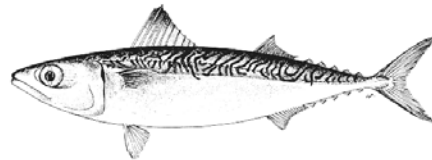
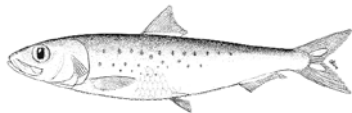


**TERMS OF REFERENCE
FOR A
COASTAL PELAGIC SPECIES
STOCK ASSESSMENT REVIEW PROCESS**

REVIEW DRAFT



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Introduction

The purpose of this document is to outline the guidelines and procedures for the Pacific Fishery Management Council's (Council) coastal pelagic species (CPS) stock assessment review (STAR) process and to clarify expectations and responsibilities of the various participants. The STAR process has been designed to establish a procedure for peer review as referenced in the 2006 Magnuson-Stevens Fishery Conservation and Management Reauthorization Act (MSRA), 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 MSRA 302(g)(1)(E)). If a peer review process is established, it should investigate the technical merits of stock assessments and other scientific information used by the Council's Scientific and Statistical Committee (SSC). The peer review process is not a substitute for the SSC and should work in conjunction with the SSC. This document will be included in the Council's Statement of Organization, Practices and Procedures as documentation of the review process that will underpin the scientific advice from the SSC.

Parties involved in implementing the peer review process described here are the Council members; Council staff; members of Council Advisory Bodies, including the SSC, the Coastal Pelagic Species Management Team (CPSMT), and the Coastal Pelagic Species Advisory Subpanel (CPSAS); the National Marine Fisheries Service (NMFS); state agencies; and interested persons. The STAR process is a key element in an overall process designed to review the technical merits of stock assessments and other relevant scientific information used by the SSC. This process will allow the Council to make timely use of new fishery and survey data, analyze and understand these data as completely as possible, provide opportunity for public comment, assure that the results are as accurate and error-free as possible, and provide the best available science for management decisions.

This current edition of the terms of reference reflects many recommendations from previous participants in the STAR process, including STAR Panel members, SSC members, 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.

Stock assessments for Pacific sardine and Pacific mackerel are typically conducted annually to assess the abundance, trends, and appropriate harvest levels for these species¹. Assessments² use statistical population models to simultaneously analyze and integrate a combination of survey, fishery, and biological data. Since 2004, the CPS assessments have undergone an assessment cycle and peer

1/ Stock assessments are conducted for species "actively" managed under the Coastal Pelagic Species Fishery Management Plan (FMP). That is, fisheries for Pacific sardine and Pacific mackerel are actively managed via annual harvest guidelines and management specifications, which are based on current stock assessment information.

2/ 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. Stock assessments provide the fundamental basis for management decisions on CPS harvests. To best serve that purpose, stock assessments should attempt to identify and quantify major uncertainties, balance realism and parsimony, and make best use of the available data.

review process. There are two distinct types of assessments which are subject to different review procedures. "Full assessments" involve a re-examination of the underlying assumptions, data, and model parameters used to assess the stock, while "update assessments" maintain the model structure of the previous full assessment and are generally restricted to the addition of new data that have become available since the last assessment.

Full assessments for Pacific sardine and Pacific mackerel typically occur every third year, necessitating a three-year STAR Panel cycle. If entirely new, structurally changed or significantly revised assessments are developed, a STAR Panel must be convened to review the assessment prior to its use for setting Overfishing Limits (OFLs), Acceptable Biological Catches (ABCs), Harvest Guidelines (HG), Annual Catch Limits (ACLs), and Annual Catch Targets (ACTs). Recommendations regarding OFLs and ABCs are an SSC responsibility. The Council identifies the risk policy that factors into setting ABC, and selects ACLs and ACTs given the HGs, ABCs and advice from its advisory bodies. Full stock assessment reports are developed and distributed following each STAR Panel review. Updated assessments are conducted during interim years and involve a less intensive review by the CPSMT and the SSC. Details from interim-year assessments are documented in executive summaries.

STAR Goals and Objectives

The goals and objectives for the CPS assessment and review process are to:

1. Ensure that CPS stock assessments are the "best available" scientific information and facilitate the use of this information by the Council. In particular, provide information that will allow the Council to adopt OFLs, ABCs, ACLs and ACTs.
2. Meet the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements.
3. Follow a detailed calendar and explicit responsibilities for all participants to produce required outcomes and reports.
4. Provide an independent external review of CPS stock assessments.
5. Increase understanding and acceptance of CPS 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.
7. Use assessment and review resources effectively and efficiently.

Responsibilities

Shared Responsibilities

All parties have a stake in ensuring 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 statements from the SSC to determine whether the information on which it will base its recommendation is the "best available" science. Fishery managers and scientists providing technical documents to the Council for use in management need to ensure the work is technically correct.

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 used to produce stock assessments. However, the time-frame for this sort of review is not suited to the routine examination of assessments that are, generally, the primary basis for harvest recommendations. The review of current stock assessments requires a routine, dedicated effort that simultaneously meets the needs of NMFS, the Council, and others. Leadership, in the context of the stock assessment review process for CPS means consulting with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. Coordination means organizing and carrying out review meetings, distributing documents in a timely fashion, and making sure that assessments and reviews are completed according to plan. Leadership and coordination involve costs, both monetary and time, which have not been calculated, but are likely substantial.

