Agenda Item I.4
Attachment 1
September 2018

DRAFT TERMS OF REFERENCE

FOR THE

GROUNDFISH AND COASTAL PELAGIC SPECIES STOCK ASSESSMENT REVIEW PROCESS FOR 2019-2020



AUGUST 2018



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TABLE OF CONTENTS

1. SUMMARY OF MAJOR CHANGES FROM THE 2016 TERMS OF REFERENCE 4

2. INTRODUCTION 5

3. STOCK ASSESSMENT PRIORITIZATION 7

4. STOCK ASSESSMENT REVIEW PROCESS GOALS AND OBJECTIVES 8

5. ROLES AND RESPONSIBILITIES OF STOCK ASSESSMENT REVIEW PROCESS PARTICIPANTS 9

5.1. Shared Responsibilities 9
5.2. STAR Panel Responsibilities 10
5.3. STAR Panel Chair Responsibilities 18
5.4. Stock Assessment Team Responsibilities 19
5.5. National Marine Fisheries Service Responsibilities 22
5.6. Council Staff Responsibilities 23
5.7. Management Team Responsibilities 24
5.8. Advisory Panel Responsibilities 25
5.9. State / Tribal Data Stewards and State / Tribal Agency Responsibilities 25
5.10. Scientific and Statistical Committee Responsibilities 25

6. FULL ASSESSMENTS 27

7. UPDATE ASSESSMENTS 27

8. CATCH-ONLY PROJECTIONS 31

9. DATA-MODERATE ASSESSMENTS FOR GROUNDFISH SPECIES 31

10. DATA-POOR ASSESSMENTS FOR GROUNDFISH SPECIES 32

11. CATCH REPORTS 33

APPENDIX A: 2019 GROUNDFISH AND CPS STOCK ASSESSMENT REVIEW CALENDAR 34

APPENDIX B: OUTLINE FOR FULL AND UPDATE STOCK ASSESSMENT DOCUMENTS 35

APPENDIX C: TEMPLATE FOR AN EXECUTIVE SUMMARY FOR FULL AND UPDATE STOCK ASSESSMENT DOCUMENTS 42

APPENDIX D: CHECK LIST OF ELEMENTS TO BE INCLUDED IN FULL AND UPDATE ASSESSMENT DOCUMENTS ~~(GROUNDFISH ONLY)~~ 44

APPENDIX E: TEMPLATE FOR A DATA-MODERATE OR DATA-POOR ASSESSMENT DOCUMENT 48

APPENDIX F: DEFINITIONS OF SPECIES CATEGORIES FOR GROUNDFISH AND CPS ASSESSMENTS AND RULES FOR MAKING CATEGORY ASSIGNMENTS FOR FULL OR UPDATE ASSESSMENTS 49

APPENDIX G: PROPOSED OUTLINE FOR 2019 ACCEPTED PRACTICES GUIDELINES FOR GROUNDFISH STOCK ASSESSMENTS 51

1. Summary of Major Changes from the 2016 Terms of Reference

- Addition of this summary of major changes.
- New review step: SSC Groundfish Subcommittee review of all new groundfish assessments prior to the SSC review in September.
- Specification of a November deadline for finalizing all groundfish assessments not reviewed at a mop-up panel.
- STAR Panel and STAT decide on an appropriate method for measuring the scientific uncertainty in the stock assessment (sigma).
- STAR Panel recommends a stock assessment's category designation, subject to SSC review and approval.
- Addition of a section for STAR Panel Chair responsibilities.
- Clarification of steps leading to a mop-up panel review.
- STATs must report any changes in the model brought to the STAR compared to the pre-STAR draft assessment document.
- ~~STATs must provide formal written responses to any formal STAR panel requests (i.e., figures with no text are not sufficient.)~~
- STAR Panel Chair responsible for making certain that STAT responses to STAR panel requests are thorough and clearly presented.
- Removal of the requirement that post-STAR assessment document include a point-by-point response to the current STAR panel's recommendations.
- NMFS is encouraged to develop stand-alone documentation of key data sources.
- NMFS is encouraged to organize and convene pre-assessment workshops to evaluate the proposed methods and data.
- Default assumptions for removals in projections and decision tables in groundfish assessments will be specified in the *Accepted Practices Guidelines*. The STAT in consultation with GMT and Council staff can deviate from default assumptions, in which case they must provide written justification.
- The SSC may request post-STAR analyses and model changes to arrive at an acceptable assessment, but the requests should be limited and focused.
- Reordering the presentation of the different stock assessment types.
- Section added on full stock assessments.
- Clarification of changing the major axis of uncertainty in update assessments.
- Description added of contents for a catch-only projection report.
- Several new elements to be reported in full and update stock assessments:
    - Total mortality estimates from WCGOP.
    - Summary (if possible) of catches, stock size, and stock status for the most recent ten years for assessed fisheries off Canada, Alaska, and/or Mexico.
    - Swept-area biomass estimates for surveys.
    - Table with step-by-step changes when bridging from the most recent previous assessment model to the new base model.
    - ~~Sensitivity comparison of MacAllister & Ianelli weighting versus Francis weighting~~

~~versus Dirichlet for compositional data.~~

- Likelihood profiles reported in tabular format.
- Section on *Unresolved problems and major uncertainties* (groundfish only) in main document (not just in the Executive Summary).
- Document the calculation of the base model's sigma.
- Describe progress on *Research and Data Needs* items identified in the most recent previous stock assessment.

