TERMS OF REFERENCE

FOR THE

COASTAL PELAGIC SPECIES STOCK ASSESSMENT REVIEW PROCESS FOR 2023-2024

NOVEMBER 2022

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1. SUMMARY OF MAJOR CHANGES FROM THE 2021 TERMS OF REFERENCE

In 2021 and prior, a combined Terms of Reference (TOR) for both groundfish and coastal pelagic species (CPS) was used. In 2022, separate TOR were developed for groundfish and CPS. While this entailed too many changes to enumerate here, all items specific to groundfish were dropped, along with all references to data-moderate and data-limited stock assessments, and additional details relevant to CPS were added.

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 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 panel process for CPS, including the timing and participation by Council and panel bodies is provided in Appendix F: Timeline Table for CPS Stock Assessment and Review.

Parties involved in the process are Council members, Council staff, members of Council advisory bodies, including the Scientific and Statistical Committee (SSC), the CPS Management Team (CPSMT), the CPS Advisory Subpanel (CPSAS), the National Marine Fisheries Service (NMFS), state agencies, and interested persons. The review by the STAR panel is a key element in an overall procedure designed to investigate the technical merits of stock assessments and other relevant scientific information. 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 employed to produce stock assessments. The extended time frame and resources required for such reviews limits the number of assessments reviewable at a given time, thus requiring a stock assessment prioritization and 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, stock assessment teams (STATs), Council staff, and Council advisory groups. 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. The SSC has developed a separate TOR for reviewing new methods that might be used in stock assessments.

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, 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, beginning with data collection 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 that are outlined below:

There are several distinct types of assessment products, which are subject to different review procedures.
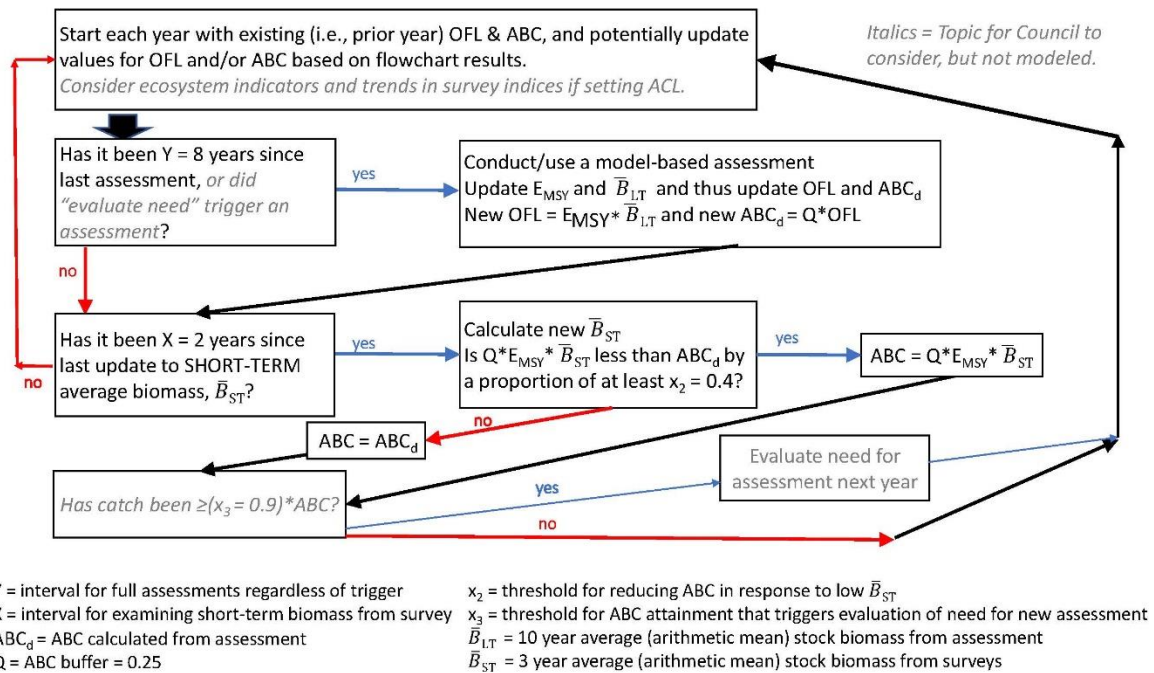
1. **Full/Benchmark assessment**: The least restricted assessment type is a **"full (or benchmark) assessment,"** which makes greater use of data than other assessment types. A full assessment can be applied to a stock that has not been previously assessed or re-applied to a previously assessed stock, in which case the full assessment involves a re-examination of the underlying assumptions, data, and model parameters previously used to assess the stock. Full assessments are reviewed via the full STAR process, which includes STAR panel review. 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 them to address them.

2. **Update assessment**: Resource limitations constrain the number of full 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 full assessments. An update assessment is defined as an assessment that maintains the model structure of the previous full assessment, with additions generally restricted to data that have become available since the last assessment added to previously evaluated time series, along with limited allowable minor alterations (described further in section 7 of this document). Authors are encouraged to incorporate sections by reference to the previous full assessment where methods do not differ appreciably. Update assessments are reviewed by the CPS subcommittee of the SSC rather than by a STAR panel.

3. **Catch-only or catch and climate-only projection**: In some cases, only recent fisheries catch or catch and climate information are added to an existing, approved stock assessment model to generate catch-only or catch and climate-only projections for the stock. The latter case is applicable only to benchmark assessments that include a relationship between environmental variables and environmental parameters. Catch-only and catch and climate-only projections are reviewed by the CPS subcommittee of the SSC rather than by a STAR panel. Catch-only projection documents are short, but still require careful review, including ensuring catches are correctly distributed among fleets in fixed and forecasted years.

4. **Catch Report**: A **"catch report"** tabulates fishery removals over recent years to ensure

that they are below specified annual catch limits (ACLs). A catch report would be produced when little new information is available about the stock to inform the assessment. Catch reports may be reviewed by the SSC.

Stock assessment products are assigned to one of three categories based on the amount of information available for the species, model diagnostics, and subsequent uncertainty associated with the stock assessments. Assignments are made by the SSC based on the recommendations from the STAR panels. Category 1 includes the most robust assessments that have the smallest number of fixed parameters leading to a better characterization of uncertainty. Category 2 can be used to categorize full 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, and/or make unusual simplifying assumptions (e.g., no recruitment deviations), and Category 3 is primarily for assessments with the largest number of fixed parameters and underestimates of uncertainty associated with assessment results. Detailed definitions for each of the three categories are provided in Appendix E: Definitions of Species Categories for CPS Assessments and Rules for Making Category Assignments for Full or Update Assessments.

