

STOCK ASSESSMENT REVIEW PANEL TERMS OF REFERENCE FOR 2007

Full assessments for Pacific sardine and Pacific mackerel typically occur every third year, necessitating a three-year cycle for the Coastal Pelagic Species (CPS) Stock Assessment Review (STAR) process. If entirely new, structurally changed or significantly revised assessments are developed in a full assessment, a STAR Panel must be convened to review the assessment prior to its use for setting harvest guidelines. Full stock assessment reports are developed and distributed following each STAR Panel review. Updated assessments are conducted during interim years and involve a less formal review process. The next CPS STAR Panel process is due to be completed in 2007.

The last CPS STAR Panel convened in June 2004 to review full assessments for both Pacific mackerel and Pacific sardine. For 2007, full assessments for these two species are planned to be reviewed by two separate STAR Panels. These STAR Panels are scheduled for May 1-3, 2007 for Pacific mackerel and September 19-21, 2007 for Pacific sardine. To help guide and coordinate stock assessment authors and reviewers, the final draft of the revised *Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process* (Agenda Item C.2.a, Attachment 1) has been completed by the Scientific and Statistical Committee (SSC) and has been reviewed and approved by the Coastal Pelagic Species Management Team (CPSMT) and the Coastal Pelagic Species Advisory Subpanel (CPSAS).

The Pacific Fishery Management Council (Council) is scheduled to review and approve the final CPS Terms of Reference at its March 2007 meeting.

Council Action:

Adopt Final Terms of Reference for 2007 Coastal Pelagic Species STAR Process.

Reference Materials:

1. Agenda Item C.2.a, Attachment 1: Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process, Final Review Draft.
2. Agenda Item C.2.c, CPSMT Report.
3. Agenda Item C.2.c, CPSAS Report.
4. Agenda Item C2.c, Supplemental SSC Report.

Agenda Order:

- a. Agenda Item Overview
- b. Agency and Tribal Comments
- c. Reports and Comments of Advisory Bodies
- d. Public Comment
- e. **Council Action:** Adopt Final Coastal Pelagic Species STAR Terms of Reference

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PFMC
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TERMS OF REFERENCE FOR A COASTAL PELAGIC SPECIES
STOCK ASSESSMENT REVIEW PROCESS
FINAL REVIEW DRAFT

MARCH 2007

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Introduction

The purpose of this document is to help the Council family and others understand the coastal pelagic species (CPS) stock assessment review (STAR) process. Parties involved in the CPS STAR process are the National Marine Fisheries Service (NMFS); state agencies; the Council and its advisors, including the Scientific and Statistical Committee (SSC), Coastal Pelagic Species Management Team (CPSMT), Coastal Pelagic Species Advisory Subpanel (CPSAS), Council staff; and interested persons. The STAR process is a key element in an overall process designed to make timely use of new fishery and survey data, to analyze and understand these data as completely as possible, to provide opportunity for public comment, and to assure the results are as accurate and error-free as possible. The STAR process is designed to assist in balancing these somewhat conflicting goals of timeliness, completeness and openness.

Stock assessments for Pacific sardine and Pacific mackerel are conducted annually to assess the abundance, trends and appropriate harvest levels for these species.^{1/} Assessments 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 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 its use for setting harvest guidelines. Full stock assessment reports are developed and distributed following each STAR Panel review. Updated assessments are conducted during interim years and involve a less formal review by the CPSMT and the SSC. Details from interim-year assessments are documented in executive summaries.

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. Jack mackerel, Northern anchovy, and market squid are "monitored" species under the FMP. Annual landings of these species are monitored and reported in the annual Stock Assessment and Fishery Evaluation (SAFE) report, but harvest guidelines are not set for them.