- New appendix with check-lists for elements to be reported in full and update stock assessments.
- Appendix with stock assessment category definitions includes the rules for making category assignments.
- New appendix outlining topics that will be covered in the *Accepted Practice Guidelines for Groundfish Stock Assessments*, including many new topics not covered in the 2016 version of the *Guidelines*.

~~1.~~2. INTRODUCTION

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

Parties involved in the process are Council members, Council staff, members of Council Advisory Bodies, including the Scientific and Statistical Committee (SSC), the Groundfish and CPS Management Teams (GMT and CPSMT), the Groundfish and CPS Advisory Subpanels (GAP and CPSAS), the National Marine Fisheries Service (NMFS), state agencies, and interested persons. The review by the STAR panel is a key element in an overall procedure designed to investigate the technical merits of stock assessments and other relevant scientific information. The review of stock assessments requires a routine, dedicated effort that simultaneously meets the needs of the NMFS, the Council, and others. Program reviews, in-depth external reviews, and peer-reviewed scientific publications are used by federal and state agencies to provide quality assurance for the basic scientific methods employed to produce stock assessments. The extended time frame required for such reviews is not suited to the routine examination of assessments that are, generally, the primary basis for harvest recommendations.

This current version of the terms of reference (TOR) reflects recommendations from previous

participants in the STAR process, including STAR panel members, the SSC, stock assessment teams (STATs), Council staff, and Council advisory groups. Nevertheless, no set of guidelines can be expected to deal with every contingency, and all participants should anticipate the need to be flexible and address new issues as they arise. This document is included in the Council's Statement of Organization, Practices and Procedures as documentation of the review process that underpins scientific advice from the SSC. The SSC has developed a separate TOR for reviewing new methods that might be used in stock assessments, including methods and tools to incorporate ecosystem processes.

Stock assessments are conducted to assess the abundance and trends of fish stocks, and provide the fundamental basis for management decisions regarding appropriate harvest levels. In most cases, assessments use statistical population models to integrate and simultaneously analyze survey, fishery, and biological data. Environmental and ecosystem data may also be integrated in stock assessments. Hilborn and Walters (1992)[1] define stock assessments as "the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices." In this document, the term "stock assessment" includes activities, analyses and reports, beginning with data collection and continuing through to scientific recommendations presented to the Council and its advisors. To best serve their purpose, stock assessments must attempt to identify and quantify major uncertainties, balance realism and parsimony, and make best use of the available data.

There are several distinct types of assessment products, which are subject to different review procedures.

1. **Full/Benchmark assessement**: The ~~most complicated~~ least restricted assessment type is a~~A~~ **"full (or benchmark) assessment"**, which makes greater use of data than other assessment types and generally has a larger and more complex set of equations ~~used~~ in the underlying assessment model than for many "data-moderate" or "data-poor" assessments. A full assessment can ~~is~~ be applied to a stock that has not been previously assessed or re-applied to a previously assessed stock, in which case the ~~a new assessment or an assessment that may be substantially different from the previously conducted assessment. A~~ full assessment involves a re-examination of the underlying assumptions, data, and model parameters previously used to assess the stock. Full assessments are reviewed via the full STAR process, which includes STAR panel review.

2. **Update assessement**: Resource limitations constrain the number of full assessments that can be conducted and reviewed during an assessment cycle. ~~Some a~~For assessment models that have relatively few outstanding modeling or data issues and provide relatively stable results as new data are added~~, such that it is not necessary to develop a completely new assessment every time the species is assessed. In these cases~~, an **"update assessment"** may be preferable when more current information is desired and other there are other priorities for full assessments. An update assessment is defined as an assessment that maintains the model structure of the previous full assessment, with additions ~~and is~~ generally restricted to ~~the addition of new~~ data that have become available since the last assessment appended to previously evaluated time series, ~~that have become available since the last assessment and~~ along with limited allowable minor alterations described further in section 7 of this document. Update assessments are reviewed by the relevant subcommittee

[1] Hilborn, R., and C. J. Walters. 1992. Quantitative fisheries stock assessment: Choice, dynamics and uncertainty. Chapman and Hall.

of the SSC (Groundfish or CPS) rather than by a STAR panel.

3. **Catch-only projection**: In some cases, ~~an update assessment uses~~ only recent fisheries catch information ~~and uses~~ are added to an existing, approved stock assessment model to generate~~s~~ **catch-only projections** for the stock. ~~CUpdate assessments and c~~atch-only projections are reviewed by the relevant subcommittee of the SSC (Groundfish or CPS) rather than by a STAR panel.

4. ~~A "d~~**Data-moderate assessment**~~"~~: ~~is a~~A ~~third fourth type of assessment~~ **"data-moderate assessment"** ~~that incorporates~~ uses historical catch data and one or more indices of abundance (or biomass) (e.g., trawl survey or fishery catch per unit effort (CPUE) indices). Council-approved methods for ~~D~~data-moderate assessments are limited in that they do not use ~~available~~ compositional data (i.e., length or age data), even if available, and have simplified population dynamics (deterministic recruitment), which makes such assessments less complicated and enables more expeditious review. Data-moderate assessments are reviewed by the relevant SSC Subcommittee if an approved standard methodology is proposed to be used. They are reviewed by a STAR panel if a new or non-standard assessment methodology is proposed to be used.