3. STOCK ASSESSMENT PRIORITIZATION

The Council adopted a new CPS stock assessment prioritization process at its June 2019 meeting. Before then, Pacific sardine benchmark assessments were conducted every three years with updates in interim years, Pacific mackerel benchmark assessments were conducted every four years with a catch-only projection in the second interim year, and assessments for other CPS stocks did not have a set schedule. The Council is set to implement a CPS stock assessment prioritization agenda item for the first time in November 2022. In November 2021, the Council adopted a framework for managing the central subpopulation of northern anchovy (CSNA), including timelines for conducting stock assessments and triggers for revising acceptable biological catch (ABC) levels in response to changes in stock abundance indices. The flowchart (Figure 1) describes the eight-year assessment schedule and how the Council can consider new data in revising ABC levels or if there is a need for another assessment sooner than the scheduled eight years (see Council Operating Procedure [COP] 9 for full details).

Start each year with existing (i.e., prior year) OFL & ABC, and potentially update values for OFL and/or ABC based on flowchart results.
Consider ecosystem indicators and trends in survey indices if setting ACL.

Italics = Topic for Council to consider, but not modeled.

Has it been Y = 8 years since last assessment, *or did "evaluate need" trigger an assessment?*

yes →

Conduct/use a model-based assessment
Update E_{MSY} and $\bar{B}_{LT}$ and thus update OFL and ABC_d
New OFL = $E_{MSY} * \bar{B}_{LT}$ and new $ABC_d = Q*OFL$

no

Has it been X = 2 years since last update to SHORT-TERM average biomass, $\bar{B}_{ST}$?

no

yes →

Calculate new $\bar{B}_{ST}$
Is $Q*E_{MSY} * \bar{B}_{ST}$ less than ABC_d by a proportion of at least $x_2 = 0.4$?

yes →

$ABC = Q*E_{MSY} * \bar{B}_{ST}$

no →

$ABC = ABC_d$

Has catch been $\geq (x_3 = 0.9)*ABC$?

yes

Evaluate need for assessment next year

no

Y = interval for full assessments regardless of trigger
X = interval for examining short-term biomass from survey
ABC_d = ABC calculated from assessment
Q = ABC buffer = 0.25

x_2 = threshold for reducing ABC in response to low $\bar{B}_{ST}$
x_3 = threshold for ABC attainment that triggers evaluation of need for new assessment
$\bar{B}_{LT}$ = 10 year average (arithmetic mean) stock biomass from assessment
$\bar{B}_{ST}$ = 3 year average (arithmetic mean) stock biomass from surveys

Figure 1. Flowchart from COP 9 that depicts the framework for managing the central subpopulation of northern anchovy with the parameter values to be utilized

4. STOCK ASSESSMENT REVIEW PROCESS GOALS AND OBJECTIVES

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

1) ensure that stock assessments represent the best scientific information available and 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) provide an independent review of stock assessments;
5) increase understanding and acceptance of stock assessments and peer reviews by all members of the Council family;
6) identify research needed to improve assessments, reviews, and fishery management in the future; and
7) use assessment and review resources effectively and efficiently.

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 advice has been used when it approves fishery management recommendations made by the Council. The Council

uses advice from the SSC to determine that the information on which it bases its recommendations represents the best scientific information available (BSIA) as defined by criteria described under National Standard 2 of the MSA. The STAT and STAR panel reviewers should be aware of the criteria and strive to create a final assessment that reflects the BSIA. These BSIA criteria include inclusiveness, transparency, and openness in communication, which 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, NMFS, and the Secretary of Commerce 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 NMFS Science Center staff member will be assigned as the Point of Contact (POC) to facilitate and assist Council staff in overseeing the stock assessment process. 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 full stock assessments and other assessments as determined during the stock assessment prioritization process to advance the best scientific information available to the Council. Types of stock assessment other than full do not necessarily undergo review by a STAR panel. 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) review 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) discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting, work with the STATs to correct deficiencies, and, when possible, suggest new tools or analyses to improve future assessments; and
  4) develop STAR panel reports for all reviewed assessments to document meeting discussion

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[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."

and recommendations.

STAR panels include a chair appointed by the SSC and three other experienced stock assessment analysts knowledgeable of the specific modeling approaches being reviewed. Details of the Chair's responsibilities are provided in a separate section below. Of these three other members, at least one should be appointed from the Center for Independent Experts (CIE) and at least one should be familiar with West Coast stock assessment practices. 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.

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 National Oceanic and Atmospheric Administration 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 representatives of 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 representatives, and the public are all legitimate meeting participants who should be accommodated in discussions. It is the STAR panel Chair's responsibility 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 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 or the Southwest Fisheries Science Center posts background materials on an accessible site (e.g., ftp) prior to the meeting and makes hard copies available upon request. A STAR panel normally meets for four to five days. The panel Chair should schedule the meeting 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.

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 panel process to ensure the best scientific information available is used in stock assessments. 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 default approaches they should use 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 STAR panel unless there have been changes in the approach or method previously reviewed, or under other extenuating circumstances.

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 panel should not impose their preferred methodologies when this is a matter of professional opinion. 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 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, caution should be exercised in making 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 (i.e., early dismissal of a STAT). If follow-up work by the STAT is required after the review meeting (such as Markov chain Monte Carlo (MCMC) integration of an alternative model created during the STAR panel meeting), this should be completed before the briefing book deadline for the Council meeting at which the assessment is scheduled for review.

For some stocks selected for full assessments, the available data may prove to be insufficient to support a category 1 assessment (Appendix E: Definitions of Species Categories for CPS Assessments and Rules for Making Category Assignments for Full or Update Assessments). 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. If useful results have been produced, 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 of 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.

Uncertainty in Stock Assessments
The STAR panel review focuses on technical aspects of full stock assessments. It is recognized that no model or data set is perfect or issue-free. Therefore, outputs of a broad range of model runs should be evaluated to better define the scope of the accepted model results. 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 on other grounds should be identified by the panel and excluded from the alternatives upon which management advice is to be developed. The panel Chair should schedule the meeting to give the STAT adequate time to respond to requests for additional analyses/ information category designation, and the associated sigma value should be determined at the STAR panel.