STAR Goals and Objectives

The goals and objectives for the CPS assessment and review process^{2/} are to:

1. Ensure that CPS stock assessments provide the kinds and quality of information required by all members of the Council family.
2. Satisfy the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and other legal requirements.
3. Provide a well-defined, Council-oriented process that helps make CPS stock assessments the "best available" scientific information and facilitates use of the information by the Council. In this context, "well-defined" means with a detailed calendar, explicit responsibilities for all participants, and specified outcomes and reports.
4. Emphasize external, independent review of CPS stock assessment work.
5. Increase understanding and acceptance of CPS stock assessment and review work 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 assuring adequate technical review of stock assessments. NMFS 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 whether the information on which it will base its recommendation is the "best available" scientific advice. 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 a harvest recommendation. 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 species, 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 both involve costs, both monetary and time, which have not been calculated, but are likely substantial.

2/ In this document, the term "stock assessment" includes activities, analyses, and management recommendations, beginning with data collection, and continuing through to the development of management recommendations by the Coastal Pelagic Species Management Team and information presented to the Council as a basis for management decisions.

The Council and NMFS share primary responsibility for a successful STAR process. The Council will sponsor 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 they will consult with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. NMFS and the Council will share fiscal and logistical responsibilities.

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 to limit the number of advisory committees; ensure that advisory committees fairly represent affected parties; and 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 Magnuson-Stevens Act exempts the Council from FACA per se, but requires public notice and open meetings similar to those under FACA.

CPS STAR Coordination

The SSC CPS subcommittee chair will work with the Council, Council staff, other agencies, groups or interested persons that carry out assessment work to coordinate and organize Stock Assessment Team (STAT) Teams, 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 select STAR Panel chairs, and will coordinate the selection 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. The public is welcome to nominate qualified reviewers. 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 review the stock assessments and panel reports 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 HG 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 and complete. The Council's review process is the principal means for review of complete stock assessments, although additional in-depth technical review of methods and data is desirable. Stock assessments conducted by NMFS, state agencies, or other entities must be completed and reviewed in full accordance with the terms of reference, at times specified in the calendar.

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 HG recommendations to the Council based on agreed control rules. The CPSMT will use stock assessments, STAR Panel reports, and other information in making their HG recommendations. Preliminary HG recommendations will be developed by the CPSMT according to the management process defined in Council Operating Procedures (COP-9). A representative of the CPSMT will serve as a liaison to each assessment update review meeting or STAR Panel, but will not serve as a member of a STAR Panel. The CPSMT will not seek revision or additional review of the stock assessments after they have been reviewed by the STAR Panel. The CPSMT chair will communicate any unresolved issues to the SSC for consideration. Successful separation of scientific (i.e., STAT Team and STAR Panels) from management (i.e., CPSMT) work depends on stock assessment documents and STAR reviews being completed by the time the CPSMT meets to discuss preliminary HG levels.

CPSAS Responsibilities

The chair of the CPSAS will appoint a representative to participate at an assessment update review meeting or STAR Panel meeting. 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 will attend the CPSMT meeting at which preliminary HG recommendations are developed. The CPSAS representative will also attend subsequent CPSMT, Council, and other necessary meetings.

The CPSAS representative will 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.

SSC Responsibilities

The SSC will participate in the stock assessment review process and provide the CPSMT and Council with technical advice related to the stock assessments and the review process.

The SSC will assign at least two 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. In addition, the SSC will review and advise the CPSMT and Council on harvest guideline recommendations.

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 HG recommendations are made, and the Council meetings when CPS stock assessment agenda items are 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 and STAR Panel chair. The SSC will review any additional analytical work on any of the stock

assessments required or carried out by the CPSMT after the stock assessments have been reviewed by the STAR Panels. In addition, the SSC will review and advise the CPSMT and Council on harvest guideline recommendations.

The SSC, during their normally scheduled meetings, will serve as arbitrator to resolve disagreements between the STAT Team, STAR Panel, or CPSMT. The STAT Team and the STAR Panel may disagree on technical issues regarding an assessment. In this case, the stock assessment report must include a point-by-point response by the STAT Team to each of the STAR Panel recommendations. Estimates and projections representing all sides of the disagreement need to be presented, reviewed, and commented on by the SSC.

