty (s_{base}), is defined as the larger of: the category-specific default value ($s_{category}$); or log-space standard deviation of the biomass estimate from the assessment model (s_{model}: $s_{model} = CV_{model}$ for the terminal year).[2]

To account for increasing uncertainty over time, the final OFL uncertainty (s_{final}) applied to the decision table must be calculated using the following formula:

$$s_{final} = (s_{base}) * (1 + 0.52 * M * t)$$

[2] If the assessment model reports uncertainty as a linear Coefficient of Variation (CV) rather than a log-space standard error, the CV should be converted to s_{model} using the formula $\sigma_{model} = \sqrt[ln(1+CV^2)]{}$ prior to comparison with the category default

where:
σ_{base} = the larger of the $\sigma_{category}$, or σ_{model}
M = the natural mortality rate used in the assessment
t = The number of years following the most recent full assessment or update assessment

To ensure standardized application, t increments sequentially based on the absence of new biological data. For example, following a 2027 assessment update, t = 1 for the 2027-2028 fishing year, and t = 2 for the 2028-2029 fishing year

The SSC will determine and include in their report the appropriate sigma value (e.g., a proxy sigma value for the stock category or a stock-specific sigma) to apply to estimates of ABC based on these calculations. As of 2019, sigma values should account for the increase in scientific uncertainty with time. This incorporates a concomitant increase in the buffer between the overfishing limit and acceptable biological catch with each year since the most recent data supporting the most recent benchmark or update assessment, which should be accounted for in biomass projections (Wetzel and Hamel 2023; Privitera-Johnson and Punt 2020).

5.2.4 Areas of Disagreement
STATs and STAR panels are required to resolve any areas of disagreement during the meeting, if possible. Occasionally, fundamental differences between the STAR panel and STAT cannot be resolved during the STAR panel meeting. In such cases, the STAR panel must document the areas of disagreement in its report. If there are disagreements, the report should document the nature of the disagreement and the arguments in favor of the alternative options.

The STAT may choose to submit a supplemental report supporting its view, but in that case, an opportunity must be given to the STAR panel to prepare a rebuttal. These documents would then be appended to the STAR panel report as part of the record of the review meeting. In some cases, STAR panel members may have fundamental disagreements among themselves that cannot be resolved during the review meeting. In such cases, dissenting STAR panel members may prepare a report that would also become part of the record of the review meeting. The SSC would then review all information pertaining to STAR panel and STAR panel/STAT disputes and issue its recommendation.

5.2.5 STAR Panel Report
The preliminary STAR panel report should be developed and approved by the full panel no later than two weeks after the STAR panel meeting. The final report should be submitted to the Council by the Briefing Book deadline.

The STAR panel report should include:
- Summary of the STAR panel meeting:
    - names and affiliations of STAR panel members, STAT, and STAR panel advisors;
    - brief overview of the meeting (where the meeting took place, what species/stock was assessed, what was the STAR panel recommendation, etc.);
    - brief summary of the assessment model and the data used; and
    - list of analyses requested by the STAR panel, the rationale for each request, and a brief summary of the STAT response to the request.
- Description of the base model.
- Recommended sigma value and the basis for the recommendation.

- Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
- Areas of disagreement regarding STAR panel recommendations:
    - between the STAR panel and STAT(s); and
    - among STAR panel members (including concerns raised by STAR panel advisors).
- Unresolved problems and major uncertainties, e.g., any special issues that complicate the assessment and/or interpretation of results.
- Management, data, or fishery issues raised by the STAR panel advisors during the STAR panel.
- Prioritized recommendations for future research and data collection, including methodology and ecosystem considerations for the subsequent assessment.

The STAR panel should recommend the Category for the assessment based on the definitions of assessment categories in Appendix D. The SSC will consider this recommendation when ultimately deciding the appropriate stock Category.

The preliminary STAR panel report should be made available for review by the STAT within two weeks of the conclusion of the review, allowing sufficient time for the STAT to comment on issues of fact or differences in interpretation prior to the briefing book deadline. If the STAT disagrees with topics in the preliminary STAR panel report, the STAR panel and STAT should attempt to resolve them prior to the final STAR panel report. Otherwise, the areas of disagreement must be documented in the final STAR panel report.

5.3. STAR Panel Chair Responsibilities

The STAR panel chair is appointed by the SSC and is responsible to: 1) develop a STAR panel meeting agenda; 2) ensure that STAR panel participants follow these TOR and any STAR panel-specific TOR; 3) guide the STAR panel and the STAT to mutually agreeable solutions; and 4) coordinate and conduct reviews of revised stock assessment documents before they are forwarded to the SSC.

It is the STAR panel chair responsibility to ensure that STAR panel participants adhere to the TOR and that the meeting is run effectively and efficiently. The STAR Panel chair should also provide an overview of the code of conduct (as described in Council policies) to ensure that respectful interactions among STAR participants occur throughout the meeting. This avoids discussing topics beyond the scope of the assessment review to focus efforts on the task at hand. During the panel meeting, the STAR panel chair appoints members of the panel to act as rapporteurs and draft the report (or specific sections thereof) according to the STAR panel chair guidance on format and level of detail. The STAR panel chair will also solicit questions and comments from the CPSMT and CPSAS advisors throughout the meeting, provide time for discussion, and allow public comment(s).

It is the obligation of the STAR panel chair, in consultation with other panel members, to prioritize and clarify requests to the STAT for additional analyses. It is the responsibility of the STAR panel reviewers (and a designated rapporteur) to capture the explanation and discussion of each request in the 'response' section of the requests, rational, and responses, and the chair should ensure that sufficient details are captured and requests are reasonable.

Following the STAR panel meeting, the chair will lead the effort to draft the STAR panel report. In addition to the reviewers, the chair will solicit comments on the draft report from the STAT and the STAR panel advisors. The purpose of this is limited to ensuring that the report is technically accurate and reflects the discussion that occurred at the meeting and should not be viewed as an opportunity to reopen debate on issues. The panel chair is the final arbiter on wording changes suggested by STAT and the STAR panel advisors as the report is the panel's report of the meeting. The chair is responsible for providing the Council staff with the final version of the STAR panel report before the Briefing Book deadline.