The Council, NMFS, and the Secretary of Commerce share primary responsibility to create and foster a successful STAR process. The Council will oversee the process and involve its standing advisory committees, especially the SSC. The chair of the SSC CPS subcommittee will coordinate, oversee, and facilitate the process. Together NMFS and the Council will consult with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables for final approval by the Council. NMFS and the Council will share fiscal and logistical responsibilities and both parties should ensure that there are no conflicts of interest in the process³.

The CPS STAR process is sponsored by the Council, because the Federal Advisory Committee Act (FACA) limits the ability of NMFS to establish advisory committees. FACA specifies a procedure for convening advisory committees that provide consensus recommendations to the federal government. The intent of FACA was three-fold: to limit the number of advisory committees; to ensure that advisory committees fairly represent affected parties; and to ensure that advisory committee meetings, discussions, and reports are carried out and prepared in full public view. Under FACA, advisory committees must be chartered by the Department of Commerce through a rather cumbersome process. However, the Sustainable Fisheries Act exempts the Council from FACA per se, but requires public notice and open meetings similar to those under FACA.

³ The proposed NS2 guidelines state: “Peer reviewers who are federal employees must comply with all applicable federal ethics requirements. Peer reviewers who are not federal employees must comply with the following provisions. Peer reviewers must not have any real or perceived conflicts of interest with the scientific information, subject matter, or work product under review, or any aspect of the statement of work for the peer review. For purposes of this section, 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. Potential reviewers must be screened for conflicts of interest in accordance with the procedures set forth in the NOAA Policy on Conflicts of Interest for Peer Review subject to OMB’s Peer Review Bulletin.”

CPS STAR Coordination (Full Assessments)

The SSC CPS subcommittee chair will work with the Council, Council staff, other agencies, and groups or interested persons that carry out assessment work to coordinate and organize STATs, STAR Panels, and reviews of assessment updates. The objective is to make sure that work is carried out in a timely fashion according to the calendar and terms of reference.

The SSC CPS Subcommittee chair, in consultation with the SSC and the Southwest Fisheries Science Center (SWFSC), will coordinate the selection (including number) of external reviewers. Criteria for reviewer qualifications, nomination, and selection will be established by the SWFSC in consultation with the SSC, and will be based principally on a candidate's knowledge of stock assessments and familiarity with West Coast CPS fisheries or the ecological role of CPS in the California Current. The public is welcome to nominate qualified reviewers. The majority of panelists should be experienced stock assessment scientists, i.e., individuals who have conducted stock assessments using current methods (generally statistical age- and or length-structured assessment models). It is, however, recognized that the pool of qualified reviewers is limited, and that staffing of STAR Panels is subject to constraints that may make it difficult to achieve the ideal, and some diversity of expertise may be desirable.

Following any modifications to the stock assessments resulting from STAR Panel reviews and prior to distribution of stock assessment documents and STAR Panel reports, the SSC CPS subcommittee chair will ensure that the stock assessments and Panel reports are reviewed for consistency with the terms of reference, especially completeness. If inconsistencies are identified, authors will be requested to make appropriate revisions in time to meet the deadline for distributing documents for the CPSMT meeting at which ACL and ACT recommendations are developed.

Individuals (employed by NMFS, state agencies, or other entities) that conduct assessments or technical work in connection with CPS stock assessments are responsible for ensuring their work is technically sound, complete, and delivered in a timely manner. The Council's review process is the principal means for review of complete stock assessments, although additional in-depth technical review of data utilized in the stock assessment and the methods utilized to collect those data is desirable. Stock assessments must be completed and reviewed in full accordance with the terms of reference (Appendices A and B).

CPSMT Responsibilities

The CPSMT is responsible for identifying and evaluating potential management actions based on the best available scientific information. In particular, the CPSMT makes ACL and ACT recommendations to the Council based on OFL, ABC and HG control rules. The CPSMT will use stock assessments, STAR Panel reports, and other information, including ecological factors, in making their ACL, ACT, or HG recommendations. Preliminary ACL and ACT recommendations will be developed by the CPSMT according to the management process defined in the CPS Fishery Management Plan and Council Operating Procedures.

A representative of the CPSMT will be appointed by the CPSMT chair and will serve as a liaison to each assessment update review meeting (in most cases, the entire CPSMT participates in assessment update reviews) or full assessment STAR Panel, and will participate in review discussions. The

CPSMT representative will not serve as a member of a STAR Panel. The CPSMT representative should be prepared to advise the STAT and STAR Panel on changes in fishing regulations or practices that may influence data used in the assessment and the nature of the fishery in the future. The CPSMT will not seek revision or additional review of stock assessments after they have been reviewed by a STAR Panel. However, the CPSMT can request additional model projections in order to develop a full evaluation of potential management actions. The CPSMT chair will communicate any unresolved issues to the SSC for consideration. Successful separation of scientific (i.e., STATs and STAR Panels) from management (i.e., CPSMT) work depends on completion of stock assessment documents and STAR reviews prior to the time the CPSMT meets to discuss preliminary ACL and ACT levels.