Council Staff Responsibilities

Council staff will prepare meeting notices and distribute stock assessment documents, stock summaries, meeting minutes, and other appropriate documents. Council staff will assist in coordination of the STAR process. Staff will also publish or maintain file copies of reports from each STAR Panel (containing items specified in the STAR Panel's term of reference), the outline for CPS stock assessment documents, comments from external reviewers, SSC, CPSMT, and CPSAS, letters from the public, and any other relevant information. At a minimum, the stock assessments (STAT Team reports, STAR Panel reports, and stock summaries) should be published and distributed in the Council's annual CPS SAFE document.

Terms of Reference for STAR Panels and Their Meetings

The principal responsibility of the STAR Panel is to carry out the following terms of reference. The STAR Panel's work includes:

1. reviewing draft stock assessment documents and any other pertinent information (e.g.; previous assessments and STAR Panel reports, if available);
2. working with STAT Teams to ensure assessments are reviewed as needed;
3. documenting meeting discussions; and
4. reviewing summaries of stock status (prepared by STAT Teams) for inclusion in the SAFE document.

STAR Panels normally include an SSC chair, at least one "external" member (i.e., outside the Council family and not involved in management or assessment of West Coast CPS, and one additional member. The total number of STAR Panel members should be at least "n+2" where n is the number of stock assessments and "2" counts the chair and external reviewer. In addition to Panel members, STAR meetings will include CPSMT and CPSAS advisory representatives with responsibilities as laid out in their terms of reference. STAR Panels normally meet for one week. The number of assessments reviewed per Panel should not exceed two.

The STAR Panel is responsible for determining if a stock assessment document is sufficiently complete. 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 its report.

The STAR Panel's terms of reference concern technical aspects of stock assessment work. The STAR Panel should strive for a risk neutral approach in its reports and deliberations. 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 should identify scenarios that are unlikely or have a flawed technical basis.

Recommendations and requests to the STAT Team for additional or revised analyses must be clear, explicit and in writing. A written summary of discussion on significant technical points and lists of all STAR Panel recommendations and requests to the STAT Team are required in the STAR Panel's report. This should be completed (at least in draft form) prior to the end of the meeting. It is the chair and Panel's responsibility to carry out any follow-up review work that is required.

Additional analyses required in the stock assessment should be completed during the STAR Panel meeting. If follow-up work by the STAT Team is required after the review meeting, then it is the Panel's responsibility to track STAT Team progress. In particular, the chair is responsible for communicating with all Panel members (by phone, email, or any convenient means) to determine if the revised stock assessment and documents are complete and ready to be used by managers in the Council family. If stock assessments and reviews are not complete at the end of the STAR Panel meeting, then the work must be completed prior to the CPSMT meeting where the assessments and preliminary HG levels are discussed.

The STAR Panel, STAT Team, and all interested parties are legitimate meeting participants that must be accommodated in discussions. It is the STAR Panel chair's responsibility to manage discussions and public comment so that work can be completed.

STAT Teams and STAR Panels may disagree on technical issues. If the STAR Panel and STAT Team disagree, the STAR Panel must document the areas of disagreement in its report. The STAR Panel may request additional analysis based on alternative approaches. Estimates representing all sides of the disagreement need to be presented in the assessment document, reviewed, and commented on by the SSC. It is expected that the STAT Team will make a good faith effort to complete these analyses.

The SSC representative on the STAR Panel is expected to attend CPSMT and Council meetings where stock assessments and harvest projections are discussed to explain the reviews and provide other technical information and advice.

The chair is responsible for providing Council staff with a camera ready and suitable electronic version of the Panel's report for inclusion in the annual SAFE report.

Suggested Template for STAR Panel Report

- Minutes of the STAR Panel meeting, including name and affiliation of STAR Panel members.
- List of analyses requested by the STAR Panel.
- Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
- Explanation of areas of disagreement regarding STAR Panel recommendations: among STAR Panel members (majority and minority reports), and between the STAR Panel and STAT Team.
- Unresolved problems and major uncertainties, (e.g., any special issues that complicate scientific assessment, questions about the best model scenario).
- Prioritized recommendations for future research and data collection.