The STAR panel chair is also responsible for communicating with the STAT to determine if the revised stock assessment document is complete. In particular, the chair should confirm that the revised stock assessment document includes an accurate description of the final base model that was agreed upon during the review (rather than the pre-STAR base model). Any post-STAR drafts of the stock assessment must be reviewed and approved by the STAR panel chair. The final assessment document can only be distributed to Council staff after it has been endorsed by the STAR panel chair, and when it is accompanied by a complete and approved STAR panel report. Council staff will also review for completion. Likewise, the final draft that is published on the Council's website (www.pcouncil.org) must also be approved by the STAR panel chair prior to being accepted by Council staff.

The STAR panel chair is also expected to attend the SSC CPS subcommittee meeting, SSC meeting, and, if requested, CPSMT meetings and the relevant portions of the Council meetings, where stock assessments are discussed, explain the reviews, and provide technical information and advice.

The STAR panel chair is responsible for ensuring that the following schedule is adhered to (as closely as possible, recognizing that exceptional and personal circumstances do arise):

1. The STAR panel report should be in complete form, except for minor wording edits, etc. within two weeks of the end of the STAR panel, so that the STAT can review and ensure the post-STAR draft assessment document sent to the STAR panel chair adheres to the STAR panel report (or at least explains reasons for any discrepancies in that version of the assessment)
2. Comments on the post-STAR/pre-SSC draft of the assessment should be returned to the STAT by the panel chair within one week after the deadline for that draft.
3. Comments on the post-STAR/pre-SSC draft of the assessment should be returned to the STAT by the panel chair within one week[A1] after the deadline for that draft.
4. When time is limited between the STAR panel and the briefing book submission deadline, an accelerated timeline of intermediate deadlines for the STAT and STAR panel/chair should be decided upon when the STAR panel calendar is approved to ensure an appropriately reviewed and revised version of the assessment will be available by the submission deadline.

5.4. Stock Assessment Team Responsibilities

The STAT is responsible for conducting a complete and technically sound stock assessment that conforms to the TOR.

For benchmark assessments reviewed at a STAR panel, the STAT is responsible for preparing

three versions of the stock assessment document:

1) a "draft" for discussion during the STAR panel meeting (often referred to as the "pre-STAR draft").
2) a "revised draft" for presentation to the SSC, the Council, CPSMT, and CPSAS (often referred to as the "post-STAR draft"); and
3) a "final version" to be posted on the Council's website once adopted.

For update assessments and catch-only projections reviewed by the SSC-CPSSC, the STAT is responsible for preparing three versions of the stock assessment document:

1) a "draft" for discussion during an SSC subcommittee review;
2) a "revised draft" for presentation to the SSC, the Council, the CPSMT, and the CPSAS; and
3) a "final version" to be posted on the Council's website (tech memo once published).

The draft assessment document for benchmark and update assessments should follow the outline in Appendix A with an executive summary that follows the template in Appendix B, and includes elements as described in the table of Appendix C. Where possible, the executive summary should paraphrase the shared content of the body of the report to minimize redundancy.

In the draft document, the STAT should identify a candidate base model, fully-developed and well-documented, for the STAR Panel to review. A draft assessment document should be submitted by the STAT to the STAR Panel chair, Council staff, and the NMFS stock assessment point of contact for the panel two full weeks prior to the STAR panel meeting, to determine whether the document is sufficiently complete to undergo review. If the draft assessment is judged complete, the pre-STAR draft assessment and supporting materials would be distributed to the STAR panel and the CPSMT and CPSAS advisors two weeks prior to the STAR panel meeting.

If the STAT brings a model to the STAR panel that differs from what was described in the pre-STAR document, the STAT should prepare and distribute a detailed errata sheet and/or list of changes detailing how the pre-STAR draft assessment differs from the version that will be presented at the STAR panel. The STAT should document any major pre-STAR model changes (including a sequential analysis of model changes) and present them at the start of the STAR panel to allow as much time as possible for consideration and review. If the assessment document does not meet minimum criteria of the TOR, the STAT will add elements to the draft as soon as possible upon notification such that the document does meet minimum criteria of the TOR. Otherwise, the review would be postponed to a subsequent assessment cycle.

The STAT is also responsible for providing model files and data (in digital format) to the review meeting. For assessments conducted with Stock Synthesis, the set of files provided by the STAT should include all files needed to run the model as well as the standard set of r4ss output files as an electronic index of tables and figures. Inclusion of the electronic index may reduce the need to include some tables and figures historically included in the assessment document unless they are pertinent to considerations explicitly discussed. A list of available tables and figures provided in the electronic index should be included as an appendix in the assessment to make the readers aware of what tables and figures are available and where the electronic index can be found.

The STAT is responsible for providing responses to any formal STAR panel requests with an explanation of how the new analysis affected model results The STAT is encouraged to provide

extractable tables and/or figures with their responses to STAR panel requests to facilitate their use in STAR panel reports.

In most cases, the STAT should produce a revised draft of the assessment document before the briefing book deadline for the Council meeting at which the assessment is scheduled for review. Post-STAR drafts must be reviewed and approved by the chair of the review meeting prior to being submitted to Council staff. These reviews are limited to editorial issues, verifying that all required elements are included, and confirming that the document reflects the discussion and decisions made during the review meeting.

The final version of the assessment document is produced after the assessment has been reviewed and endorsed by the SSC and adopted by the Council. Other than changes recommended by the SSC, and assuming the document already meets the criteria of the TOR, only editorial and other minor alterations should be made to the revised draft for the final version. Electronic versions of the final assessment document, model files, and key output files should be submitted by the STATs to Council staff for inclusion in a stock assessment archive three months after the assessment is adopted. Any tabular data that are inserted into the final documents in an object format should also be submitted to the Council staff in alternative forms (e.g., spreadsheets), which allow selection of individual data elements.

A STAT conducting an assessment for which no base model was endorsed by a STAR panel should, in most cases, provide the pre-STAR draft assessment (or corrected/ updated version thereof, as agreed upon with the STAR panel) to the Council by the relevant briefing book deadline. This draft assessment should include the results of any sensitivity runs which the STAR panel recommends to bracket uncertainty in the assessment.