CPSAS Responsibilities

It is the responsibility of the CPSAS representative to ensure that CPSAS concerns regarding the adequacy of data being used by the STAT are expressed at an early stage in the process. The chair of the CPSAS will appoint a representative to track each assessment and participate at the assessment update review meeting or STAR Panel meeting. The CPSAS representative will serve as an advisor to the STAT and STAR Panel. It is especially important that the CPSAS representative be included in the STAT's discussion and review of all the data sources being used in the assessment, prior to development of the stock assessment model. This coordination should first occur via telephone or email. Council-funded travel for coordination between the STAT and the CPSAS representative requires advanced approval by the Council or the Council Executive Director. The CPSAS representative will participate in review discussions as an advisor to the STAR Panel, in the same capacity as the CPSMT advisor. The CPSAS representative may provide appropriate data and advice to the assessment update review meeting, STAR Panel, and CPSMT, and will report to the CPSAS on STAR Panel and other meeting proceedings.

The CPSAS representative will attend the CPSMT meeting at which preliminary ACL and ACT recommendations are developed. The CPSAS representative will also attend subsequent CPSMT, Council, and other necessary meetings.

SSC Responsibilities

The SSC will participate in the stock assessment review process and provide the CPSMT and Council with technical advice related to stock assessments and the review process. The SSC is also responsible for making OFL and ABC recommendations to the CPSMT and the Council.

The SSC will assign at least two (ideally three) members from its CPS subcommittee to each assessment update review meeting. The SSC representatives at the review meeting will prepare a meeting summary and present it to the full SSC at its next regular meeting. The SSC will review any additional analytical work required or carried out by the CPSMT after the stock assessments have been reviewed at the update review meeting.

The SSC will assign at least one member from its CPS subcommittee to each STAR Panel for reviewing full assessments. This member will chair the STAR Panel and will be expected to attend the assigned STAR Panel meeting, the CPSMT meeting at which ACL, and ACT recommendations are made, and the Council meetings when the STAR Panel reviewed stock assessment is discussed.

The SSC representative on the STAR Panel will present the STAR Panel report at CPSMT, SSC, and Council meetings. The SSC representative will communicate SSC comments or questions to the CPSMT. The SSC will review the outcomes of additional analytical work (e.g. additional projections using the agreed base model) requested by the CPSMT after the stock assessments have been reviewed by the STAR Panels.

The SSC, during their normally scheduled meetings, will serve as arbitrator to resolve disagreements between the STAT, the CPS subcommittee, the STAR Panel, the CPSAS or the CPSMT. The STAT and the STAR Panel (CPS subcommittee in the case of update reviews) may disagree on technical issues regarding an assessment. Estimates and projections representing all sides of the disagreement need to be presented, reviewed, and commented on by the SSC.

Council Staff Responsibilities

A Council staff officer will be assigned to coordinate, monitor and document the STAR process. The Council staff officer will be responsible for timely issuance of meeting notices and distribution of stock assessment documents, stock summaries, meeting minutes, and other appropriate documents. The Council staff officer will monitor compliance with the most recent version of the terms of reference for the CPS STAR process adopted by the Council. The Council staff officer will coordinate materials and presentations for Council meetings relevant to final Council adoption of CPS stock assessments. Council staff will also collect and maintain file copies of reports from each STAR Panel (containing items specified in the STAR Panel terms of reference), the outline for CPS stock assessment documents, Scientific and Statistical Committee (SSC), Coastal Pelagic Species Management Team (CPSMT), and Coastal Pelagic Species Advisory Subpanel (CPSAS) comments and reports, letters from the public, and any other relevant information. At a minimum, the stock assessments (assessment documents, STAR Panel reports, and stock summaries) should be published and distributed in the Council annual stock assessment and fishery evaluation (SAFE) document.

A primary role for the Council staff officer assigned to the STAR process will be to monitor STAR Panel and SSC activities to ensure compliance with these terms of reference. The Council staff officer will attend all STAR Panels to ensure continuity and adherence to these terms of reference. The Council staff officer will identify inconsistencies with the terms of reference that occur during STAR Panels and work with the STAR Panel chair to develop solutions and to correct them. The Council staff officer will coordinate with the STAR Panel chair and the NMFS in a review of STAT documents to assure they are received on time, are consistent with the terms of reference, and are complete. The Council staff officer will review the Executive Summary for consistency with the terms of reference. If the STAT materials are not in compliance with the terms of reference, the Council staff officer will return the materials to STAT with either a list of deficiencies, a notice that the deadline has expired, or both. Inconsistencies will be identified and the authors requested to make appropriate revisions in time for the appropriate SSC, CPSMT, and CPSAS meetings, when an assessment is considered. The Council staff officer will also coordinate and monitor SSC review of stock assessments and STAR Panel reports to ensure compliance with these terms of reference and the independent review requirements of Council Operating Procedure 4 (roles, responsibilities, and functions of the SSC).

National Marine Fisheries Service Responsibilities

NMFS Southwest Fisheries Science Center (SWFSC) will provide staff to work with the Council, other agencies, groups, or interested persons that carry out assessment work to assist in organizing the STAR and STAR Panels. Since most assessments are conducted by NMFS STATs, the SWFSC will work with STATs to develop a draft list of assessments to be considered by the Council. The SWFSC also will develop a draft STAR Panel schedule for review by the Council. The SWFSC will identify independent STAR panelists following criteria for reviewer qualifications. The costs associated with these reviewers will be borne by NMFS. The SWFSC will coordinate with the STATs to facilitate delivery of materials by scheduled deadlines and in compliance with other requirements of these terms of reference, to the extent possible and with the assistance of the assigned Council staff officer and the STAR Panel chair.