5. ~~A "d~~**Data-poor assessment**~~:", which is the fourth fifth assessment type,~~ A **"data-poor assessment"** relies on catch data and basic life history information about the species to determine the overfishing limit (OFL) for the stock. A data-poor assessment differs from a data-moderate assessment in that it does not include any abundance indices.

~~1.~~6. **Catch Report**: A **"catch report"** ~~is a fifth sixth type of assessment product that~~ tabulates fishery removals over recent years to ensure that they are below specified annual catch limits (ACLs). A catch report would be produced when little new information is available about the stock to inform the assessment. Data-poor assessments and catch reports are reviewed by the relevant Subcommittee of the SSC (Groundfish or CPS).

Stock assessments for ~~Managed~~ managed species are assigned to one of three categories, based on the amount of information available for the species. Assignments are made by the SSC based on the recommendations from the STAR Panels. Category 1 includes the most robust assessments that have the smallest amount of uncertainty associated with assessment results. Category 2 is primarily for data-moderate assessments, but can also be used to categorize full assessments that are constrained by data quality, result in ~~large~~ unrealistically small variance around key management quantities (e.g., $SB_{current}$), ~~-~~and/or make~~the need for many~~ unusual simplifying assumptions (e.g., no recruitment deviations)~~in the face of complex reality~~, and Category 3 is for data-poor assessments with the largest amount of uncertainty associated with assessment results. Detailed definitions for each of the three categories are provided in Appendix ~~E~~F.

~~2.~~3. STOCK ASSESSMENT PRIORITIZATION

Stock assessments for Pacific sardine are conducted annually, with full assessments occurring every third year, and update assessments during interim years. In June 2013, the Council established a Pacific mackerel management and assessment schedule such that full stock assessments will be conducted every four years, starting in 2015, and catch-only projections ~~estimates (i.e., catch-only updates)~~ will be conducted every four years, starting in 2017 (i.e. either a full assessment or catch-only projections will occur every two years on an alternating basis). The Council also directed that annual harvest measures for Pacific mackerel be implemented on a

biennial basis beginning with the 2015-2016 fishing year. Assessments for groundfish species are conducted every other year as part of the biennial harvest specification cycle. A relatively small number of the more than 100 species in the Council's Groundfish Fishery Management Plan are selected each cycle for full, update or data-moderate assessments. To implement the RMSA requirements to establish OFLs and acceptable biological catches (ABCs) for all species in fishery management plans, catch-only methods (e.g., Depletion-Corrected Average Catch (DCAC)[2], Depletion-Based Stock Reduction Analysis (DB-SRA)[3] and Simple Stock Synthesis (SSS)[4]) have been applied to data for the majority of groundfish species. It remains the goal of the Council to substantially increase the number of groundfish stocks with full assessments.

~~In April 2006, the SSC recommended, and the Council adopted, an approach to prioritize groundfish species for full and update stock assessments as well as catch reports based on: 1) economic or social importance of the species, 2) vulnerability[5] and resilience of the species, 3) time elapsed since the last assessment (NMFS advises assessments to be updated at least every five years), 4) data availability, 5) potential risk to the stock from the current or foreseeable management regime, and 6) qualitative trends from surveys (when available). It was also recommended that overfished groundfish stocks that are under rebuilding plans be evaluated each assessment cycle to ensure adequate progress towards achieving stock recovery. Recently t~~Council decisions on stock assessment priorities are aided by a formulaic approach for ranking groundfish stock assessments developed by the Northwest Fisheries Science Center based on a national framework for stock assessment prioritization described in Methot (2015)[6] ~~he Northwest Fisheries Science Center developed a formulaic approach for ranking groundfish stock assessments based on a national framework for stock assessment prioritization described in Methot (2015)[7]~~. The formal rankings were considered by the Council in June ~~2016~~ 2018 when the Council adopted the ~~2017~~ 2019 stock assessment plan for groundfish and CPS stocks that is provided in Appendix A. Additionally, the Council decided preliminary priorities for 2021 groundfish stock assessments to allow agencies more time to prepare for future stock assessments (e.g., focus on ageing collected structures, biological sampling, etc.). Final decisions on 2021 groundfish stock assessment priorities will be made in June 2020.

~~3.~~4. STOCK ASSESSMENT REVIEW PROCESS GOALS AND OBJECTIVES

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

1) ensure that stock assessments represent the best scientific information available and facilitate the use of this information by the Council to adopt OFLs, ABCs, ACLs, harvest guidelines (HGs), and annual catch targets (ACTs);

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[2] MacCall, A. D. 2009. Depletion-corrected average catch: a simple formula for estimating sustainable yields in data-poor situations. *ICES Journal of Marine Science* 66: 2267-2271.

[3] Dick, E. J. and A. D. MacCall. 2011. Depletion-Based Stock Reduction Analysis: A catch-based method for determining sustainable yields for data-poor stocks. *Fisheries Research* 110: 331-341.

[4] Cope, J.M. 2013. Implementing a statistical catch-at-age model (Stock Synthesis) as a tool for deriving overfishing limits in data-limited situations. *Fisheries Research* 142: 3-14.