Determination of assessment model uncertainty
The STAR panel and STAT in consultation with Council staff should propose an appropriate method for measuring the scientific uncertainty in the stock assessment, known as "sigma." Uncertainty should be based on the OFL uncertainty, to correspond to the newly-adopted approach for addressing scientific uncertainty (Wetzel and Hamel 2019; Privitera-Johnson and Punt 2020).

Typically, sigma would be based on the larger of the category-specific default value or the asymptotic uncertainty estimate associated with the estimated OFL distribution. The SSC will determine 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 account for the increase in scientific uncertainty with time, incorporating a concomitant increase in the buffer between the overfishing limit and acceptable biological catch with each year since the most recent last full or update assessment, which should be accounted for in producing projections (Wetzel and Hamel 2019; Privitera-Johnson and Punt 2020).

Areas of Disagreement
STATs and STAR panels are required to make an honest attempt to resolve any areas of disagreement during the meeting. Occasionally, fundamental differences of opinions may remain between the STAR panel and STAT that cannot be resolved during the STAR panel meeting. In such cases, the STAR panel must document the areas of disagreement in its report. While identifying areas of disagreement, the following questions should be discussed at the meeting:
1) Are there any differences in opinion about the use or exclusion of data?
2) Are there any differences in opinion about the choice of the base model?
3) Are there any differences in opinion about the characterization of uncertainty?

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.

STAR Panel Report
The STAR panel report should be developed and approved by the full panel shortly after the STAR panel meeting.

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

o 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 E and associated rules for relating category designations with sigma (the metric for an assessment's scientific uncertainty). The SSC will consider this recommendation when ultimately deciding the appropriate stock category.

The STAR panel report should be made available for review by the STAT within two weeks of the conclusion of the review, with sufficient time that the STAT can comment on issues of fact or differences in interpretation prior to the briefing book deadline. If differences of opinion come up during review of the STAR panel report, the STAR panel and STAT should attempt to resolve them. Otherwise, the areas of disagreement must be documented in the 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 the 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's responsibility to ensure that STAR panel participants adhere to the TOR and that the meeting is run effectively and efficiently. This avoids discussing topics beyond the scope of the assessment review to focus efforts on the task at hand. Additional resources on running an efficient review can be provided by Council staff upon request. 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. Participation in any pre-assessment workshop is desirable to provide input on the direction of the assessment early in the process and to be aware of all issues raised. The STAR panel Chair in collaboration with Council staff should prepare a report detailing issues raised at a pre-assessment workshop and ensure that any issues raised at a pre-assessment workshop are adequately addressed. The STAR panel Chair (or an appropriate designee) should document modeling decisions agreed to at any pre-assessment workshop, including the spatial strata for assessments, via the pre-assessment meeting workshop report, in consultation with the STAT.

It is the obligation of the STAR panel Chair, in consultation with other panel members, to prioritize requests to the STAT for additional analyses and to make certain that STAT responses are thorough and clearly presented. 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. The STAR panel Chair is responsible for preparing the final draft of the panel report, obtaining panel approval, providing a copy for STAT review and comment, and submitting it to the Council in a timely fashion (i.e., as dictated by the schedule below).

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.

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. Any post-STAR drafts of the stock assessment must be reviewed and approved by the STAR panel Chair. The assessment document can only be given to Council staff for distribution after it has been endorsed by the STAR panel Chair, and when it is accompanied by a complete and approved STAR panel report. 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 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. In addition, the Chair is expected to participate in the stock assessment process review meeting to discuss any issues and provide feedback to improve the process for future assessment cycles.

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 within two weeks after the deadline for that draft.
3. Comments on the post-SSC assessment document draft, if there is one, should be returned to the STAT within two weeks after the Council meeting at which it is discussed.

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 accepted standards of quality, and in accordance with these TOR.

For any assessment 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;
2) a "revised draft" for presentation to the SSC, the Council, CPSMT, and CPSAS; and
3) a "final version" to be posted on the Council's website.

For assessment products reviewed only by the CPS SSC subcommittee, the STAT is responsible for preparing two versions of the stock assessment document:
1) a "draft" for discussion during an SSC subcommittee review; and
2) a "final version" to be posted on the Council's website.

The draft assessment document for full and update assessments should follow the outline in Appendix B with an optional executive summary (required in the final version) as in the template in 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 Coordinator three 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 draft assessment and supporting materials would be distributed to the STAR panel and the CPSMT and CPSAS representatives 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 as well as providing an errata sheet. If the assessment document does not meet minimum criteria of the TOR, 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. Figures should be provided with captions and sufficient written explanation to document the analysis and 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 within three weeks of the end of the review panel meeting. The revised draft must be finalized 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. Other than changes recommended by the SSC, 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 following the meeting in which 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. If the STAR panel, nonetheless, recommends using outputs of certain sensitivity runs to bracket uncertainty in the assessment, the results of those runs should be appended to the draft assessment and provided to the Council and its advisory bodies.

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. Any pre-assessment workshops should be held with sufficient time to conduct preliminary analyses, gather data, and begin initial assessment planning. The workshops allow stakeholders to discuss the available data, the potential data gaps, and have the STATs lead discussions regarding the anticipated foundational assumptions/issues and their treatment within the assessment. Sufficient detail and presentation of considerations should be provided to facilitate discussions. The STAR panel Chair, advisors to the STAR panel, Council staff, and relevant data stewards should ideally participate in the workshop to interpret and critically evaluate potential

data sources. One goal of a pre-assessment workshop is to provide quality control of the data that will be used in assessments; the STAT should present preliminary data plots and analyses. The concerns raised in a pre-assessment workshop should be submitted to the STAT in writing by the Chair of the review meeting and major concerns and responses should be documented in the draft assessment.

STATs are encouraged to evaluate alternative models and analyses that incorporate ecosystem considerations and cross-FMP interactions that may affect stock dynamics. Early coordination with the Integrated Ecosystem Assessment team to evaluate ecosystem considerations is recommended and, at a minimum, the predators and food habits of the subject species should be included in the ecosystem considerations section of the assessment. When new data sources or methods, which could be used in many assessments or are likely contentious, are planned for inclusion in the assessment, they should typically 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 panel 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 the new data sources so that it can evaluate the sensitivity of model outputs to these data sources.