Following any modifications to the stock assessments resulting from STAR Panel reviews and prior to SSC review, the SWFSC will assist the Council staff officer in reviewing the Executive Summary for consistency with the terms of reference. The STAT will be requested to make appropriate revisions in time for the appropriate SSC, CPSMT, and CPSAS meetings when inconsistencies are identified.

Terms of Reference for STAR Panels and Meetings (Full Assessments)

The objective of the STAR Panel is to complete a detailed evaluation of a stock assessment to advance the best available scientific information to the Council. The responsibilities of the STAR panel include:

1. 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);
2. discuss the technical merits and deficiencies of the input data and analytical models during the Panel meeting and work with the STATs to correct deficiencies;
3. document meeting discussions; and
4. provide complete STAR Panel reports for all reviewed species.

The STAR Panel chair has, in addition, the responsibility to:

5. review revised stock assessment documents and STAR Panel reports before they are forwarded to the SSC.

CPS STAR Panels normally include a chair (who is a member of the SSC CPS subcommittee), at least one "external" member (i.e., outside the Council family and not involved in management or assessment of West Coast CPS, typically designated by the Center for Independent Experts [CIE]), and two additional members. The total number of STAR Panel members should be at least "n+3" where n is the number of stock assessments and "3" counts the chair and external reviewer(s). Selection of STAR panelists should aim for balance between outside expertise, in-depth knowledge of CPS fisheries, data sets available for those fisheries, and modeling approaches applied to CPS. Expertise in ecosystem models and the role of CPS in the ecosystem may also be desirable. Reviewers should not have financial or personal conflicts of interest, either current to the meeting, within the previous year (at minimum), or anticipated. The majority of panelists should be

experienced stock assessment scientists (i.e., individuals who have done stock assessments using current methods). STAR panelists should be knowledgeable about the specific modeling approaches being reviewed, which in most cases will be statistical age- and/or length-structured assessment models. In addition to Panel members, STAR meetings will include CPSMT and CPSAS advisory representatives with responsibilities as laid out in their terms of reference and a Council staff member to help advise the STAR Panel and assist in recording meeting discussions and results.

STAR Panels normally meet for one week. The number of assessments reviewed per Panel should not exceed two. Contested assessments, in which alternative assessments are brought forward by competing STATs using different modeling approaches, will typically require additional time (and/or panel members) to review adequately, and should be scheduled accordingly. While contested assessments are likely to be rare, they can be accommodated in the STAR Panel review process. STAR Panels 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. STAR Panels are charged with selecting a preferred base model, which will be more difficult when there are several modeling approaches from which to choose.

The STAR Panel chair is responsible for: 1) developing an agenda, 2) ensuring that STAR Panel members and STATs follow the terms of reference, 3) participating in the review of the assessment, 4) guiding the STAR Panel and STAT to mutually agreeable solutions, 5) coordinating review of final assessment documents, and 6) providing Council staff with a camera ready and suitable electronic version of the Panel's report for inclusion in the annual SAFE report. The STAR Panel, STAT, the CPSMT and CPSAS representatives, and the public are legitimate meeting participants that should be accommodated in discussions. It is the STAR Panel chair's responsibility to manage discussions and public comment so that work can be completed.

The STAR Panel is responsible for determining if a stock assessment document is sufficiently complete according to Appendix A. It is the Panel's responsibility to identify assessments that cannot be reviewed or completed for any reason. The Panel's decision that an assessment is complete should be made by consensus. If a Panel cannot reach agreement, then the nature of the disagreement must be described in the Panel's report.

The STAR Panel's terms of reference solely concern technical aspects of stock assessment work. It is therefore important that the Panel strive for a risk neutral perspective in its reports and deliberations. Assessment results based on model scenarios or data that have a flawed technical basis, or are questionable on other grounds, should be identified by the Panel and excluded from consideration in developing management advice. It is recognized that no model scenario or data set will be perfect or issue free. Therefore, a broad range of results should be reported to better define the scope of the accepted model results. The STAR Panel should comment on the degree to which the accepted model describes and quantifies the major sources of uncertainty. Confidence intervals of indices and 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 various model results, especially if the Panel does not think that the probability distributions calculated by the STAT capture all major sources of uncertainty. However, as a scientific peer review body, the STAR Panel should avoid matters of policy.

Recommendations and requests to the STAT for additional or revised analyses must be clear, explicit, and in writing. STAR Panel recommendations and requests to the STAT should reflect the consensus opinion of the entire Panel and not the minority view of a single individual or individuals on the Panel. A written summary of discussion on significant technical points and lists of all STAR Panel requests and recommendations and requests to the STAT are required in the STAR Panel's report, which should be completed (at least in draft form) prior to the end of the Panel meeting. It is the chair and Panel's responsibility to carry out any follow-up review of work that is required.