STATs are strongly encouraged to develop assessments in a collaborative environment by forming working groups and consulting with other stock assessment and ecosystem assessment scientists.

STATs should also evaluate alternative models and analyses that incorporate ecosystem considerations and cross-FMP interactions that may affect stock dynamics. When new data sources or methods, which could be used in many assessments, are planned for inclusion in the assessment, they should be reviewed by a methodology panel. STATs should identify whether such new data sources or methods will be proposed for inclusion in assessments as early as feasible so that it is possible to hold a methodology review if one is needed (COP 26). Irrespective of whether a methodology review panel takes place, the STAR panel should be provided with model runs with and without any new data sources so that it can evaluate the sensitivity of model outputs to these data sources.

For all assessment types, the STAT should work with state data stewards to verify catch and other data and on a data delivery plan that provides sufficient time (eight weeks preferred) for model development and internal review prior to the draft document deadline to the review body (SSC-CPSSC or STAR Panel). If necessary, updated catch and other data should be provided to the STAT no later than eight weeks prior to the draft document deadline to the review body. STATs, state agency representatives, the CPSMT, through its chair if no specific CPSMT advisor has been selected yet, and other data stewards should coordinate early in the process to ensure timely availability of data. The STAT should work closely with the data stewards during model development and review to prevent errors, misunderstandings, etc. No changes to data values will

be allowed after submission to the STAT, except with the approval of the STAT and the STAR Panel chair.

STATs should make themselves available for discussions and meetings with industry and interested parties to discuss data and stock assessment issues, as needed. The STAT should initiate contact with the CPSAS advisor once they have been appointed, keep the CPSAS informed of the data being used, and respond to any concerns that are raised. The STAT should also contact the CPSMT advisor once they have been appointed and Council staff early in the process for information about changes in fishing regulations and spatial management issues that may influence model structure and the way data are used in the assessment.

The selection of catch streams for catch-only projections should be made by the STAT. Catch streams should include full attainment of HGs as well as lower levels, for example based on recent average catches. The STAT, in consultation with the CPSMT, will provide the catches for catch-only projections using the same stratification as the original assessment. Full ACL or HG attainment should be assumed for the catch projections in the absence of a strong rationale from the CPSMT that an alternative assumption is appropriate.

Barring exceptional circumstances, STAT members who are not attending the STAR panel meeting should be available remotely to assist with responses. A member of the STAT should be available to respond to questions during the review by the SSC and Council, whether in person or remotely. In addition, the STAT should be prepared to respond to CPSMT or Council staff requests to facilitate development of ACL alternatives for projections; these requests will be provided in writing to the STAT prior to the end of the STAR panel.

When developing an assessment model, the STAT should follow accepted best practices. However, for some technical issues, there is not yet documentation about what constitutes best practice. To produce greater consistency among assessments in the approaches taken to common technical problems, the STATs should follow the *Accepted Practices Guidelines*. The STATs may diverge from the guidelines if they provide adequate justification to the review group and in the assessment document.

For a stock identified as needing a rebuilding analysis, a STAT member is strongly encouraged to attend the SSC meeting at which the draft rebuilding plan is reviewed.

5.5. National Marine Fisheries Service Responsibilities

The NMFS Southwest Fisheries Science Center (SWFSC) provides a staff member to work with STAR panel chairs and Council staff during the STAR process. The STAR panel chair and Council staff identify STAR panel members based on criteria for reviewer qualifications. The costs associated with these reviewers are borne by NMFS for Federal or CIE reviewers and the Council for other reviewers. NMFS also helps organize STAR panel meetings and develops meeting schedules.

NMFS (along with Council staff and the STAR panel chair) coordinates with the STATs to facilitate delivery of required materials by scheduled deadlines and in compliance with the TOR.

NMFS is encouraged to develop stand-alone documentation of key data sources under its purview that can be incorporated by reference in stock assessment reports. Such documentation should

include maps of the areas covered by surveys. There should also be thorough stand-alone documentation of stock assessment software and associated analytical methods that have been endorsed by the SSC. Such documentation will aid reviewers at STAR panels who may be unfamiliar with key data sources or modeling approaches and serves to maintain transparency in the STAR process.

5.6. Council Staff Responsibilities

The role of Council staff is to coordinate, monitor, and document the STAR process to ensure compliance with this TOR. Council staff using COP 9 guidelines develop assessment prioritization guidance for consideration by the Council, with further input from the NMFS, CPSMT, CPSAS and SSC. Council staff coordinate with the STAR panel chair and NMFS in a pre-review of assessment documents, to assure they are complete. If an assessment document is not in compliance with the minimum criteria of the TOR, Council staff returns the assessment document to the STAT with a list of deficiencies, a notice that the deadline has expired, or both. Council staff also coordinate with the STAR panel chair, STAT, and NMFS in a post-STAR review of the revised assessment document to ensure compliance with the TOR. When inconsistencies are identified, Council staff request appropriate revisions to be made by the STAT in time for briefing book deadlines. Stock assessment documents should strive to be compliant with the TOR, but inadvertent omission of a few elements will not be grounds to reject a stock assessment document for management purposes (though it may be sent back for revisions). Intentional omission should be justified.

Council staff attend and monitor all STAR panel meetings to ensure continuity and adherence to the TOR and the independent review requirements of COP 4. If inconsistencies with the TOR occur during STAR panel meetings, Council staff coordinate with the STAR panel chair to develop solutions to correct the inconsistencies. Council staff serves as an advisor to the STAT and STAR panel but does not serve as a member of the STAR panel. Council staff also attends and monitors the SSC review of stock assessments to ensure compliance with the TOR.

Council staff is responsible for timely issuance of meeting notices and distribution of stock assessments and other appropriate documents to relevant groups, including making documents publicly available during STAR panels. Council staff may work with the STAR panel chair and NMFS to develop the meeting agenda. Council staff also collects and maintains electronic copies of assessment documents and relevant reports from the STAR panel, SSC, CPSMT, CPSAS, and CIE reviewers, as well as letters from the public and any other relevant documents. These documents are typically posted on the Council's website.