~~[5] Patrick, W. S., P. Spencer, J. Link, J. Cope, J. Field, D. Kobayashi, P. W. Lawson, T. Gedamke, E. Cortes, O. Ormseth, K. Bigelow, W. Overholtz. 2010. Using productivity and susceptibility indices to assess the vulnerability of UnitedStates fish stocks to overfishing. *Fishery Bulletin*. 108(3):305-322.~~

[6] Methot Jr., R.D. (Editor). 2015. Prioritizing fish stock assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-152, 31 p.

~~[7] Methot Jr., R.D. (Editor). 2015. Prioritizing fish stock assessments. U.S. Dep. Commer., NOAA Tech. Memo. NMFS-F/SPO-152, 31 p.~~

2) meet the mandates of the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements;
3) follow a detailed calendar and fulfill explicit responsibilities for all participants to produce required reports and outcomes;
4) provide an independent ~~external~~ review of stock assessments;
5) increase understanding and acceptance of stock assessments and peer reviews by all members of the Council family;
6) identify research needed to improve assessments, reviews, and fishery management in the future; and
7) use assessment and review resources effectively and efficiently.

4.5. Roles and Responsibilities of Stock Assessment Review Process Participants

~~4.1.~~5.1. Shared Responsibilities

All parties have a stake in assuring adequate technical review of stock assessments. NMFS, as the designee of the Secretary of Commerce, must determine that the best scientific advice has been used when it approves fishery management recommendations made by the Council. The Council uses advice from the SSC to determine that the information on which it bases its recommendations represents the best available science. Scientists and fishery managers providing technical documents to the Council for use in management need to assure that their work is technically correct.

The Council, NMFS, and the Secretary of Commerce share primary responsibility to create and foster a successful STAR process. The Council oversees the process and involves its standing advisory bodies, especially the SSC. For groundfish, NMFS provides a stock assessment coordinator (SAC) to facilitate and assist in overseeing the process, while for CPS a designated SWFSC staff member performs this role. Together NMFS and the Council consult with all interested parties to plan and prepare TOR, and develop a calendar of events with a list of deliverables for final approval by the Council. NMFS and the Council share fiscal and logistical responsibilities and both should ensure that there are no conflicts of interest in the process[8].

The STAR panels are 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 is 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

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

FACA per se, but requires public notice and open meetings similar to those under FACA.

~~4.2.~~5.2. STAR Panel Responsibilities

The role of the STAR panel is to conduct a detailed technical evaluation of a full stock assessment to advance the best available scientific information to the Council. The other types of stock assessment do not undergo review by a STAR panel. The specific responsibilities of the STAR panel are to:

1) be familiar with the Terms of Reference, the *Accepted Practices Guidelines* (for groundfish assessments), and most recent Methodology Review reports;

~~1)~~2) review draft stock assessment documents, data inputs, and analytical models, along with other pertinent information (e.g., previous assessments and STAR panel reports, when available);

~~2)~~3) discuss the technical merits and deficiencies of the input data and analytical methods during the open review panel meeting, work with the STATs to correct deficiencies, and, when possible, suggest new tools or analyses to improve future assessments; and

~~3)~~4) develop STAR panel reports for all reviewed species to document meeting discussion and recommendations.

~~The STAR panel chair has, in addition, the responsibility to: 1) develop a STAR panel meeting agenda; 2) ensure that STAR panel participants follow the TOR; 3) guide the STAR panel and the STAT to mutually agreeable solutions; and 4) coordinate review of revised stock assessment documents before they are forwarded to the SSC.~~

Groundfish and CPS STAR panels include a chair appointed by the SSC and three other experienced stock assessment analysts knowledgeable of the specific modeling approaches being reviewed. Details of the Chair's many responsibilities are provided in a separate section below. Of these three other members, at least one should be appointed from the Center for Independent Experts (CIE) and at least one should be familiar with west coast stock assessment practices. Selection of STAR panelists should be based on expertise, independence, and a balance between outside expertise and in-depth knowledge of west coast fisheries, the data sets available for those fisheries, and the modeling approaches applied to west coast groundfish and CPS. Expertise in ecosystem models or processes, and knowledge of the role of groundfish and CPS in the ecosystem is also desirable, particularly if the assessment includes ecosystem models or environmental processes. For groundfish, an attempt should be made to identify one reviewer who can consistently attend all STAR panel meetings in an assessment cycle. The pool of qualified technical reviewers is limited; therefore, staffing of STAR panels is subject to constraints that can make it difficult to meet the conditions above.

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

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

STAR panel meetings also include representatives of the relevant management team (MT) and advisory panel (AP), with responsibilities as laid out in these TOR, and a Council staff member to advise the STAR panel and assist in recording meeting discussions and results. The STAR panel, STATs, the MT and AP representatives, and the public are all legitimate meeting participants who should be accommodated in discussions. It is the STAR panel chair's responsibility to coordinate discussion and public comment so that the assessment review is completed on time.