The STAR Panel's primary duty is to conduct a peer review of an assessment that is presented by a STAT; STAR Panel meetings are not workshops. In the course of this review, the Panel may ask for a reasonable number of additional runs, additional details of existing assessments, or similar items from the STAT. It would not be unusual for this evaluation to result in a change to the initial base model, provided both the STAR Panel and the STAT agree that the change(s) lead to a better assessment. STAR Panels are expected to be judicious in their requests of the STATs, recognizing that some issues uncovered during review are best flagged as research priorities, and dealt with more effectively and comprehensively between assessments. The STAR Panel may also request additional analysis based on an alternative approach. However, 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 require their preferred methodologies when such is a matter of professional opinion. Rather, if the Panel finds that an assessment is inadequate, it should document and report that opinion and, in addition, suggest remedial measures that could be taken by the STAT to rectify whatever perceived shortcomings may exist.

Large changes in data (such as wholesale removal of large data sets) or analytical methods recommended by the STAR Panel, even if accepted by the STAT, will often result in such great changes to the assessment that it cannot adequately be reviewed during the course of the STAR Panel meeting. Therefore caution should be exercised in making such changes, and in many cases those changes should be relegated to future research recommendations. If the STAR Panel feels the changes are necessary and the assessment is not otherwise acceptable, it may decide to recommend that the last reviewed model be used for management purposes until the necessary work (which could be reviewed during a methodology review or a regularly scheduled SSC meeting) is complete. Similarly, if the STAR Panel believes that the results of the stock assessment strongly indicate that current control rule is inappropriate, it should identify this in its report and recommend further analysis needed to support a change.

STATs and STAR Panels are required to make an honest attempt to resolve any areas of disagreement during the review meeting. Occasionally, fundamental differences of opinion remain between the STAR Panel and STAT that cannot be resolved by discussion. In such cases, the STAR Panel must document the areas of disagreement in its report. In exceptional circumstances, the STAT may choose to submit a supplemental report supporting its view, but in the event that such a step is taken, an opportunity must be given to the STAR Panel to prepare a rebuttal. These documents will then be appended to STAR Panel report as part of the record of the review meeting. STAR Panel members may have fundamental disagreements that cannot be resolved during the STAR Panel meeting. In such cases, STAR Panel members may prepare a minority report that will become part of the record of the review meeting. The SSC will then review all information pertaining to STAR Panel or STAR Panel/STAT disputes, and issue its recommendations, which

may include recommendations for issues to be addressed during the next full assessment. SSC members involved during the STAR Panel as reviewers or assessment authors will recuse themselves when the SSC draws conclusions regarding minority reports.

Additional analyses required by the STAR Panel should be completed by the STAT during the STAR Panel meeting. It is the obligation of the STAR Panel chair, in consultation with other panel members, to prioritize requests for additional analyses and make the requests as explicit as possible. Moreover, in situations where a STAT arrives with a well-considered, thorough assessment, it may be that the Panel can conclude its review early (i.e., early dismissal of a STAT is an option for well-constructed assessments). If follow-up work by the STAT is required after the review meeting, then it is the Panel's responsibility to track STAT progress. In particular, the chair is responsible for communicating with the STAT (by phone, e-mail, or any convenient means) to determine if the revised stock assessment and documents are complete and ready to be used by managers. If stock assessments and reviews are not complete at the end of the STAR Panel meeting, then the work must be completed a week prior to the CPSMT meeting where the assessments and preliminary ACL and ACT levels are discussed. Any post-STAR drafts of the stock assessment must be reviewed by the STAR Panel or the chair if delegated that authority by the STAR Panel. Assessments cannot be given to Council staff for distribution unless they are endorsed by the STAR Panel chair and accompanied by a complete and approved STAR Panel report. Likewise, the final draft that is published in the Council's SAFE document must also be approved by the STAR Panel chair prior to being accepted by Council staff.

Suggested Template for STAR Panel Report

- Summary of the STAR Panel meeting, containing:
 - names and affiliations of STAR Panel members;
 - list of analyses requested by the STAR Panel, the rationale for each request, and a brief summary the STAT responses to each request; and
 - description of base model.
- Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
- Areas of disagreement regarding STAR Panel recommendations:
 - among STAR Panel members (including concerns raised by the CPSMT and CPSAS representatives), and
 - between the STAR Panel and STAT(s).
- Unresolved problems and major uncertainties, e.g., any special issues that complicate scientific assessment, questions about the best model scenario.
- Management, data or fishery issues raised during the STAR Panel by the public, the CPSMT and/or the CPSAS representatives.
- Prioritized recommendations for future research and data collection.

Terms of Reference for CPS STATs

The STAT will carry out its work according to these terms of reference for full assessments.

Each STAT will appoint a representative to coordinate work with the STAR Panel and attend the

STAR Panel meeting.

The STAT shall include in both the STAR Panel draft and final assessment all data sources that include the species being assessed, identify which are used in the assessment, and provide the rationale for data sources that are excluded. The STAT is obliged to keep the CPSAS representative informed of the specific data being used in the stock assessment. The STAT is expected to initiate contact with the CPSAS representative at an early stage in the process, and to be prepared to respond to concerns about the data that might be raised. The STAT should also contact the CPSMT representative for information about changes in fishing regulations that may influence data used in the assessment.

Each STAT will appoint a representative who will attend the CPSMT, CPSAS, and Council meetings where preliminary harvest levels are discussed. In addition, a representative of the STAT should attend the CPSMT and Council meeting where final ACL and ACT recommendations are developed, if requested or necessary. At these meetings, the STAT member shall be available to give a presentation of the assessment and answer questions about the STAT report.