Final data are due to the STATs at least eight (ideally twelve) weeks in advance of the STAR panel meeting, to allow sufficient time for data processing, assessment model development, assessment document preparation, and document review. STATs are not obliged to use data provided after the deadline and delays in provision by responsible parties may affect the availability of information used in the final assessment. Deadlines for the 2023-2024 stock assessment reviews are provided in Appendix A.

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 representative early in the assessment process, keep the CPSAS informed of the data being used, and respond to any concerns that are raised. The STAT should also contact the CPSMT representative 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.

Barring exceptional circumstances, STAT members who are not attending the STAR panel meeting should be available remotely to assist with responses when needed. 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; 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 general agreement on 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 representative 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 facilitate and assist in the STAR process.

NMFS, with assistance from the CPSMT, works to develop assessment prioritization guidance, a ranking of stocks for assessment that considers a range of factors, for consideration by the Council. NMFS also develops a draft STAR panel schedule for the Council review. 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 not affiliated with a Federal agency or the CIE. NMFS also helps organize STAR panel meetings and develops meeting schedules.

NMFS (along with the 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 inform assessments that can be incorporated by reference in stock assessments. Such documentation should include digital maps of the geographical 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 can be incorporated by reference in stock assessments and 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 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 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 for consistency with the TOR. When inconsistencies are identified, the STAT is requested to make appropriate revisions in time for briefing book deadlines.

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. 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 the best scientific information available. In particular, the CPSMT uses stock assessment results and other information to make ABC, ACL, HG, and ACT recommendations to the Council. A CPSMT representative 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 representative 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. *This involvement should ideally include participating in any pre-assessment workshops.*

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 representative to avoid communication issues, and formally requested in writing to the STAT through Council staff. Any proposed changes should be discussed informally between the CPSMT and the STAT before being made officially 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.*

5.8. Advisory Subpanel Responsibilities

A CPSAS representative attends the STAR panel meeting and serves as an advisor to the STAT and STAR panel. Participation in any pre-assessment workshop is expected to provide input on direction of the assessment early in the process. The CPSAS representative 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 representative does not serve as a member of the STAR panel, but, as a legitimate meeting participant, may provide appropriate information and advice to the STAT and STAR panel during the meeting.

The CPSAS representative 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 and tribal agency staff as part of their routine fishery monitoring and sampling activities. Although these data are generally housed and available from the PacFIN and RecFIN data repositories, some data from special collections may only be available directly from the state or tribal agencies or may require special consideration (e.g., because of unusual sampling protocols). State and tribal data stewards or other knowledgeable representatives from the state and tribal agencies should be tasked with working 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, (c) provide guidance on any special attributes of the data that may need consideration for their correct analysis and interpretation, and (d) attend any pre-assessment workshops organized for the assessments. Data stewards should provide STATs with final data at least twelve (ideally eight) weeks prior to the start of the STAR panel. Specific deadlines for data are specified in Appendix A.

5.10.   Scientific and Statistical Committee Responsibilities

The Council's 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 and Council advisory bodies, is responsible for developing the TOR, and the SSC provides guidelines for accepted practices for data and modeling approaches for developing stock assessments.

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

The SSC assigns an SSC member to act as the STAR panel Chair. The STAR panel Chair ideally attends any pre-assessment workshop and the assigned STAR panel meeting and fulfills responsibilities described in the section "STAR Panel Chair Responsibilities".

The SSC conducts a final review of all the types of stock assessment. Reviews of full stock assessments (either by the CPS Subcommittee or the full SSC) should not repeat the detailed technical review conducted by the STAR panel. The SSC reviews the stock assessment document, the STAR panel report, and the CPS Subcommittee report (when applicable) to ensure the assessment and review followed the *Terms of Reference* and *Accepted Practices Guidelines*. The SSC should generally note any concerns for the next assessment and propose changes to an assessment only under exceptional circumstances, such as finding an error or a gross violation of the *Terms of Reference* or *Accepted Practices Guidelines.* Although the SSC has the discretion to look into concerns it deems critical to evaluate, even if this requires requests for additional model runs, the SSC should strive to limit its attention to issues that were not covered in the *Terms of Reference* and/or *Accepted Practices Guideline* or, in some cases, decisions concerning the base model configuration that may not have considered and evaluated all factors and diagnostics associated with the configuration.

The SSC also reviews the STAR panel recommendations and serves as an arbitrator to resolve disagreements between the STAT and the STAR panel if such disagreements occurred during the review meeting. The SSC is responsible for reviewing and endorsing any additional analytical work requested from the STAT by the CPSMT or Council staff after the stock assessment has been reviewed by the STAR panel. To ensure independence in the SSC review, the SSC members who served on the STAT or STAR panel for the stock assessment being reviewed are required to recuse themselves; their involvement in the review being limited to providing factual information and answering questions. The SSC may request post-STAR analyses and model changes to arrive at an assessment that is acceptable to the SSC, but the requests should be limited and focused.

The SSC is responsible for making 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 E, 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 full assessment would be considered the following year. This consideration should include whether the issues leading to rejection of the current assessment are likely to be addressable the next year, and the implications of possible delays in assessments of other stocks.

6. FULL ASSESSMENTS

Full stock assessments 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. Each full assessment model has underlying equations to mimic the dynamic processes of fish growth, maturation, reproduction, and mortality (due both to natural causes and related to fishing). The models produce annual estimates of age-specific abundance, biomass, and catch that are compared to the available observational data to find sets of parameters that best-fit the available data. A full assessment in its simplest form might be used for a stock having sexes with identical size-at-age, a single fishery (with an associated series of annual catches, age-specific fishery selection coefficients, weights-at-age, and age-compositional data), and a single survey (with an associated series of annual biomass index values, age-specific survey selection coefficients, and age-compositional data).

7. UPDATE ASSESSMENTS

An update assessment reruns an approved assessment model with the data series extended to include new data.

An update assessment is generally restricted to the addition of new data that have become available since the last full assessment. It must carry forward the fundamental structure of the last full 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. Particularly, when an update assessment is developed, with the exceptions noted below, no substantial changes should be made to:

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 from the sources used in the original assessment.
2) the software used in programming the assessment. It is acceptable to use a newer version of Stock Synthesis (or other assessment software used). 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 original assessment.
3) the assumptions and structure of the population dynamics model underlying the stock 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.