The STAR is by design a transparent process. STAR panel meetings are open to the public and are announced on the Council's website, through Council meeting notices, and in the Federal Register ~~at least 23 days~~ prior to the STAR panel meeting. The Council (or the SWFSC for CPS) posts background materials on an ~~ftp~~ accessible site (e.g. ftp) prior to the meeting and makes hard copies available upon request. A STAR panel normally meets for four to five days. The number of assessments reviewed per panel should not exceed two, except in extraordinary circumstances if the SSC and NMFS agree that it is advisable, feasible, and/or necessary. When separate assessments are conducted at the sub-stock level by different STATs (e.g., black rockfish in 2015), each assessment is considered an independent full assessment for review purposes. Contested assessments, in which alternative assessments are brought forward by competing STATs using different modeling approaches, would 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 within the STAR process. The STAR panel should thoroughly evaluate each analytical approach, comment on the relative merits of each, and, when conflicting results are obtained, identify the reasons for the differences. The STAR panel should work with the STATs to come to agreement on a base model that will be reviewed by the SSC to determine its merits for supporting management advice.

During ~~the off-year~~interim periods, new data collection efforts, research surveys, and/or analytical methods in support of stock assessments may be reviewed through the Council's Methodology Review Process for Groundfish and Coastal Pelagic Species (PFMC, 2018) This provides an independent peer review process of new methods in advance of the STAR Panel process to~~and~~ ensure~~s~~ the best available scientific information is used in stock assessments. The SSC's decisions and guidelines are documented~~s~~ in ~~the~~ methodology review panel reports and used to inform the ~~*Best*~~*Accepted Practices Guidelines for Groundfish Stock Assessments*. (SSC, 2018). The *Guidelines* are intended to provide groundfish STATs with default approaches they should use for dealing with certain stock assessment data and modeling issues. STATs may diverge from the *Guidelines* if they provide adequate justification for doing so. Accepted practices endorsed by the SSC should not be re-evaluated during STAR Panel, unless there have been changes in the approach or method previously reviewed, or under other extenuating circumstances.

~~**5.3. STAR Panel Chair Responsibilities**~~

~~The STAR Panel chair is appointed by the SSC and is responsible to: 1) develop a STAR panel meeting agenda; 2) ensure that STAR panel participants follow the TOR and Accepted Practices Guidelines; 3) guide the STAR panel and the STAT to mutually agreeable solutions; and 4) coordinate review of revised stock assessment documents before they are forwarded to the SSC.~~

~~It is the STAR panel chair's responsibility to ensure that STAR panel participants adhere to the TOR and Accepted Practices and the meeting is run effectively and efficiently. During the panel meeting, the STAR panel chair appoints members of the panel to act as rapporteurs and draft the report (or specific sections thereof) according to the STAR panel chair guidance on format and level of detail. The STAR panel chair is responsible for preparing the final draft of the panel report, obtaining panel approval, providing a copy for STAT review and comment, and submitting it to the Council in a timely fashion (i.e., by briefing book deadline or earlier, as dictated by the schedule below).~~

~~Following the STAR panel meeting, the chair will lead the effort to draft the STAR panel report. In addition to the reviewers, the Chair will solicit comments on the draft report from the STAT and the STAR panel advisors. The purpose of this is limited to ensuring that the report is technically accurate and reflects the discussion that occurred at meeting, and should not be viewed as an opportunity to reopen debate on issues. The STAR panel chair is the final arbiter on wording changes suggested by STAT and the STAR panel advisors as the report is the panel's report of the meeting. Any detailed commentary by STAR panel advisors should be drafted separately, reviewed by the full advisory body, and included in the briefing book. The STAR panel chair is responsible for providing the Council staff with the final version of the STAR panel report.~~

~~The STAR panel chair is also responsible for communicating with the STAT to determine if the revised stock assessment document is complete. Any post-STAR drafts of the stock assessment must be reviewed by the STAR panel chair. The assessment document can only be given to Council staff for distribution after it has been endorsed by the STAR panel chair, and when it is accompanied by a complete and approved STAR panel report. Likewise, the final draft that is published on the Council's web site (www.pcouncil.org) must also be approved by the STAR panel chair prior to being accepted by Council staff.~~

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

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

- ~~The STAR panel report should be in complete form, except for minor wording edits, etc. within two weeks of the end of the STAR panel, so that the STAT can review and ensure the post-STAR draft document sent to the STAR panel chair adheres to the STAR panel report (or at least explain reasons for any discrepancies in that version of the assessment)~~
- ~~Comments on the post-STAR/Pre-SSC draft of the assessment should be returned to the STAT within two weeks after the deadline for that draft.~~
- ~~Comments on the Post-SSC draft should be should be returned to the STAT within two weeks after the deadline for that draft, so ensure the STAT has time to complete any changes prior to the November briefing book deadline (or as soon as practicable for assessments sent to the "mop-up" panel for further work and review).~~

1. ~~When time is limited between the STAR panel and the briefing book (or subcommittee) submission deadline, an accelerated timeline of intermediate deadlines for the STAT and STAR panel/chair should be decided upon at the STAR panel to ensure an appropriately~~

~~reviewed and revised version of the assessment will be available by the submission deadline.~~