The STAT is responsible for preparing three versions of the stock assessment document:

- 1) a "draft", including an executive summary, for discussion at the STAR Panel meeting;
- 2) a "revised draft" for distribution to the CPSMT, CPSAS, SSC, and Council for discussions about preliminary harvest levels; and
- 3) a "final" version to be published in the SAFE report. Other than authorized changes, only editorial and other minor changes should be made between the "revised draft" and "final" versions. Post-STAR Panel drafts must be reviewed by the Panel chair prior to being submitted to Council staff, but these reviews are limited to editorial issues, verifying that the required elements are included according to the terms of reference, and confirming that the document reflects the discussions and decisions made during the STAR Panel.

The STAT will distribute "draft" assessment documents to the STAR Panel, Council staff, and the CPSMT and CPSAS representatives at least two weeks prior to the STAR Panel meeting. Complete, fully-developed assessments are critical to the STAR Panel process. Draft assessments will be evaluated for completeness prior to the STAR Panel meeting, and assessments that do not satisfy minimum criteria will not be reviewed. The STAR Panel chair will make an initial recommendation, which will then be reviewed by the SSC CPS subcommittee members and Council staff if the chair determines that the draft assessment is not sufficiently complete. The draft document should include all elements listed in Appendix A except a) the point-by-point responses to current STAR Panel recommendations, and 2) acknowledgements. Incomplete assessments will be postponed to the next assessment cycle.

The STAT is responsible for bringing data in digital format and model files to the review meeting so that they can be analyzed on site. STATs should have several models ready to present to the STAR Panel and be prepared to discuss the merits of each. The STAT also should identify a candidate base model, fully-developed and well-documented in the draft assessment, for STAR Panel review.

In most cases, the STAT should produce a complete draft of the assessment within three weeks of the end of the STAR Panel meeting (including any internal agency review). In any event, the STAT must

finalize the assessment document at least one week before the CPSMT meeting at which harvest recommendations are discussed.

The STAT and the STAR Panel may disagree on technical issues regarding an assessment, but a complete stock assessment must include a point-by-point response by the STAT to each of the STAR Panel recommendations. Assessment model estimates and the results of applying control rules representing all sides of any disagreements need to be presented, reviewed by, and commented on by the SSC.

Electronic versions of final assessment documents, parameter files, data files, and key output files must be provided to Council staff by the STATs. Any tabular data that are inserted into the final documents in an object format should also be submitted in alternative forms (e.g., spreadsheets), which allow selection of individual data elements.

If there are competing STATs, STATs whose models are not chosen as the base model by a STAR panel should provide those draft assessments (corrected as necessary, in consultation with the STAR Panel) to the Council prior to the briefing book deadline.”

Terms of Reference for Stock Assessment Updates

The STAR process is designed to provide a comprehensive, independent review of a stock assessment. However, when a model has already been critically examined and is simply updated by incorporating the most recent data, a less intensive review is required. For CPS, this typically occurs during two years out of every three because that is the default cycle for CPS assessments. In this context, a model refers not only to the population dynamics model *per se*, but also to the particular data sources that are used as inputs to the model, the statistical framework for fitting the model to the data, and the analytical treatment of model outputs used in providing management advice, including reference points and the basis for the OFL, ABC, ACL, ACT and/or HG. These terms of reference establish a procedure for a limited, but still rigorous, review for stock assessments that fall into this latter category. However, it is recognized that even simple updates may in practice result in situations (e.g., what seem like minor changes to data leading to large changes in estimated biomass and hence a change in stock status) that are impossible to resolve in an abbreviated process. These terms of reference allow for the possibility of limited modifications to an existing model. However, a full assessment and review might still be necessary if an updated assessment could not be accomplished without incorporating major structural changes to the model. A full assessment would then be scheduled for the next year.

Qualification

The SSC will determine whether a stock assessment qualifies as an update under these terms of reference. To qualify, a stock assessment must carry forward its fundamental structure from a model that was previously reviewed and endorsed by a STAR Panel. In practice this means similarity in: (a) the particular sources of data used, (b) the software used in programming the assessment, (c) the assumptions and structure of the population dynamics model underlying the stock assessment, (d) the statistical framework for fitting the model to the data and determining goodness of fit, and (e) the analytical treatment of model outputs in determining management reference points. A stock

assessment update is appropriate in situations where no significant change in these five factors has occurred. In general, the only changes to a previously reviewed and endorsed assessment would be that the data time series is extended using the most recent information. However, changes to: (a) the analytical methods used to summarize data prior to input to the model, such as how the compositional data are pooled across sampling strata, (b) the weighting of the various data components (including the use of methods for tuning the variances of the data components), and (c) how selectivity is modeled, such as the time periods for the selectivity blocks, are acceptable as long the update assessment clearly documents and justifies the changes. There will always be valid reasons for altering a model, although, in the interests of stability, such changes should be resisted as much as possible in assessment updates. Substantial changes to the model should be reserved for full assessment years, when they can be fully evaluated through the STAR Panel process.

Composition of the Review Panel

The CPS subcommittee of the SSC will conduct the review of stock assessment updates. A lead reviewer for each updated assessment will be designated by the chair of the CPS subcommittee from among the membership of this subcommittee, and it will be the lead reviewer's responsibility to ensure the review is completed properly and that a written report of the proceedings is produced. In addition, the CPSMT and one designee from the CPSAS will participate in the review in an advisory capacity.