Major changes to the assessment should be postponed until the next full assessment. Alterations to the assessment can be considered as long as the update assessment clearly documents and justifies the need for such changes and provides a step-by-step transition (via sensitivity analysis) from the last full assessment to an update assessment under review. If more substantial changes to the model are contemplated by the STAT, a full assessment may be recommended for the next year.

Alterations are allowed when there are clear and straightforward improvements in the input data and/or how they are processed and analyzed for use in the model. It is acceptable to use the newer versions of software to process input data (e.g., software for Generalized Linear Mixed Model [GLMM] analysis of survey catch data), with comparison provided between results generated from the same dataset using old and new software versions. It is also allowed to follow a model selection process used in the original assessment for model inputs (e.g., GLMM) rather than using the model selected in the original assessment. It is acceptable to use updated parameter priors as long as comparison of model results is provided while using old and new priors.

Examples of other allowable alterations include: 1) the weighting of the various data components (including the use of methods for tuning the variances of the data components); when data weightings in the assessment were chosen based on a repeatable process, it is allowed to repeat this same process rather than to use identical weighting as in the original assessment; 2) changes to the selectivity blocks to extend time periods for the end years of the model; 3) correcting data entry errors; 4) bug fixes in software programming; and 5) improved estimates of parameters such as steepness or the natural mortality rate due to new research or updated meta-analyses. This list is not meant to be exhaustive, and other alterations can be considered if warranted. Ideally, improved data or methods used to process and analyze data would be reviewed by the SSC prior to being used in assessments.

Review of Update Assessments

Update assessments are reviewed by members of the CPS subcommittee, during a single meeting. Reviews typically require one day, with an option of early dismissal of a STAT. The STAT is responsible for producing the update assessment document and submitting it to Council staff in a timely manner, before the CPS SSC subcommittee reviews the assessment. The document should follow the outline in Appendix B and include an Executive Summary based on the template in Appendix C. The STAT, however, can reference the last full 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 retrospective analysis illustrating 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 full assessment. The assessment document should include a detailed step-by-step transition from the last full assessment to the update under review.

In addition to the update assessment document, Council staff will provide the CPS subcommittee with a copy of the last full stock assessment reviewed via the STAR process and the associated STAR panel report. The Chair of the CPS subcommittee 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 representatives, 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 full stock assessment for the species would typically be recommended for the next year.

Shortly after the meeting, the CPS subcommittee issues a review 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 full assessment is conducted.

The report is reviewed by the full SSC at the appropriate Council meeting. If CPS subcommittee 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.

8. CATCH-ONLY AND CATCH AND CLIMATE-ONLY PROJECTIONS

In some circumstances, a STAT may be asked to produce an update assessment using only recent fisheries catch or catch and climate information to generate stock projections. 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. Projections with catches and climate may have new data to inform the deviations around the stock-recruitment relationship in the model. All projections become more uncertain with increasing the projection period. 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. 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. 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. Catch-only and catch and climate-only projections are initially reviewed by the CPS subcommittee and subsequently by the full SSC.

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. Results of these projections including the OFL, ABC, HG, and spawning biomass projections must be provided in a table such as Table 1. The catch data used in the catch-only projection should be compared to the previous assessment or update, and differences from catch estimates in years prior to the end of that previous assessment should be explained. If differences result in substantial changes in model outputs or estimates, a benchmark or update assessment may be preferable. Projections that use climate time series must provide plots or tables of the time series used in the projections.

Table 1. Example of the table to be included in catch-only projections. The fishing year starts in July of first year and ends in June of second year. Annual catch target (ACT) and annual catch limit (ACL) values, USA catch, updated catch values, summary age 1+ biomass, and spawning biomass 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

A catch-only projection report should follow a format similar to what is used for the executive summary of a full or update assessment, with a few additional items. The report should include the following sections:

- Title page, using the same format as for a full or update stock assessment.
- Introduction explaining the need for the catch-only projection.
- Stock description.
- Catches, including comparison plots (if needed) of changes in the catch series.
- Data and assessment.
- Stock biomass and dynamics.
- Recruitment.
- Exploitation status.
- Ecosystem considerations.
- Harvest control rules.
- Management performance.
- Unresolved problems and major uncertainties.
- Research and data needs.
- Table with summary time series for the base model.

See Appendix C for more details on the contents of most of these items.

9. CATCH REPORTS

In certain cases, only limited new data are available to inform the assessment. In such cases, it is appropriate for the STAT 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.

Catch reports are reviewed by the SSC. The STAT is responsible for producing the catch report and submitting it to Council staff in a timely manner, before the SSC reviews it. The report should be brief and provide enough details on how total removals 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.

In common with a review of an assessment update, Council staff will provide the SSC with the catch report, along with a copy of the last full stock assessment reviewed via the STAR process, and the associated STAR panel report. CPSMT and CPSAS representatives, as well as Council staff, should also be present for the review.

10. LITERATURE CITED

Hilborn, R. and C. J. Walters. 1992. Quantitative Fisheries Stock Assessment: Choice, Dynamics and Uncertainty. Chapman and Hall, New York.

MacCall, A. D., R. A. Klingbeil, and R. D. Methot. 1985. Recent increased abundance and potential productivity of Pacific mackerel (Scomber japonicus). Calif. Coop. Oceanic Fish. Invest. Rep. 26:119-129.

Privitera-Johnson, K. M. and A. E. Punt. 2020. Leveraging scientific uncertainty in fisheries management for estimating among-assessment variation in overfishing limits. ICES J. of Mar.Sci. 77:515-526.

Wetzel, C.R. and O. Hamel. 2019. Accounting for increased uncertainty in setting precautionary harvest limits from past assessments. Agenda Item G.3. Supplemental Revised Attachment 3.