STAR Panel Requests for Additional Analyses

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

~~For groundfish species, the SSC or SSC Groundfish Subcommittee reviews the STAR panel report and recommends whether an assessment should be further reviewed at the end of the assessment cycle (i.e., mop-up review panel) by the SSC's Groundfish Subcommittee during a meeting that occurs after all of the STAR panels, primarily to review rebuilding analyses for overfished/rebuilding stocks. Soon after completion of all STAR panels, the SSC Groundfish Subcommittee will meet by teleconference, or webinar, or, if needed, in person to recommend which assessments, if any, will be sent to the mop-up panel and to prioritize further analyses. The SSC Groundfish Subcommittee will also review all assessments endorsed by STAR panels at this meeting and consider their own endorsement of these assessments in advance of the SSC's review in September. This teleconference or webinarmeeting will be noticed in advance as one where the SSC Groundfish Subcommittee makes the decision which stocks would be subsequently reviewed at the mop-up panel and which stock assessments are approved for final consideration by the SSC and Council at their September meeting. Since only two assessments can be adequately reviewed in a one-week review panel, the SSC Groundfish Subcommittee will also have the authority to decide which two assessments are reviewed at the mop-up panel in cases where there are more than two candidate assessments for further review. The full SSC and Council can then decide in September whether to schedule a second mop-up panel before the November Council meeting to review any remaining assessments that were not reviewed in the first mop-up panel. For CPS, if an assessment is found not to be acceptable for use in management, a full assessment would be conducted the following year.~~

The STAR panels are expected to be judicious in their requests of the STATs. Requests for large changes in data or analytical methods used may often require significant amount of time to complete (e.g., GLMM or VAST analysis) and may result in changes to the assessment that cannot be adequately evaluated during the course of the STAR panel meeting. Therefore, caution should be exercised in making such changes. In many cases such changes should be relegated to future research recommendations and/or methodology review. If a groundfish STAR panel agrees that significant changes are necessary, and the assessment is not otherwise acceptable, a

recommendation for further examination of the assessment at the mop-up meeting is warranted. Similarly, if the STAR panel agrees that the assessment results strongly indicate that the current F_{MSY} value or management target and threshold are inappropriate, it should identify this in its report and recommend further analysis to support a change to more appropriate values.

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

To the extent possible, analyses requested by the STAR panel should be completed by the STAT during the STAR panel meeting. ~~It is the obligation of the STAR panel chair, in consultation with other panel members, to prioritize requests for additional analyses.~~ In situations where a STAT arrives with a well-constructed, thoroughly investigated assessment, it may be that the panel finishes its review earlier than scheduled (i.e., early dismissal of a STAT). If follow-up work by the STAT is required after the review meeting (such as MCMC integration of an alternative model created during the STAR panel meeting), this should be completed before the briefing book deadline for the Council meeting at which the assessment is scheduled for review~~. It is the STAR panel chair's responsibility to track STAT progress. In particular, the chair is responsible for communicating with the STAT to determine if the revised stock assessment document is complete. Any post-STAR drafts of the stock assessment must be reviewed by the STAR panel chair. The assessment document can only be given to Council staff for distribution after it has been endorsed by the STAR panel chair, and when it is accompanied by a complete and approved STAR panel report. Likewise, the final draft that is published on the Council's web site (www.pcouncil.org) must also be approved by the STAR panel chair prior to being accepted by Council staff.~~ All groundfish assessments not going to a mop-panel review that have been endorsed by the SSC and adopted by the Council need to be finalized and posted on the Council's web site by the November briefing book deadline. Those assessments requiring subsequent review at a mop-up panel need to be substantively complete (especially the 10-year projections of harvest specifications under default and, if requested by the Council, alternative harvest control rules) by the November briefing book deadline to facilitate a final SSC review in November. These assessments, if endorsed by the SSC and adopted by the Council, need to be finalized and posted on the Council's web site as soon after the November Council meeting as practicable.

For some stocks selected for full assessments, the available data may prove to be insufficient to support a category 1 assessment (Appendix ~~E~~F). In such cases, the STAT should consider whether simpler approaches appropriate for a category 2 assessment can be applied. Simpler approaches usually make stronger assumptions and estimate fewer parameters, but are less demanding of data. It is the responsibility of the STAR panel, in consultation with the STAT, to consider the strength of inferences that can be drawn from analyses presented, and identify major uncertainties. If useful results have been produced, the STAR panel should review the appropriateness and reliability of the methods used to draw conclusions about stock status and/or exploitation rates, and either recommend or reject the analysis on the basis of its ability to provide useful information into the management process. If the STAR panel agrees that important results have been generated, it should forward its findings and conclusions to the SSC and the Council for consideration in setting of OFLs, ABCs, and ACLs (for groundfish) and HGs (for CPS). A key section of the assessment is that on research needed to improve the assessment. Highlighting research priorities should increase the likelihood that future stocks assessments can be raised to category 1.

The STAR panel review focuses on technical aspects of ~~the~~ full stock assessments. It is recognized that no model or data set is perfect or issue-free. Therefore, outputs of a broad range of model runs should be evaluated to better define the scope of the accepted model results. The panel should strive for a risk-neutral perspective in its deliberations, and discuss the degree to which the accepted base model describes and quantifies the major sources of uncertainty in the assessment. Confidence intervals for model outputs, as well as other measures of uncertainty that could affect management decisions, should be provided in completed stock assessments and the reports prepared by STAR panels. The STAR panel may also provide qualitative comments on the probability of results from various model runs, especially if the panel does not consider the probability distributions calculated by the STAT capture all major sources of uncertainty. However, as a scientific peer review body, the STAR panel should avoid matters of policy. Assessment results from model runs that are technically flawed or questionable on other grounds should be identified by the panel and excluded from the alternatives upon which management advice is to be developed.