5.7. Management Team Responsibilities

The CPSMT is responsible for identifying and evaluating potential management actions based on BSIA. In particular, the CPSMT uses stock assessment results and other information to make ABC, ACL, HG, and ACT recommendations to the Council. A CPSMT advisor attends the STAR panel meeting and serves as an advisor to the STAT and STAR panel on changes in fishing regulations that may influence data used in the assessment and the nature of the fishery in the future. The CPSMT advisor does not serve as a member of the STAR panel. The CPSMT should be involved early in the stock assessment process to provide guidance on fishing regulations to ensure the STAT accommodates regulatory changes as best as possible in the modelling framework.

Successful separation of science (e.g., STAT and STAR panels) from management (e.g., CPSMT) depends on assessment reviews being completed by the time the CPSMT meets to discuss preliminary ACL, HG, and ACT recommendations. The CPSMT should not seek revision or additional review of the stock assessments after they have been endorsed by the STAR panel. The CPSMT chair should communicate any unresolved issues to the SSC for consideration. The CPSMT, however, can request additional model projections from the STAT, to fully evaluate potential management actions. Any additional requests from the remainder of the CPSMT, CPSAS, or other outside sources should be conveyed through the CPSMT advisor and through Council staff. Any proposed changes should be discussed informally between the CPSMT and the STAT before being made official to avoid functional duplication of alternatives that are redundant or that are similarly bracketed by prior requests. Any such additional model projection requests would need to occur during the STAR panel with approval by the STAR panel chair.

5.8. Advisory Subpanel Responsibilities

A CPSAS advisor attends the STAR panel meeting and serves as an advisor to the STAT and STAR panel. The CPSAS advisor should review the data sources being used in the assessment prior to development of the stock assessment model and ensure that industry concerns regarding the adequacy of data used by the STAT are communicated and addressed early in the assessment process. The CPSAS advisor does not serve as a member of the STAR panel but may provide appropriate information and advice to the STAT and STAR panel during the meeting.

The CPSAS advisor is expected to attend the Council meeting where the relevant harvest recommendations are discussed.

5.9. State / Tribal Data Stewards and State / Tribal Agency Responsibilities

Most stock assessments rely on data collected by state agency and Tribal staff as part of their routine fishery monitoring and sampling activities. Although these data are generally available in the PacFIN and RecFIN repositories, some data from special collections may only be available directly from the state agencies or Tribes and may require special consideration (e.g., because of unusual sampling protocols). State and Tribal data stewards or other knowledgeable representatives from the state agencies and Tribes should work with the STATs to provide relevant stock assessment data. These individuals should (a) provide the STATs with information on available data that might be relevant to upcoming assessments, (b) provide data requested by the STATs in a timely manner, and (c) provide metadata, including guidance on any special attributes of the data that may need consideration for appropriate analysis and interpretation.

Data stewards should provide STATs with the available fishery data at least eight weeks prior to the draft document deadline to the review.. Once the available final data have been provided to the STAT, no further data changes will be made for use in the assessment, except with the approval of the STAT and the STAR Panel chair (See 5.4 Stock Assessment Team Responsibilities).

5.10. Scientific and Statistical Committee Responsibilities

The SSC plays multiple roles within the STAR process and provides the Council and its advisory bodies with technical advice related to the stock assessments and the STAR process. The SSC, in coordination with NMFS, state and Tribal agencies, and Council advisory bodies, is responsible

for developing the TOR, and the SSC provides guidelines and accepted practices for data uses and modeling approaches.

The SSC is responsible for overseeing the stock assessment review process and conducts reviews of catch-only updates. To that end, at regular intervals, the SSC should review progress towards the achievement of important milestones such as the assignment of members to STAR panels, provision of data to the STATs, and planning and implementation of STAR panels.

The SSC assigns an SSC member to act as each STAR panel chair. The STAR panel chair ideally attends the assigned STAR panel meeting and fulfills responsibilities described in the section "STAR Panel Chair Responsibilities."

The SSC conducts a final review of all types of stock assessment. Reviews of benchmark stock assessments by the SSC should not repeat the detailed technical review conducted by the STAR panel. The SSC reviews the stock assessment document, the STAR panel report. The SSC-CPSSC report (update assessments and catch-only updates) to ensure the assessment and review followed the TOR and *Accepted Practices Guidelines*. The SSC should note any concerns for the next assessment or rule that the assessment does not meet BSIA.

To ensure independence in the SSC review, SSC members who served on a STAT or STAR panel are welcome to contribute to discussions but would be required to recuse themselves if details of their assessments come up for a vote.

The SSC is responsible for making BSIA determinations and recommendations related to the OFL recommendations to the Council. The SSC is also responsible for assigning species managed by the Council to a specific category based on definitions of assessment categories in Appendix D, as well as determining the scientific uncertainty in estimating the OFL (i.e., the value for sigma). It is also the SSC's responsibility to determine when it is appropriate to make changes to proxies or the use of the parameters of harvest control rules.

If an assessment is found not to be acceptable for use in management, a benchmark assessment could be considered the following year. This consideration should include whether the issues leading to rejection of the current assessment are likely to be resolved the next year, and the implications of possible delays in assessments of other stocks, and resource availability such as staff time involved in conducting and reviewing the assessment.