APPENDIX A: 2023 CPS STOCK ASSESSMENT REVIEW CALENDAR

Review Meeting	Data Distribution Deadline	Initial Review Deadline	Document Distribution Dates	STAR Panel Dates	Location	Species	Lead Stock Assessor
STAR Panel	February 7	April 11	April 18	May 2-4, 2023	TBD	Pacific Mackerel	TBD

APPENDIX B: OUTLINE FOR FULL AND UPDATE STOCK ASSESSMENT DOCUMENTS

This is a general outline of elements that should be included in full and update stock assessment documents for CPS managed by the Council. Not every item listed in the outline is relevant (or available) for every assessment. Therefore, this outline should be considered a guideline on how to organize and communicate stock assessment results. Some items are identified as being optional for draft assessment documents prepared for STAR panel meetings but should be included in the final document. Also, some items are identified as being not applicable for a final assessment document associated with an assessment rejected by the STAR panel or withdrawn by the STAT. A check-list of elements to be included in full or update stock assessment documents is included in Appendix D and a list of tables and figures to include in assessment documents or associated electronic indices are described in Appendix G.

Tables placed in assessment documents should not use a font-size smaller than 10 point and preferably should be in editable form (i.e., tables that can be copied or converted from the document, not images). For assessments undergoing review, all tables should be available upon request in editable, electronic files in text or spreadsheet format.

A. Title page and list of preparers

The names and affiliations of the stock assessment team either alphabetically or as first and secondary authors.

1. The back of the title page should include text on how to cite the assessment document, based on the following example.

This report may be cited as:
Kutiyama, P.T., Zwonlinki, J.P, Hill, K.T. and P.R. Crone. Assessment of the Pacific sardine resource in 2020 for U.S. management in 2020-2021. Available from https://www.pcouncil.org/stock-assessments-and-fishery-evaluation-safe-documents/

B. Executive Summary (should follow the template in Appendix C). Where possible the executive summary should paraphrase the shared content of the body of the report to minimize redundancy. **The executive summary is not required (though is useful) in a draft assessment undergoing review and not submitted to a Council Briefing Book.**

C. Introduction ***An update assessment may include abbreviated information from each of the following items, citing the previous full assessment for additional information, if there has not been new or changed understanding of the following attributes.**

1. Scientific name, distribution, the basis for the choice of stock structure, including regional differences in life history or other biological characteristics that should form the basis of management units.
2. A map showing the scope of the assessment and depicting boundaries for fisheries or data collection strata. ***Not required for an update assessment.**
3. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography).
4. Ecosystem considerations 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. ***Not required for an update assessment if a citation to the previous assessment is provided.**

5. Important features of current fishery and relevant history of fishery.
6. 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).
7. Management performance, including a table or tables comparing OFL, ACL, HG, landings, and catch (i.e., landings plus discard) for each area and year. Investigation into how these methods differ is beyond the scope of a benchmark assessment. The rationale for modeling discard mortality can also be provided. This should be included in all update assessments.
8. Description of fisheries for this species off Canada and/or Mexico, including references to any recent assessments of those stocks. STATs are strongly encouraged to include a summary of catches and estimates of stock size and stock status for the most recent ten years, if such information can be assembled without excessive difficulty. ***Not required for an update assessment.**

D. Data

Description of all data and sources used in the assessment; if not all data sources are used, provide the rationale for excluding particular data sources; report on consulting with CPSAS and CPSMT representatives 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, description of methods to estimate abundance indices, sample size information for length- and age-composition data by survey and year, including b 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. If environmental or ecosystem data are incorporated in the stock assessment model, provide a report of consultations with technical teams that evaluate ecosystem data or methodologies used in the assessment.

E. Model

1. History of modeling approaches used for this stock. ***Not required for an update assessment.**
2. Response to the most recent previous STAR panel and SSC recommendations for remedying deficiencies in the most recent previous full assessment. ***Not required for an update assessment.**
3. Description of new modeling approaches and changes made from the last assessment, with rationale. ***Not required for an update assessment.**
4. 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.).
5. Model parameters: estimated and fixed parameters, constraints on parameters, selectivity assumptions, natural mortality, treatment of age reading bias and/or imprecision, and other fixed parameters, description of stock-recruitment constraints or components, critical assumptions and consequences of assumption failures.

F. Base model(s) selection and evaluation

1. Figures showing data and model changes that produce the greatest change in spawning biomass trend and stock status in the new base model compared to the previous stock assessment model accepted for management decision making.
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. ***Not required for an update assessment.**
3. Evaluation of model parameters. Likelihood profile for the base model over key parameters (e.g., natural morality, stock-recruit steepness, survey catchability). The profile should indicate all likelihood values for individual components (e.g., indices by survey, compositional data for each type and fleet). Are parameter estimates (e.g., survey catchability) consistent with estimates for related stocks?
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.

G. Base-model(s) results

1. Table listing all explicit 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 actually 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). ***Not required in draft assessment undergoing review.** Can be included in electronic appendices (SS report

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files), should be provided as supplementary material for assessments developed with alternative assessment platforms.

3. Time-series of total biomass, 1+, summary biomass, and spawning biomass (and/or spawning output), recruitment and fishing mortality (1-SPR) (or exploitation rate estimates if fishing mortality not available) (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.

H. 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). 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.

I. Harvest control rules and management advice

The OFL, ABC, and HG harvest control rules for Pacific sardine and Pacific mackerel apply to the U.S. (California, Oregon, and Washington) harvest recommended for the next fishing year and are defined as follows:

- OFL = BIOMASS * F_{MSY} * U.S. DISTRIBUTION
- ABC = BIOMASS * BUFFER * F_{MSY} * U.S. DISTRIBUTION
- ACL LESS THAN OR EQUAL TO ABC
- HG = (BIOMASS-CUTOFF) * FRACTION * U.S. DISTRIBUTION
- ACT EQUAL TO HG OR ACL, WHICHEVER VALUE IS LESS

where F_{MSY} is the fishing mortality rate that maximizes catch biomass in the long term.

Implementation for Pacific Sardine

1. BIOMASS is the estimated stock biomass (ages 1+) at the start of the next year from the current assessment,
2. CUTOFF (150,000 mt) is the lowest level of estimated biomass at which directed harvest is allowed,
3. FRACTION is an environment-based percentage of biomass above the CUTOFF that can be harvested by the fisheries. Given that the productivity of the sardine stock has been shown to increase during relatively warm-water ocean conditions, the following formula has been used to determine an appropriate (sustainable) FRACTION value:

$$F_{MSY} = -18.46452 + 3.25209(T) - 0.19723(T^2) + 0.0041863(\quad T^3)$$

where T is the <u>temperature term derived from the CalCOFI sea surface temperature index</u>. Under the harvest control rule, FRACTION is constrained and ranges between 0 and 25 percent for the OFL and 5 percent and 20 percent for the ABC depending on the value of T.