Once alternative models, which capture the overall degree of uncertainty in the assessment, are formulated, a ~~2~~two-way decision table (alternative models versus management actions) should be developed to illustrate the repercussions of uncertainty to management decisions. The ratio of probabilities of alternative models should be 25:50:25, with the base model being twice as likely as each of the low and high stock size alternatives. There are a number of ways in which the probabilities can be assigned to each model. Probabilities can be assigned to each model through finding the major axis of uncertainty parameter values that correspond to the 12.5% and 87.5% quantiles of the lognormal distribution of the estimated stock size (i.e., taking the natural log of the estimate of stock size from the base model and then adding and subtracting 1.15 times the standard error of the base model estimate in log space), and running the alternative models with those parameters. The 12.5% and 87.5% quantiles of the parameter determining the major axis of uncertainty may also provide reasonable alternative models. Expert judgment may also be used as long as it is fully explained, justified and documented.

Bracketing of the base model for which the geometric mean of the final biomass levels from the high and low stock size alternative models approximates the base model biomass level (indicating that it is evenly distributed in log space) ~~would be~~is an ~~ideal~~ option which corresponds well to the assumption of a lognormal uncertainty distribution inherent in the current PFMC approach to determining scientific uncertainty buffers. ~~In this case, stock size in log space should be used~~ This approach is based on the recognition that~~because~~ the distribution of possible stock sizes is necessarily bounded at the low end, while the right tail can extend much further from the point estimate, and thus the probability density is more log-normal than normal. ~~If the bracketing models are far from this option (e.g., if the base model is closer to the upper bracketing model in absolute terms than to the lower bracketing model), the three levels should be reconsidered and either one or more of them adjusted. In certain cases, if there is a great deal of confidence in the bracketing models, the base model could be reconsidered, or a justification for the~~Explanation and justification of severely non-lognormal structure of alternatives should be given.~~, and/or justification for an adjustment to the 25:50:25 probabilities be provided.~~ Similarly, if more than one dimension is used to characterize uncertainty, resulting in, for example, a 3-by-3 decision table, careful consideration and justification of how the complete table brackets the uncertainty should be undertaken. Likelihood-profile based approaches are another option for determining

decision tables. Guidance on approaches for constructing decision tables will be provided in the 2019 *Accepted Practices Guidelines for Groundfish Stock Assessments*.

The STAR panel and STAT in consultation with Council Staff should decide on an appropriate method for measuring the scientific uncertainty in the stock assessment, known as "sigma". Typically sigma would be based on the larger of the category-specific default value or the asymptotic uncertainty estimates associated with the estimated biomass in the last year of the modeled period. Alternatively sigma could be based on the spread of uncertainty underlying the decision table (by taking the log of the ratio of the base state of nature to the low state of nature and dividing the result by 1.15, which is the normal quantile corresponding to a 75% two-sided confidence interval). The SSC will determine the appropriate sigma value (e.g., a proxy sigma value for the stock category or a stock-specific sigma) to apply to estimates of acceptable biological catch based on these calculations.

Areas of Disagreement

STATs and STAR panels are required to make an honest attempt to resolve any areas of disagreement during the meeting. Occasionally, fundamental differences of opinions may remain between the STAR panel and STAT that cannot be resolved during the STAR panel meeting. In such cases, the STAR panel must document the areas of disagreement in its report. While identifying areas of disagreement, the following questions should be discussed at the meeting:

1) Are there any differences in opinion about the use or exclusion of data?
2) Are there any differences in opinion about the choice of the base model?
3) Are there any differences in opinion about the characterization of uncertainty?

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

STAR Panel Report

The STAR panel report should be developed and approved by the full panel shortly after the STAR panel meeting. ~~The STAR panel chair appoints members of the panel to act as rapporteurs and draft the report (or specific sections thereof) according to the STAR panel chair guidance on format and level of detail. The STAR panel chair is responsible for preparing the final draft of the panel report, obtaining panel approval, providing a copy for STAT review and comment, and submitting it to the Council in a timely fashion (i.e., by briefing book deadline).~~

The STAR panel report should include:

- Summary of the STAR Panel meeting:
  - Names and affiliations of STAR panel members, STAT, and STAR panel advisors;
  - Brief overview of the meeting (where the meeting took place, what species was assessed, what was the STAR panel recommendation, etc.);

    - Brief summary of the assessment model and the data used;
    - List of analyses requested by the STAR panel, the rationale for each request, and a brief summary of the STAT response to the request;
- Description of the base model and, for groundfish species, the alternative models used to bracket uncertainty;
- Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies;
- Areas of disagreement regarding STAR panel recommendations:
    - Between the STAR panel and STAT(s).
    - Among STAR panel members (including concerns raised by STAR panel advisors);
- Unresolved problems and major uncertainties, e.g., any special issues that complicate the assessment and/or interpretation of results;
- Management, data, or fishery issues raised by the STAR panel advisors during the STAR panel; and
- Prioritized recommendations for future research and data collection, including methodology and ecosystem considerations for the subsequent assessment.

For groundfish species, the STAR panel also makes a recommendation on whether the next assessment of the species should be a full assessment or could be an update assessment, and explain reasons for its recommendation. Additionally, the STAR panel should recommend the category ~~of~~ for the assessment based on the definitions of species categories in Appendix ~~E~~F and associated rules for relating category designations with sigma (the metric for an assessment's scientific uncertainty). The SSC will consider this recommendation when ultimately deciding the appropriate stock category.