6. LITERATURE CITED

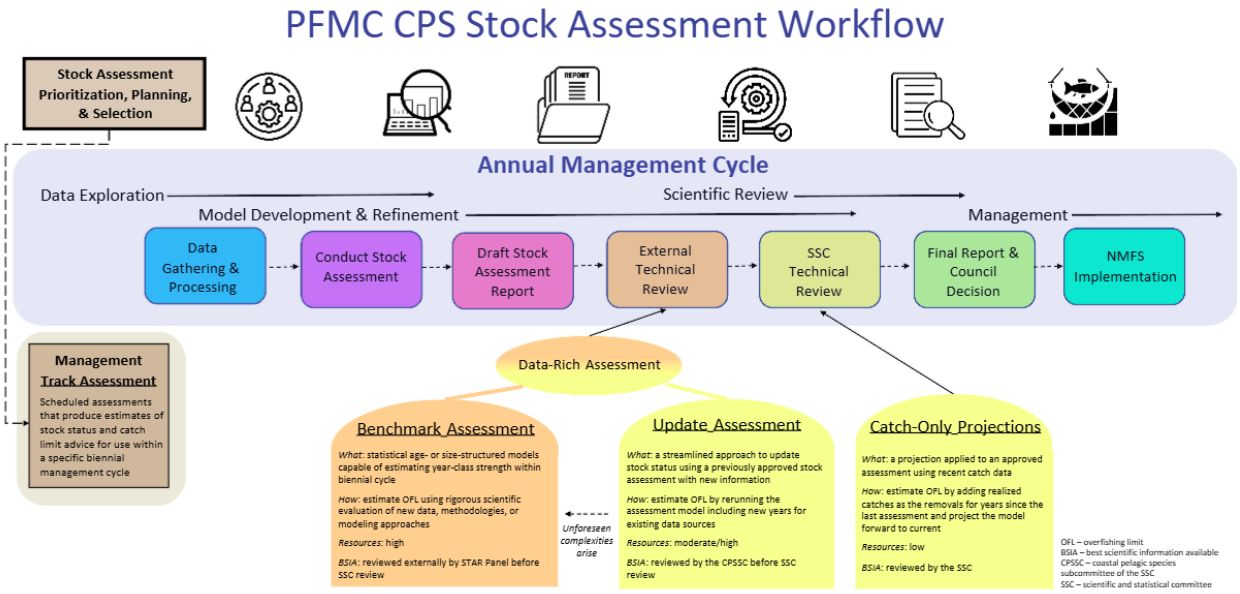
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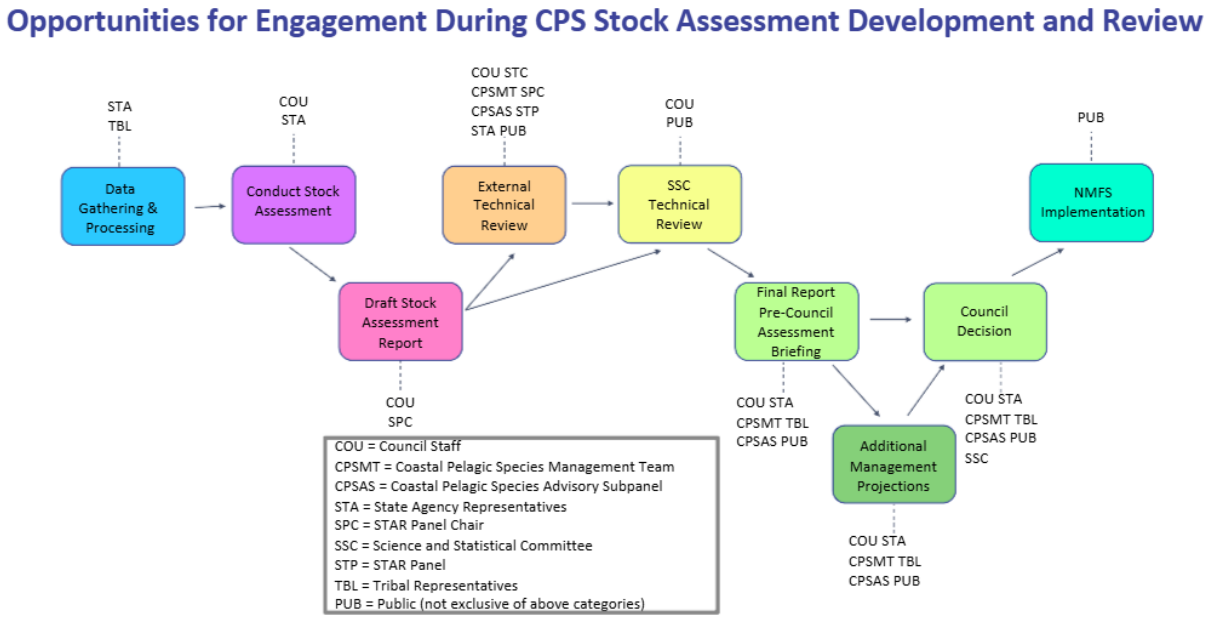
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6. FIGURES AND TABLES



[**placeholder Figure A**]. Overview of the stock assessment process for the Pacific Fishery Management Council from planning and prioritization to review to implementation.



[**placeholder Figure B**]. Explicit opportunities for engagement during the annual stock assessment development and review process.

APPENDIX A: OUTLINE FOR BENCHMARK STOCK ASSESSMENT DOCUMENTS

This is a general outline with a detailed description of elements to be included in benchmark stock assessment documents for CPS managed by the Council. This outline should be considered a guideline on how to organize and communicate stock assessment results. This outline is available in table form in Appendix C, which also includes columns indicating whether a given element is to be included in an update or catch-only projection. Stock assessment documents should strive to include all such elements, including relevant tables and figures, but inadvertent omission of a few elements will not be grounds to reject a stock assessment document for management purposes. Intentional omission should be justified. A checklist of elements to be included in benchmark or update stock assessment documents is included in Appendix C.

A. Title page and list of preparers

STAT names and affiliations either alphabetically or as first and secondary authors.

include text on how to cite the assessment document.

B. Executive Summary (should follow the template in Appendix B). Where possible the executive summary should paraphrase the shared content of the body of the report to minimize redundancy.

C. Introduction (expected to be 2-3 pages)

1. Scientific name, distribution, the basis for the choice of stock structure (as defined in the management unit in the FMP), including regional differences in life history or other biological characteristics taken into consideration.
2. A map showing the scope of the assessment and depicting boundaries for fisheries or data collection strata.
3. Important features of life history that may affect management (e.g., migration, sexual dimorphism, bathymetric demography).
4. Summary of management history (e.g., changes in mesh sizes, trip limits, or other management actions that may have significantly altered selection, catch rates, or discards). Important features of current fishery and relevant history of fishery.
5. Ecosystem considerations (described within documentation or utilizing documentation incorporated by reference [i.e., Ecosystem Status Report]) that include relevant information on how environmental drivers, prey, competition, predation, and/or (habitat requirements/preferences) may affect stock's status, vital rates (growth, survival, productivity, recruitment), or range and distribution. Ecosystem considerations may also include how these factors, cross-FMP interactions with other fisheries and human social dynamics that may affect the stock (e.g., reliance and dependence by fishing communities, non-target species constraining harvest rates). The length and depth of this section will depend on availability of information from published studies and Integrated Ecosystem Assessment reports, expertise of the STAT, and whether ecosystem factors contribute quantitative information to the assessment.