Terms of Reference for CPS STAT Teams

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

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

Each STAT Team 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 Team should attend the CPSMT and Council meeting where final HG recommendations are developed, if requested or necessary. At these meetings, the STAT Team member shall be available to answer questions about the STAT Team report.

The STAT Team is responsible for preparing three versions of the stock assessment document, (1) a "draft" for discussion at the stock assessment review meeting; (2) a revised "complete draft" for distribution to the CPSMT, CPSAS, SSC, and Council for discussions about preliminary harvest levels; (3) a "final" version published in the SAFE report. Other than authorized changes, only editorial and other minor changes should be made between the "complete draft" and "final" versions. The STAT Team will distribute "draft" assessment documents to the STAR Panel, Council, and CPSMT and CPSAS representatives at least two weeks prior to the STAR Panel meeting.

The STAT Team is responsible for bringing computerized data and working assessment models to the review meeting in a form that can be analyzed on site. STAT Teams should take the initiative in building and selecting candidate models. If possible, the STAT Team should have several complete models and be prepared to justify model recommendations.

The STAT Team is responsible for producing the complete draft by the end of the STAR Panel meeting. In the event that the complete draft is not completed, the Team is responsible for completing the work as soon as possible and to the satisfaction of the STAR Panel at least one week before the CPSMT meeting.

The STAT Team and the STAR Panel may disagree on technical issues regarding an assessment. A complete stock assessment must include a point-by-point response by the STAT Team to each of the STAR Panel recommendations. Estimates and projections representing all sides of any disagreements need to be presented, reviewed, 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.

Terms of Reference for Stock Assessment Updates

The STAR process is designed to provide a comprehensive, independent review of a stock assessment. In other situations, a less comprehensive review of assessment results is desirable, particularly in situations where a “model” has already been critically examined and the objective is to simply update the “model” by incorporating the most recent data. 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 to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points and the harvest guideline (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 what in theory may seem to be a simple update, may in practice result in a situation that is impossible to resolve in an abbreviated process. In these cases, it may not be possible to update the assessment – rather the assessment may need to be revised in the next full assessment review cycle.

Qualification

The Scientific and Statistical Committee (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 analytical methods used to summarize data prior to input to the model, (c) the software used in programming the assessment, (d) the assumptions and structure of the population dynamics model underlying the stock assessment, (e) the statistical framework for fitting the model to the data and determining goodness of fit, (f) the procedure for weighting of the various data components, and (g) 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 seven factors has occurred, other than extending the time series of elements within particular data components used by the model, e.g., adding information from a recently completed survey and an update of landings. Extending catch per unit of effort (CPUE) time series based on fitted models (i.e., GLM models) will require refitting the model and updating all values in the time series. Assessments using updated CPUE time series qualify as updates if the CPUE standardization models follow the criteria for

assessment models described above that are applicable to CPUE standardization models. In practice there will always be valid reasons for altering a model, as defined in this broad context, although, in the interests of stability, such changes should be resisted as much as possible. Instead, significant alterations should be addressed in the next subsequent full assessment and review.

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 the CPSAS will designate one person each to participate in the review in an advisory capacity.

Review Format

Stock assessment updates will be reviewed during a single meeting of the SSC CPS Subcommittee. This meeting may precede or follow a normally scheduled SSC meeting. The review process will be as follows. The STAT Team 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 panelists 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 analytical requests or model runs during the meeting, although large or unexpected changes in model results may necessitate some model exploration. The review will focus on two crucial questions: (1) has the assessment complied with the terms of reference for stock assessment updates and (2) are new input data and model results sufficiently consistent with previous data and results that the updated assessment can 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.