Review Format

Stock assessment updates will be reviewed during a single 2-3-day meeting of the SSC CPS Subcommittee, although there may be situations where the update review could take place in less time, i.e., early dismissal of a STAT is an option. The review process will be as follows. The STAT preparing the update will distribute the updated stock assessment to the review panelists at least two weeks prior to the review meeting. In addition, Council staff will provide the participants in the update review with a copy of the last stock assessment reviewed under the full STAR process, as well as the previous STAR Panel report. Review of stock assessment updates is not expected to require extensive analytical requests or model runs during the meeting. The review will focus on two crucial questions: (1) has the assessment complied with the terms of reference for stock assessment updates and (2) can the results from the updated assessment form the basis of Council decision-making. If either of these criteria is not met, then a full stock assessment will be required in the next year. If the review meeting concludes that it is not possible to update the stock assessment, the SSC will consider all the model runs examined during the review meeting and will provide fishing level recommendations to the Council. Recommendations for modifications to the assessment should be recorded in the CPS Subcommittee's report for consideration by the STAT during the next full assessment.

STAT Deliverables

It is the STATs responsibility to provide the review panel with a completed update at least two weeks prior to the review meeting. To streamline the review process, the STAT can reference whatever material it chooses, including that presented in the previous stock assessment (e.g., a description of methods, data sources, stock structure, etc.). However, it is essential that any new information that is incorporated in the assessment is presented in enough detail for the review panel to determine whether the update satisfactorily meets the Council's requirement to use the best available scientific information. There must be a retrospective analysis showing the performance of

the model with and without the updated data streams. Similarly, if any changes to the “model” structure are adopted, above and beyond updating specific data streams, the impact of this needs to be documented. The STAT is required to present key assessment outputs in tabular form. The final update document should include the following:

- title page and list of preparers;
- Executive Summary (see Appendix B);
- introduction;
- documentation of updated data sources;
- short description of overall model structure;
- base-run results, including a time series of total, 1+, and spawning biomass (and/or spawning output), recruitment and fishing mortality or exploitation rate estimates (table and figures); and
- uncertainty analysis, including retrospective analysis.

Review Panel Report

The SSC subcommittee members will issue a report that will include the following items:

- Name and affiliation of panelists
- Comments on the technical merits and/or deficiencies of the update
- List of analyses requested by the review panel, the rationale for each request, and a brief summary the STAT responses to each request
- Explanation of areas of disagreement between the panel and STAT
- Recommendation regarding the adequacy of the updated assessment for use in management

Appendix A: Outline for CPS Stock Assessment Documents

This is an outline of items that should be included in stock assessment reports for CPS managed by the Pacific Fishery Management Council. The outline is a working document meant to provide assessment authors with flexible guidelines about how to organize and communicate their work. All items listed in the outline may not be appropriate or available for each assessment. Items flagged by asterisks (*) are optional for draft assessment documents prepared for STAR Panels, but should be included in the final assessment document. In the interest of clarity and uniformity of presentation, stock assessment authors and reviewers are encouraged (but not required) to use the same organization and section names as in the outline. It is important that time trends of catch, abundance, harvest rates, recruitment and other key quantities be presented in tabular form to facilitate full understanding and follow-up work.

1. Title page and list of preparers - the names and affiliations of the stock assessment team (STAT), either alphabetically or as first and secondary authors
2. Executive Summary (see attached template in Appendix B). This also serves as the STAT summary included in the SAFE)
3. Introduction
 - a. Scientific name, distribution, the basis for the choice of stock structure, including differences in life history or other biological characteristics that should form the basis for management units
 - b. A map depicting the scope of the assessment and identifying boundaries for fisheries or data collection strata.
 - c. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography)
 - d. Important features of the current fishery and relevant history of fishery
 - e. Summary of management history (e.g., changes in management measures, harvest guidelines, or other management actions that may have significantly altered selection, catch rates or discards)
 - e. Management performance - a table or tables comparing annual biomass, harvest guidelines, and landings for each management subarea and year
4. Assessment
 - a. Data
 - i. Landings by year and fishery, catch-at-age, weight-at-age, survey and catch-per-unit-effort (CPUE) data, data used to estimate biological parameters (e.g., growth rates, maturity schedules, and natural mortality) with coefficients of variation (CVs) or variances if available. Include complete tables and figures (if practical) and date of extraction.
 - ii. Sample size information for length and age composition data by area, year, gear, market category, etc. including the number of trips and fish sampled.
 - iii. All data sources that include the species being assessed, which are used in the assessment, and provide the rationale for data sources that are excluded

- b. History of modeling approaches used for this stock - changes between current and previous assessment models
 - i. Response to STAR Panel recommendations from the last assessment
 - ii. Report of consultations with CPSAS and CPSMT representatives regarding the use of various data sources in the stock assessment.