D. Data

Description of all data and sources used in the assessment; provide the rationale for excluding particular data sources; report on consulting with CPSAS and CPSMT advisors regarding the use of various data sources.

1. Fishery-dependent data: Commercial fisheries landings by state, year, and gear (PacFIN is the standard source for recent domestic commercial landings), historical catch estimates, discards, recreational fisheries catches, foreign removals; sample size information for length- and age-composition data by state, year, and gear, including both the number of trips and fish sampled. Description of methods to estimate abundance indices, sample size information by survey and year. Include complete tables, figures, and date of data extraction.
2. Fishery-independent data: Description of surveys used in the assessment, sample size information for length- and age- composition data by survey and year, including number of samples taken by any given sampling method and fish sampled.
3. Sources used to estimate biological parameters (e.g., natural mortality, growth, maturity schedules, etc.).
4. Environmental or ecosystem data or model products used in the stock assessment model and/or in the preparation of data or estimation of biological parameters.

E. Assessment

a. Model

1. History of modeling approaches used for this stock.
2. Response to the most recent recommendations from the previous STAR panel and SSC recommendations from review of the most recent previous benchmark assessment of that stock.
3. Description of new modeling approaches and changes made from the last assessment, with rationale.
4. Description of the version of the assessment software.
5. Assessment program and its version used for the assessment (i.e., date executable program file was compiled), description of model structure, definitions of fleets and areas. Description of how the first year that is included in the model was selected and how the population state at the time is defined (e.g., B_0, stable age structure, etc.).

6. Model parameters: estimated and pre-specified parameters, constraints on parameters, selectivity assumptions, natural mortality assumptions, treatment of age reading bias and/or imprecision, description of stock-recruitment constraints or components, critical assumptions and consequences of assumption failures.

b. Base model(s) selection and evaluation

1. Bridging Analysis: Briefly describe the bridging analysis performed to the previous assessment.
2. Evidence of search for balance between model realism and parsimony. Key model assumptions and structural choices (e.g., asymptotic vs. domed selectivities, constant vs. time-varying selectivities). Summary of alternate model configurations that were examined but rejected.
3. Evaluation of model parameters.
4. Residual analysis for the base-run configuration, e.g., residual plots, time series plots of observed and predicted values, etc.

5. Convergence status and convergence criteria for the base-run model (or proposed base-run). Randomization of starting parameter value run (e.g., jitter) results or other evidence of search for global best estimates.

c. Base-model(s) results

1. Table listing all parameters in the stock assessment model used for base model, their purpose (e.g., recruitment parameter, selectivity parameter) and whether or not the parameter was estimated in the stock assessment model. Include the associated asymptotic standard error estimates.
2. Population numbers and biomass at age × year × sex (if sex-specific M, growth, or selectivity) (may be provided as a text or spreadsheet file). Can be included in electronic appendices (SS report files), should be provided as supplementary material for assessments developed with alternative assessment platforms.
3. Time-series of total biomass, summary (1+) biomass, and spawning biomass (and/or spawning output), recruitment and fishing mortality or exploitation rate (table and figures).
4. Selectivity estimates (if not included elsewhere).
5. Stock-recruitment relationship.
6. Clear description of units for all outputs.
7. Description of how discard is included in yield estimates.

d. Evaluation of uncertainty in model results.

1. Sensitivity to assumptions about model structure, i.e., model specification uncertainty.
2. Sensitivity to data set choice (e.g., using emphasis factors to selectively remove data sources) and weighting schemes (e.g., MacAllister & Ianelli weighting versus Francis weighting vs. Dirichlet weighting for compositional data), which may also include a consideration of recent patterns in recruitment.
3. Parameter uncertainty (variance estimation conditioned on a given model, estimation framework, data set choice, and weighting scheme), including likelihood profiles for important assessment parameters (e.g., natural mortality, steepness, and R_0, and terminal year biomass). Likelihood profiles should indicate all likelihood values for individual components (e.g., indices by survey, compositional data for each type and fleet). This element for evaluating uncertainty includes expressing uncertainty in derived outputs of the model and estimating CVs using appropriate methods (e.g., bootstrap, asymptotic methods, Bayesian approaches, such as MCMC)
4. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of input data being dropped.
5. Historical analysis (plot of actual estimates from current and previous assessments).
6. If a range of model runs is used to characterize uncertainty it is important to provide some qualitative or quantitative information about relative probability of each. If no statements about relative probability can be made, then it is important to state that all scenarios (or all scenarios between the bounds depicted by the runs) are equally likely.

F. Harvest control rules and management advice

Provide the specifications for the harvest control rules used to calculate OFL, ABC and HG. Outline the basis for the calculation of the base model's sigma associated with the OFL value.

G. Discussion

a. Unresolved problems and major uncertainties.

Describe any special issues (e.g., unbalanced or questionable data, missing survey data) that complicate scientific assessment, questions about the best model scenario.

b. Regional management considerations.

Discussion of whether there is biological evidence for a regional management approach. If a regional management approach is desirable for the stock, but there are insufficient data for it, what are the research and data needs to address this issue?

c. Research and data needs.

1. Describe progress on Research and Data Needs items identified in the most recent previous benchmark stock assessment document and associated STAR panel report.
2. Describe new research and data needs and specify their priority (high, medium, low).

H. Acknowledgments.

Include STAR panel members and affiliations as well as names and affiliations of persons who contributed data, advice or information but were not part of the assessment team. The STAT is encouraged to ensure acknowledgement of contribution and can consult with members of the CPSAS and CPSMT if warranted in order to do so.