4. U.S. DISTRIBUTION is the percentage of BIOMASS in U.S. waters (87 percent).

Implementation for Pacific Mackerel

1. BIOMASS is the estimated stock biomass (ages 1+) at the start of the next year from the current assessment,
2. CUTOFF (18,200 mt) is the lowest level of estimated biomass at which harvest is allowed,
3. FRACTION (30 percent) is the fraction of biomass above CUTOFF that can be taken by fisheries, and
4. U.S. DISTRIBUTION (70 percent) is the average fraction of total BIOMASS in U.S. waters.

The CUTOFF and FRACTION values applied in the Council's harvest policy for mackerel are based on simulations published by MacCall et al. in 1985.

Assessment reports for the central subpopulation of northern anchovy should provide the information needed to apply the framework of Figure 1. Harvest control rules for other stocks can be found in Section 4.6.1 of the CPS FMP.

J. <u>Unresolved problems and major uncertainties.</u> ***Not required in draft assessment undergoing review**.

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

K. <u>Evaluation of scientific uncertainty</u>.

Fully document the calculation of the base model's sigma associated with the current year's OFL value.

L. <u>Regional management considerations</u>.

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?

M. <u>Research and data needs</u>.

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

N. <u>Acknowledgments.</u>

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. ***Not required in draft assessment undergoing review.**

O. <u>Literature cited</u>.

P. <u>Auxiliary files</u>.

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.

For assessments conducted using Stock Synthesis, the following files should be included and archived with the stock assessment document: starter.ss, forecast.ss, Fishstock.ctl, Fishtock.dat, Report.sso and the Stock Synthesis model executable.

APPENDIX C: TEMPLATE FOR AN EXECUTIVE SUMMARY FOR FULL AND UPDATE STOCK ASSESSMENT DOCUMENTS

Items marked with an asterisk (*****) are optional for draft assessment documents prepared for STAR panel meetings but should be included in the final document. Items with double asterisks (**) are not applicable for a final assessment document associated with an assessment rejected by its STAR panel or withdrawn by its STAT.

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 estimates.
Recruitment	Trends and current levels relative to historical levels-include table for last 10 years and graph with long term estimates
Exploitation status	Exploitation rates (i.e., total catch divided by exploitable biomass, or the annual SPR harvest rate) - include a table with the last 10 years of data and a graph showing the trend in fishing mortality relative to the target (y-axis) plotted against the trend in biomass relative to the target (x-axis).
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	Results of applying any control rules to compute the harvest guideline, including specification of each of the quantities on which the harvest guideline is based (BIOMASS, CUTOFF, FRACTION, U.S. DISTRIBUTION)
Management performance	Catches in comparison to OFL, ABC, HG, and OY/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 sigma value and the basis for its calculation.
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 D: CHECK LIST OF ELEMENTS TO BE INCLUDED IN FULL AND UPDATE ASSESSMENT DOCUMENTS

Section	Element description
A	STAT names and affiliations
A	Citation instructions, on the back of the title page.
B	Executive Summary *** Not required in draft assessment undergoing review.**
B	<u>Exec. Summ., Stock description</u>: Species and area; basis for regional management.
B	<u>Exec. Summ., Catches</u>: Table with last 10 years; graph with long term information.
B	<u>Exec. Summ., Data & assessment</u>: Date and type of last assessment, model type, …
B	<u>Exec. Summ., Stock biomass and dynamics</u>: Trends table with last 10 years; graph with long term information.
B	<u>Exec. Summ., Recruitment</u>: Trends and current levels; . . . table with last 10 years; graph with long term information.
B	<u>Exec. Summ., Exploitation status</u>: Exploitation rates . . . ; table with last 10 years; Kobe (phase) plot with long term information.
B	<u>Exec. Summ., Ecosystem considerations</u>: Summary of relevant environmental and ecosystem factors . . .
B	<u>Exec. Summ., Harvest control rules</u>
B	<u>Exec. Summ., Management performance</u>: Catches compared to OFLs, ABCs, . . . table with values for last 10 years. (To be provided by Council staff).
B	<u>Exec. Summ., Unresolved problems and major uncertainties</u>: Special issues that complicate the assessment . . .
B	<u>Exec. Summ., Scientific uncertainty</u>: Sigma and how calculated.
B	<u>Exec. Summ., Research and data needs</u>: Identify information gaps . . .
B	<u>Exec. Summ., Rebuilding projections</u>: Reference to principal results from the rebuilding analysis (if applicable) . . .
C	<u>Introduction</u>: 1. Scientific name, distribution, choice of stock structure, . . .
C	<u>Introduction</u>: 2. A map showing the scope of the assessment . . . ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
C	<u>Introduction</u>: 3. Important features of life history . . . ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
C	<u>introduction</u>: 4. Ecosystem considerations . . . ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
C	<u>Introduction</u>: 5. Important features of current fishery . . . ***Not required for update assessments. May refer to the most recent full assessment for additional information.**

Section	Element description
C	<u>Introduction</u>: 6. Summary of management history. ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
C	<u>Introduction</u>: 7. Management performance, including a table with OFLs ACLs, HGs, landings, and catch . . .
C	<u>Introduction</u>: 8. Description of fisheries for this species off Canada, and/or Mexico . . . ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
D	<u>Data</u>: 1. Fishery-dependent data: Commercial fisheries landings by state, year and gear . . .
D	<u>Data</u>: 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.
D	<u>Data</u>: 3. Sources used to estimate biological parameters (e.g., natural mortality, . . .
D	<u>Data</u>: 4. Environmental or ecosystem data used.
E	<u>Model</u>: 1. History of modeling approaches used for this stock. ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
E	<u>Model</u>: 2. Response to most recent past STAR panel recommendations . . . ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
E	<u>Model</u>: 4. Description of new modeling approaches and changes from the last assessment. ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
E	<u>Model</u>: 5. General model specifications: Assessment program, model structure, area and fleet definitions, initial conditions.
E	<u>Model</u>: 6. Model parameters: estimated and fixed parameters, parameter constraints, priors, selectivity assumptions, …
F	<u>Base model selection</u>: 1. Figure with changes when bridging from the previous to the new base model.
F	<u>Base model selection</u>: 2. Evidence of search for balance between model realism and parsimony . . . ***Not required for update assessments. May refer to the most recent full assessment for additional information.**
F	<u>Base model evaluation</u>: 3. Evaluation of model parameters. Likelihood profile for natural mortality; Likelihood profile for steepness; Likelihood profile for R_0.
F	<u>Base model evaluation</u>: 4. Residual analysis, residual plots, time-series of observed and predicted values.
F	<u>Base model evaluation</u>: 5. Convergence status and convergence criteria, randomization runs.
G	<u>Base-model results</u>: 1. Table with all explicit parameters in the base model and associated SDs.