- c. Model description
 - i. Complete description of any new modeling approaches
 - ii. Definitions of fleets and areas
 - iii. Assessment program with last revision date (i.e., date executable program file was compiled)
 - iv. List and description of all likelihood components in the model
 - v. Constraints on parameters, selectivity assumptions, natural mortality, treatment of age reading bias/imprecision, and other fixed parameters
 - vi. Description of stock-recruitment constraints or components
 - vii. Description of how the first year that is included in the model was selected and how the population state at that time is defined (e.g. B_0 , stable age-structure)
 - viii. Critical assumptions and consequences of assumption failures

- d. Model selection and evaluation
 - i. Evidence of search for balance between model realism and parsimony
 - ii. Comparison of key model assumptions, include comparisons based on nested models (e.g., asymptotic vs. domed selectivities, constant vs. time-varying selectivities)
 - iii. Summary of alternative model configurations that were tried, but rejected
 - iv. Likelihood profile for the base-run (or proposed base-run model for a draft assessment undergoing review) configuration over one or more key parameters (e.g. M, h, q) to show consistency among input data sources.
 - v. Residual analysis for the base-run (or proposed base-run model for a draft assessment undergoing review) configuration, e.g., residual plots, time series plots of observed and predicted values, or other approaches. Note that model diagnostics *are* required in draft assessments undergoing review.
 - vi. Convergence status and convergence criteria for base-run model (or proposed base-run model)
 - vii. Randomization run results or other evidence of search for global best estimates
 - viii. Evaluation of model parameters. Do they make sense? Are they credible?

- e. Point-by-point response to the STAR Panel recommendations*

- f. Base-run(s) results
 - i. Table listing all explicit parameters in the stock assessment model used for base runs, their purpose (e.g., recruitment parameter, selectivity parameter) and whether or not the parameter was actually estimated in the stock assessment model
 - ii. Time-series of total 1+ and spawning biomass (or spawning output), depletion relative to B_0 , recruitment and fishing mortality or exploitation rate estimates (table and figures)
 - iii. Selectivity estimates (if not included elsewhere)

- v. Stock-recruitment relationship
 - vi. OFL, ABC and ACL (and/or ABC, ACT and HG) for recent years
 - vii. Clear description of units for all outputs
- f. Uncertainty and sensitivity analyses. i. The best approach for describing uncertainty and range of probable biomass estimates in CPS assessments may depend on the situation. Possible approaches include:
- A. Parameter uncertainty (variance estimation conditioned on a given model, estimation framework, data set choice, and weighting scheme), including likelihood profiles of important assessment parameters (e.g., natural mortality). This also includes expressing uncertainty in derived outputs of the model and estimating CVs by an appropriate method (e.g., bootstrap, asymptotic methods, Bayesian approaches, such as MCMC). Include the CV of spawning biomass in the first year for which an OFL has not been specified (typically end year +1 or +2).
 - B. Sensitivity analyses (tables or figures) that show ending biomass levels or likelihood component values obtained while systematically varying emphasis factors for each type of data in the model
 - C. Sensitivity to assumptions about model structure, i.e., model specification uncertainty
 - D. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of data input being dropped.
 - E. Historic analysis (plot of actual estimates from current and previous assessments)
 - F. Subjective appraisal of magnitude and sources of uncertainty
 - G. If a range of model runs (e.g., based on CVs or alternate assumptions about model structure or recruitment) is used to depict uncertainty, then it is important that some qualitative or quantitative information about relative probability be included. 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
 - H. If possible, ranges depicting uncertainty should include at least three runs: (a) one judged most probable; (b) at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and (c) one that depicts the range of uncertainty in the direction of higher current biomass levels.

5. Harvest Control Rules⁴

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

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

⁴ Not yet adopted by the Council at the time of writing.

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

The assessment report should include ecological factors to consider when reviewing and / or adopting status determination criteria, OFLs, ABCs and ACLs.

Implementation for Pacific Sardine

1. TOTAL STOCK 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 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:

$$\text{FRACTION} = 0.248649805(T^2) - 8.190043975(T) + 67.4558326,$$

where T is the running average sea-surface temperature at Scripps Pier, La Jolla, California during the three preceding years. Under the harvest control rule, FRACTION is constrained and ranges between 5% and 15% depending on the value of T.

4. U.S. DISTRIBUTION is the percentage of TOTAL STOCK BIOMASS in U.S. waters (87%).

Implementation for Pacific Mackerel

1. TOTAL STOCK 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%) is the fraction of biomass above CUTOFF that can be taken by fisheries, and
4. STOCK DISTRIBUTION (70%) 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.

6. Management Recommendations
7. Research Needs (prioritized)

8. Acknowledgments (include STAR Panel members and affiliations as well as names and affiliations of persons who contributed data, advice, or information but were not part of the assessment team)*
9. Literature Cited
10. An appendix with the complete parameter and data in the native code of the stock assessment program. (For a draft assessment undergoing review, these listings can be provided as text files or in spreadsheet format.)

Appendix B: Template for Executive Summaries Prepared by STATs

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

Unresolved problems and major uncertainties: any special issues that complicate scientific assessment, questions about the best model scenario, etc.

Stock biomass: trends and current levels relative to virgin or historic levels, description of uncertainty - include table for last 10 years and graph with long-term estimates

Recruitment: trends and current levels relative to virgin or historic 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) – include a table with the last 10 years of data and a graph showing the trend in total fishing mortality relative to the target (y-axis) plotted against the trend in biomass relative to the target (x-axis).

Management performance: catches in comparison to the OFL, ABC, ACL/HG values for the most recent 10 years (when available), actual catch and discard.

Research and data needs: identify information gaps that seriously impede the stock assessment