I. Literature cited.

J. Auxiliary files.

A list naming the required text files (complete parameter and data files in the native code of the stock assessment program) and any other supplementary electronic files that will accompany the assessment document when archived with the PFMC.

Input, output and executable files should be included and archived with the stock assessment document. For assessments conducted using Stock Synthesis, the file are: starter.ss, forecast.ss, control.ss, data.ss, Report.sso, and the Stock Synthesis model executable.

K. Appendices

Include the CPSAS lead appendix that summarizes on-the-water observations. Include any other relevant appendices.

APPENDIX B: TEMPLATE FOR AN EXECUTIVE SUMMARY FOR BENCHMARK STOCK ASSESSMENT DOCUMENTS

This appendix includes more detailed descriptions of elements to be included in a benchmark stock assessment Executive Summary. See Appendix C for a table that shows which elements need to be included in an update assessment and catch-only projections.

Stock	Species/area, including an evaluation of any potential biological basis for regional management..
Catches	Trends and current levels - include table for last ten years and graph with long term data.
Data and assessment	Date of last assessment, type of assessment model, data available, new information, and information lacking.
Stock biomass and dynamics	Trends and current levels relative to historical levels, description of uncertainty-include table for last 10 years and graph with long term historical estimates.
Recruitment	Trends and current levels relative to historical levels-include table for last 10 years and graph with long term estimates
Ecosystem considerations	A summary of reviewed environmental and ecosystem factors that appear to be correlated with stock dynamics. These may include variability in the physical environment, habitat, competitors, prey, or predators that directly or indirectly affects the stock's status, vital rates (growth, survival, productivity/recruitment) or range and distribution. Note which, if any, ecosystem factors are used in the assessment and how (e.g., as background information, in data preparations, as data inputs, in decisions about model structure).
Reference points	Inputs needed to apply control rules to compute the harvest guideline, including specification of each of the quantities on which the harvest guideline is based. .
Management performance	Catches in comparison to OFL, ABC, and HG, and ACL values for the most recent 10 years (when available), overfishing levels, actual catch and discard. Include OFL (encountered), OFL (retained) and OFL (dead) if different due to discard and discard mortality.
Unresolved problems and major uncertainties	Any special issues that complicate scientific assessment, questions about the best model scenario, etc.
Scientific Uncertainty	State the forecast biomass CV to calculate the sigma value.
Research and data needs	Identify information gaps that seriously impede the stock assessment.
Rebuilding Projections	Reference to the principal results from rebuilding analysis if the stock is overfished.

APPENDIX C: TABLE OF REQUIRED ELEMENTS FOR BENCHMARK ASSESSMENTS, UPDATE ASSESSMENTS, AND CATCH-ONLY PROJECTIONS

This table provides a comprehensive list of required elements for benchmark assessments, update assessments, and catch - only projections. See Appendix A for more detailed descriptions of each element and Appendix B for more detailed descriptions of the Executive Summary.

Section	Element	Benchmark/ full	Update	Catch-only projection
A	STAT names and affiliations	X	X	X
A	Citation instructions, following the title page.	X	X	X
B	Executive Summary	X	X	X
B	Exec. Summ., Stock description: Species and area.	X	X	X
B	Exec. Summ., Catches: Table with last 10 years; graph with long term information.	X	X	X
B	Exec. Summ., Data & assessment: Date and type of last assessment, model type and short description.	X	X	X
B	Exec. Summ., Stock biomass and dynamics: Trends table with last 10 years; graph with long term information.	X	X	X
B	Exec. Summ., Recruitment: Trends table with last 10 years; graph with long term information.	X	X	X
B	Exec. Summ., Exploitation status: Exploitation rates trends table with last 10 years.	X	X	X
~~B~~	~~Exec. Summ., Ecosystem considerations: Summary of relevant environmental and ecosystem factors.~~	~~X~~	~~No~~	~~No~~
B	Exec. Summ., Harvest control rules	X	X	X
B	Exec. Summ., Management performance: Catches compared to OFLs, ABCs, and HGs. Table with values for last 10 years. (To be provided by Council staff).	X	X	X
B	Exec. Summ., Unresolved problems and major uncertainties: Special issues that complicate the assessment.	X	If applicable	No
B	Exec. Summ., Scientific uncertainty: Sigma and how calculated.	X	X	X
B	Exec. Summ., Research and data needs: Identify information gaps.	X	If applicable	If applicable
B	Exec. Summ., Rebuilding projections: Reference to principal results from the rebuilding analysis (if applicable).	X	If applicable	If applicable
C	Introduction: 1. Scientific name, distribution, choice of stock structure.	X	X	X
C	Introduction: 2. A map showing the spatial scope of the assessment..	X	Refer to bchmrk	Refer to bchmrk
C	Introduction: 3. Important features of life history.	X	Refer to bchmrk	Refer to bchmrk
C	Introduction: 4. Ecosystem considerations.	X	Refer to bchmrk	Refer to bchmrk
C	Introduction: 5. Important features of current fishery.	X	Refer to bchmrk	Refer to bchmrk
C	Introduction: 6. Summary of management history.	X	Refer to bchmrk	Refer to bchmrk
C	Introduction: 7. Management performance: Catches compared to OFLs, ABCs, HGs. Table with values for last 10 years. (To be provided by Council staff).	X	X	X
C	Introduction: 8. Description of fisheries for this species off Canada, and/or Mexico, if such fisheries exist and information is available.	X	Refer to bchmrk	No
D	Data: 1. Fishery-dependent data: Commercial fisheries landings by	X	X	Refer to