Section	Element description
G	<u>Base-model results</u>: 2. Table with population numbers at age × year × sex, which may be included as a text or spreadsheet file. ***Not required in a draft assessment undergoing review.**
G	<u>Base-model results</u>: 3. Table with time-series of total biomass, summary biomass, spawning biomassrecruitment, . . .
G	<u>Base-model results</u>: 4. Selectivity estimates (if not included elsewhere).
G	<u>Base-model results</u>: 5. Stock-recruitment relationship.
G	<u>Base-model results</u>: 6. OFL, ABC, and ACL, HG. . . for recent years.
G	<u>Base-model results</u>: 7. Clear description of units for all outputs.
G	<u>Base-model results</u>: 8. Description of how discard is included in yield estimates.
G	<u>Base-model results</u>: 9. Description of environmental or ecosystem data.
H	<u>Evaluation of uncertainty</u>: 1. Sensitivity runs to evaluate assumptions about model structure.
H	<u>Evaluation of uncertainty</u>: 2. Sensitivity to data set choice and weighting schemes: removal of data sources; alternative weighting methods for compositional data.
H	<u>Evaluation of uncertainty</u>: 3. Parameter uncertainty . . . Uncertainty estimates for parameters and derived quantities; Likelihood profiles (tabular format) for M, h, and R_0 . . .
H	<u>Evaluation of uncertainty</u>: 4. Retrospective analysis, . . .
H	<u>Evaluation of uncertainty</u>: 5. Historical analysis . . .
H	<u>Evaluation of uncertainty</u>: 6. If a range of models runs for characterizing uncertainty . . . information on their relative probability.
H	The following model runs in the table below are required.

Parameter(s) / Issue	Base Model Run	Sensitivity Model Run	Notes
Age or sex specific M	If: Sex specific M	Then: Single M	
Weighting of compositional data	Francis (2011)	McAllister and Ianelli (1997) harmonic mean	STATs may also explore the Thorson et al. (2016) Dirichlet multinomial likelihood.
Selectivity	If: All dome shaped	Then: One fleet asymptotic	
Confirm convergence	50-100 jitter model runs with a strong preference for 100 jitter runs when feasible.	NA	

Section	Element description
I	<u>Harvest control rules</u>: The OFL, ABC and HG harvest control rules: *Implementation for sardine . . .* BIOMASS; CUTOFF; FRACTION; AND U.S. DISTRIBUTION. *Implementation for Pacific mackerel . . .* BIOMASS; CUTOFF; FRACTION; AND U.S. DISTRIBUTION. *For anchovy, the values needed to apply the framework of Figure 1 should be listed.*
J	<u>Unresolved problems and major uncertainties</u>: Describe any special issues . . .
K	<u>Evaluation of scientific uncertainty</u>. Sigma and how it was calculated.
L	<u>Regional management considerations</u>. 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.
M	<u>Research and data needs</u>: 1. Describe progress on research and data needs identified in the most recent previous assessment . . .
N	<u>Acknowledgments</u>: Include STAR panel members and affiliations . . . *** Not required in a draft assessment undergoing review.**
O	<u>Literature cited</u>:
P	<u>Auxiliary files</u>: A list naming the required text files (. . .) and any other supplementary electronic files . . .

APPENDIX E: DEFINITIONS OF SPECIES CATEGORIES FOR CPS ASSESSMENTS AND RULES FOR MAKING CATEGORY ASSIGNMENTS FOR FULL 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 (as in Rogers 1996).
	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 F: 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		
Pre-assessment workshop	Stock dependent	X		X	X			X	X
Final data cutoff	12 weeks before STAR panel	X			X				
Pre-STAR draft stock assessment document submitted	3 weeks before STAR panel	X							
Pre-review for completion and compliance with TOR	3 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 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 report	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

APPENDIX G: TABLES AND FIGURES TO BE INCLUDED IN CPS STOCK ASSESSMENT REPORTS OR IN ASSOCIATED ELECTRONIC INDICES

Section	Figure (f) / Table (t)	Keep	Eliminate	Electronic Index
Executive Summary	t:10 yr. catches	x		
	f:all yrs. catches	x		
	t:10 yr. SB, 1+ biomass	x		
	f:all yrs. SB, 1+ biomass	x		
	t: 10 year recruits, recruitment deviations	x		
	f: all yrs. recruitments	x		
	f: all yrs. recruitment deviations		x	
	t: management performance	x		
	t: projections 1+ biomass, recruitments	x		
	t: harvest control rule tables	x		
Introduction and Data	f: assessment area map		x	
	t: all year landings	x		
	t: management performance (OFL, ACL, Landings, discard estimates)	x	x	
	t: historical management actions		x	
	t: number of tows, samples, and N			x
	t: survey estimates		x	
	f: data used in the model for each fleet and across years	x		
	f: catch figures	x		
	f: all indices used in the model	x	?	
	f: general data figures (compositions)	x	?	
	f: parameter prior distributions	x		
	f: assorted biology plots	x		
Model	t: model set-up description	x		
	t: parameters in the model	x		
	t: parameter estimates/fixed and distributions	x		
	t: time-series table	x		
	t: jitter results	x		
	t: data weights by data type	x		
	t: likelihood and parameters from base and sensitivities	x		
	t: profile likelihoods	x		
	t: numbers-at-age			x
	f: estimated biology	x		

	f: stock synthesis version comparison and simple bridging	x		
	f: all fits to data	x		
	f: selectivity estimates	x		
	f: population time series (SSB, recruits, 1+ biomass)	x		
	f: sensitivity results	x		
	f: profiles (Piner plots preferred)	x		
	f: population trajectories by profile parameter values	x		
	f: retrospective results	x		
	f: comparison with previous assessments	x		
Harvest specifications	OFL and ABC tables	x		
	Information needed to apply Figure 1	x		