STAT Team Deliverables

Since there will be limited opportunities for revision during the review meeting, it is the STAT team's responsibility to provide the Panel with a completed update at least two weeks prior to the meeting. To streamline the process, the team 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 being incorporated into the assessment be presented in enough detail, so that the STAR Panel can determine whether the update satisfactorily meets the Council's requirement to use the best available scientific information. Of particular importance will be a retrospective analysis showing the performance of the model with and without the updated data streams. Similarly, if any minor changes to the "model" structure are adopted, above and beyond updating specific data streams, a sensitivity analysis to those changes will be required.

In addition to documenting changes in the performance of the model, the STAT Team will be required to present key assessment outputs in tabular form. Specifically, the STAT Team's 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 (largely tabular and graphical)
- Uncertainty analysis, including retrospective analysis.

Review Panel Report

The STAR Panel 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
- Explanation of areas of disagreement among panelists and between the Panel and STAT Team
- 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. 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 (this also serves as the STAT summary included in the SAFE)
3. Introduction
 - a. Scientific name, distribution, stock structure, management units
 - b. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography)
 - c. Important features of current fishery and relevant history of fishery
 - d. Management history (e.g., changes in management measures, harvest guidelines)
 - 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 CPUE data, data used to estimate biological parameters (e.g., growth rates, maturity schedules, and natural mortality) with coefficients of variances (CVs) or variances if available. Include complete tables and figures if practical
 - ii. Sample size information for length and age composition data by area, year, etc.
 - b. History of modeling approaches used for this stock and changes between current and previous assessment models
 - c. Model description
 - i. Complete description of any new modeling approaches
 - ii. Assessment program with last revision date (i.e., date executable program file was compiled)
 - iii. List and description of all likelihood components in the model
 - iv. Constraints on parameters, selectivity assumptions, natural mortality, assumed level of age reader agreement or assumed ageing error (if applicable), and other assumed parameters
 - v. Description of stock-recruitment constraint or components
 - vi. Critical assumptions and consequences of assumption failures

- vii. Convergence criteria
- d. Model selection and evaluation
 - i. Evidence of search for balance between realistic (but possibly over-parameterized) and simpler (but not realistic) models
 - ii. Use hierarchical approach where possible (e.g., asymptotic vs. domed selectivities, constant vs. time varying selectivities)
 - iii. Do parameter estimates make sense, are they credible?
 - iv. Residual analysis (e.g., residual plots, time series plots of observed and predicted values, or other approach)
 - v. Convergence status and convergence criteria for "base-run(s)"
 - vi. Randomization run results or other evidence of search for global best estimates
- e. Base-run(s) results
 - i. Table listing all 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 and spawning biomass, recruitment and fishing mortality or exploitation rate estimates (table and figures)
 - iii. Selectivity estimates (if not included elsewhere)
 - iv. Stock-recruitment relationship
- 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. 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
 - B. Likelihood profiles for parameters or biomass levels
 - C. CVs for biomass estimated by bootstrap, Bayesian, or asymptotic methods
 - D. Subjective appraisal of magnitude and sources of uncertainty
 - E. Comparison of alternate models
 - F. Comparison of alternate assumptions about recent recruitment
 - ii. 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
 - iii. 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. The entire range of uncertainty should be carried through to the value for the HG
 - iv. Retrospective analysis (retrospective bias in base model or models for each area)

- v. Historic analysis (plot of actual estimates from current and previous assessments for each area)
- vi Simulation results (if available)

5. Harvest Control Rules

Pacific Sardine

The CPS FMP defines the maximum sustainable yield (MSY) control rule for Pacific sardine. This formula is intended to prevent Pacific sardine from being overfished and maintain relatively high and consistent catch levels over a long-term. The harvest formula for sardine is:

$$HG = (\text{TOTAL STOCK BIOMASS} - \text{CUTOFF}) \times \text{FRACTION} \times \text{U.S. DISTRIBUTION},$$

where harvest guideline (HG) is the total U.S. (California, Oregon, and Washington) harvest recommended for the next fishing year, TOTAL STOCK BIOMASS is the estimated stock biomass (ages 1+) from the current assessment, CUTOFF (150,000 mt) is the lowest level of estimated biomass at which harvest is allowed, FRACTION is an environment-based percentage of biomass above the CUTOFF that can be harvested by the fisheries, and U.S. DISTRIBUTION is the percentage of TOTAL STOCK BIOMASS in U.S. waters.