	state, year and gear. Table with sample size information for length- and age-composition data, including both the number of trips and fish sampled.			bchmrk
D	Data: 2. Fishery-independent data: Description of surveys used. Table with sample size information for length- and age-composition data, including both the number of tows and fish sampled.	X	X	Refer to bchmrk
D	Data: 3. Sources used to estimate biological parameters.	X	Refer to bchmrk	Refer to bchmrk
D	Data: 4. Environmental or ecosystem data used.	X	Refer to bchmrk	Refer to bchmrk
E	Model: 1. History of modeling approaches.	X	Refer to bchmrk	Refer to bchmrk
E	Model: 2. Response to most recent past STAR panel recommendations.	X	Refer to bchmrk	No
E	Model: 4. Bridging analysis and description of new modeling approaches and other changes from the last assessment.	X	If applicable	No
E	Model: 5. General model specifications: Assessment program, model structure, area and fleet definitions, initial conditions.	X	Refer to bchmrk	Refer to bchmrk
E	Model: 6. Model parameters: estimated and fixed parameters, parameter constraints, priors, selectivity assumptions.	X	Refer to bchmrk	Refer to bchmrk
F	Base model selection: 1. Methods or evidence used to select final model.	X	Refer to bchmrk	No
F	Base model evaluation: 2. Evaluation of model parameters. ● Likelihood profile for natural mortality; ● Likelihood profile for steepness; ● Likelihood profile for R_0.	X	X	No
F	Base model evaluation: 3. Residual analysis, residual plots, time-series of observed and predicted values.	X	X	No
F	Base model evaluation: 4. Convergence status and convergence criteria, randomization runs.	X	X	No
G	Base-model results: 1. Table with all explicit parameters in the base model and associated standard deviations.	X	X	Refer to bchmrk
G	Base-model results: 2. Table with population numbers at age × year × sex, which may be included as a text or spreadsheet file.	X	X	Refer to bchmrk
G	Base-model results: 3. Table with time-series of total biomass, summary (1+) biomass, spawning biomass, and recruitment numbers.	X	X	X
G	Base-model results: 4. Selectivity estimates (if not included elsewhere).	X	VV	No
G	Base-model results: 5. Stock-recruitment relationship.	X	X	No
G	Base-model results: 6. OFL, ABC, and HG for the last 20 years.	X	X	X
G	Base-model results: 7. Clear description of units for all outputs.	X	X	X
G	Base-model results: 8. Description of how discard is included in catch estimates.	X	X	No
H	Evaluation of uncertainty: 1. Sensitivity runs to evaluate assumptions about model structure.	X	No	No
H	Evaluation of uncertainty: 2. Sensitivity to data set choice and weighting schemes: removal of data sources; alternative weighting methods for compositional data.	X	If applicable	No
H	Evaluation of uncertainty: 3. Parameter uncertainty: Uncertainty estimates for parameters and derived quantities; Likelihood profiles (tabular format) for M, h, and R_0.	X	X	No
H	Evaluation of uncertainty: 4. Retrospective analysis	X	X	No
H	Evaluation of uncertainty: 5. Historical analysis.	X	X	No
I	Harvest control rules: The OFL, ABC and HG harvest control rules:. Sigma and how it was calculated.	X	X	No
J	Unresolved problems and major uncertainties: Describe any special issues.	X	If applicable	If applicable

	Evaluation of scientific uncertainty.			
K	Regional management considerations. Discuss biological evidence for a regional management approach and provide the estimates of survey biomass in each management region using the standard survey index standardization software used in the assessment.	If applicable	If applicable	No
L	Research and data needs: 1. Describe progress on research and data needs identified in the most recent previous STAR panel.	If applicable	Refer to bchmrk	No

APPENDIX D: DEFINITIONS OF SPECIES CATEGORIES FOR CPS ASSESSMENTS AND RULES FOR MAKING CATEGORY ASSIGNMENTS FOR BENCHMARK OR UPDATE ASSESSMENTS

Category 3: OFL is derived from historical catch.	**a**	No reliable catch history. No basis for establishing OFL.
	b	Reliable catches estimates only for recent years. OFL is the average catch during a period when stock is considered to be stable and close to B_{MSY} equilibrium on the basis of expert judgment.
Category 2: OFL is derived from model output (or natural mortality).	**a**	M*survey biomass assessment.
	b	Historical catches, fishery-dependent trend information only. An aggregate population model is fit to the available information.
	c	Historical catches, survey trend information, or at least one absolute abundance estimate. An aggregate population model is fit to the available information.
	d	Full age-structured assessment, but results are substantially more uncertain than assessments used in the calculation of the P* buffer. The SSC will provide a rationale for each stock placed in this category. Reasons could include that assessment results are very sensitive to model and data assumptions, or that the assessment has not been updated for many years.
Category 1: OFL is based on E_{MSY} or E_{MSY} proxy from model output. ABC based on P* buffer.	**a**	Reliable compositional (age and/or size) data sufficient to resolve year-class strength and growth characteristics. Only fishery-dependent trend information available. Age/size structured assessment model.
	b	As in 1a, but trend information is also available from surveys. Age/size structured assessment model.
	c	Age/size structured assessment model with reliable estimation of the stock-recruit relationship.

APPENDIX E: TIMELINE TABLE FOR CPS STOCK ASSESSMENT AND REVIEW

Event	Timing	STAT	STAR	Panel Chair	Council Staff	SSC CPS SUB	NMFS POC	MT Rep.	AS Rep.
Assessment prioritization finalized	Nov. of even years								
STAR panel schedule drafted	After June Council meeting in even years						X		
Accepted practices and TOR update	As needed	X			X	X		X	X
Final data cutoff	8 weeks before STAR panel document delivery to review body	X			X				
Pre-STAR draft stock assessment document submitted	3 weeks before STAR panel	X							
Pre-review for completion and compliance with TOR	2 weeks before STAR panel			X	X		X		
Pre-STAR draft assessment distributed to STAR panel	2 weeks before STAR panel			X	X				
STAR panel	Various	X	X	X	X			X	X
STAR panel complete report due	2 weeks after end of STAR panel		X	X	X			X	X
Comments on draft assessment report due	2 weeks after end of STAR panel		X	X					
Revised draft assessment	3 weeks after end of STAR panel	X							
Post-STAR review for compliance with TOR	2 weeks after revised draft assessment submission			X	X		X		
Pre-SSC draft assessment	Briefing Book deadline when assessment considered	X							
SSC Review	Council meeting at which assessment is adopted			X	X	X			
Final version of assessment	Three months after assessment is adopted	X							
All files submitted to assessment archive	Three months after assessment is adopted	X							
Post-assessment process review meeting	Dec. of odd years (if needed)			X	X	X		X	X