The value for FRACTION in the MSY control rule for Pacific sardine is a proxy for F_{MSY} (i.e., the fishing mortality rate that achieves equilibrium MSY). Given F_{MSY} and the productivity of the sardine stock have been shown to increase during relatively warm-water ocean conditions, the following formula has been used to determine an appropriate (sustainable) FRACTION value:

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

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, F_{MSY} is constrained and ranges between 5% and 15% depending on the value of T. Based on the T values observed throughout the period covered by this stock assessment (1983-2002), the appropriate F_{MSY} exploitation fraction has consistently been 15%; and this remains the case under current oceanic conditions ($T_{2002} = 17.3 \text{ }^\circ\text{C}$). However, it should be noted that the decline in sea-surface temperature observed in recent years (1998-2002) may invoke environmentally-based reductions in the exploitation fraction in the near future and could substantially reduce the harvest guideline.

The harvest guideline recommended for the U.S. (California, Oregon, and Washington) Pacific sardine fishery for 2003 was 110,908 mt.

Pacific Mackerel

The CPS FMP defines the MSY control rule for Pacific mackerel as:

$$HG = (\text{BIOMASS} - \text{CUTOFF}) \times \text{FRACTION} \times \text{STOCK DISTRIBUTION},$$

where HG is the U.S. harvest guideline, CUTOFF (18,200 mt) is the lowest level of

estimated biomass at which harvest is allowed, FRACTION (30%) is the fraction of biomass above CUTOFF that can be taken by fisheries, and STOCK DISTRIBUTION (70%) is the average fraction of total BIOMASS in U.S. waters.

CUTOFF and FRACTION values applied in the Council's harvest policy for mackerel are based on simulations published by MacCall et al. in 1985. BIOMASS is the estimated biomass of fish age 1 and older for the whole stock as of July 1. As for Pacific sardine, FRACTION is a proxy for F_{MSY} .

Based on this formula and current BIOMASS of 77,516 mt, the HG for the July 1, 2002 - June 30, 2003 season was 12,456 mt. The recommended harvest guideline was 1,381 mt lower (-10%) than the 2001-2002 HG, but similar to the average yield (14,053 mt) realized by the fishery since the 1992-1993 season.

6. Target Fishing Mortality Rates (if changes are proposed)
7. Management Recommendations
8. Research Needs (prioritized)
9. 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)
10. Literature Cited
11. Complete Parameter Files and Results for Base Runs

Appendix B: Template for Executive Summary Prepared by STAT Teams

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 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 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

Rebuilding Projections: principal results from rebuilding analysis if the stock is overfished

Summary Table: as detailed in the attached spreadsheet

COASTAL PELAGIC SPECIES MANAGEMENT TEAM STATEMENT ON STOCK
ASSESSMENT REVIEW (STAR) PANEL TERMS OF REFERENCE FOR 2007

The Coastal Pelagic Species Management Team (CPSMT) has reviewed the draft *Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process* (Agenda Item C.2.a, Attachment 1). The CPSMT recommends the Pacific Fishery Management Council adopt the document for use in the review of the full assessments for Pacific mackerel and Pacific sardine in 2007.

PFMC
02/09/07

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL STATEMENT ON STOCK
ASSESSMENT REVIEW (STAR) PANEL TERMS OF REFERENCE FOR 2007

The Coastal Pelagic Species Advisory Subpanel (CPSAS) has reviewed the draft *Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process* (Agenda Item C.2.a, Attachment 1). The CPSAS recommends the Pacific Fishery Management Council adopt the document for use in the review of the full assessments for Pacific mackerel and Pacific sardine in 2007.

PFMC
02/09/07