The STAR panel report should be made available for review by the STAT with adequate time prior to the briefing book deadline (i.e., a week in most circumstances, but at minimum a full 24 hours, in cases when the time between the STAR panel and the deadline is particularly compressed) so that the STAT can comment on issues of fact or differences in interpretation. If differences of opinion come up during review of the STAR panel report, the STAR panel and STAT should attempt to resolve them. Otherwise, the areas of disagreement must be documented in the STAR panel report.

~~The chair will also solicit comment on the draft report from the STAT and the STAR panel advisors. The purpose of this is limited to ensuring that the report is technically accurate and reflects the discussion that occurred at meeting, and should not be viewed as an opportunity to reopen debate on issues. The STAR panel chair is the final arbiter on wording changes suggested by STAT and the STAR panel advisors as the report is the panel's report of the meeting. Any detailed commentary by STAR panel advisors should be drafted separately, reviewed by the full advisory body, and included in the briefing book.~~

If the STAR Panel recommends an assessment ~~is recommended for~~ undergo further review at a mop-up panel, the STAR report should document the deficiencies that are recommended to be addressed at the mop-up panel. In the event an assessment is rejected by the STAR panel or withdrawn by the STAT and there is no recommendation for a subsequent review at a mop-up panel, the STAR panel report should document the deficiencies in the assessment that will need to be addressed before the stock is next assessed.

~~The STAR panel chair is responsible for providing the Council staff with the final version of the STAR panel report. The STAR panel chair is also expected to attend the SSC meeting and, if~~

~~requested, MT meetings and the relevant portions of the Council meetings, where stock assessments and harvest projections are discussed, explain the reviews, and provide technical information and advice. The final STAR panel reports are posted on the Council's website.~~

5.3. STAR Panel Chair Responsibilities

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

It is the STAR panel chair's responsibility to ensure that STAR panel participants adhere to the TOR and that the meeting is run effectively and efficiently. During the panel meeting, the STAR panel chair appoints members of the panel to act as rapporteurs and draft the report (or specific sections thereof) according to the STAR panel chair guidance on format and level of detail. It is the obligation of the STAR panel chair, in consultation with other panel members, to prioritize requests to the STAT for additional analyses and to make certain that STAT responses are thorough and clearly presented. The STAR panel chair is responsible for preparing the final draft of the panel report, obtaining panel approval, providing a copy for STAT review and comment, and submitting it to the Council in a timely fashion (i.e., by briefing book deadline or earlier, as dictated by the schedule below).

Following the STAR panel meeting, the chair will lead the effort to draft the STAR panel report. In addition to the reviewers, the Chair will solicit comments on the draft report from the STAT and the STAR panel advisors. The purpose of this is limited to ensuring that the report is technically accurate and reflects the discussion that occurred at meeting, and should not be viewed as an opportunity to reopen debate on issues. The STAR panel chair is the final arbiter on wording changes suggested by STAT and the STAR panel advisors as the report is the panel's report of the meeting. Any detailed commentary by STAR panel advisors should be drafted separately, reviewed by the full advisory body, and included in the briefing book. The STAR panel chair is responsible for providing the Council staff with the final version of the STAR panel report.

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

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

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

1. The STAR panel report should be in complete form, except for minor wording edits, etc. within two weeks of the end of the STAR panel, so that the STAT can review and ensure the post-STAR draft assessment document sent to the STAR panel chair adheres to the STAR panel report (or at least explains reasons for any discrepancies in that version of the assessment)
2. Comments on the post-STAR/Pre-SSC draft of the assessment should be returned to the STAT within two weeks after the deadline for that draft.
3. Comments on the Post-SSC draft should be should be returned to the STAT within two weeks after the deadline for that draft, tso ensure the STAT has time to complete any changes prior to the November briefing book deadline (or as soon as practicable for assessments sent to the "mop-up" panel for further work and review).
4. When time is limited between the STAR panel and the briefing book (or subcommittee) submission deadline, an accelerated timeline of intermediate deadlines for the STAT and STAR panel/chair should be decided upon at the STAR panel to ensure an appropriately reviewed and revised version of the assessment will be available by the submission deadline.

5.4. Stock Assessment Team Responsibilities

The STAT is responsible for conducting a complete and technically sound stock assessment that conforms to accepted standards of quality, and in accordance with these TOR.

For full assessments ~~T~~the STAT is responsible for preparing three versions of the stock assessment document:

1) a "draft" for discussion during the STAR panel meeting;
2) a "revised draft" for presentation to the SSC, the Council, and relevant MT and AP; and
3) a "final version" to be posted on the Council's web site.

For update assessments the STAT is responsible for preparing two versions of the stock assessment document:

1) a "draft" for discussion during an SSC review; and
2) a "final version" to be posted on the Council's web site.

The draft assessment document for full and update assessments should follow the outline in Appendix B with an optional executive summary (required in the final version) as in the template in Appendix C. In the draft document, the STAT should identify a candidate base model, fully-developed and well-documented, for the STAR panel to review. A draft assessment document should be submitted by the STAT to the STAR panel chair, Council staff, and the NMFS Stock Assessment Coordinator (SAC, for groundfish) three full weeks prior to the STAR panel meeting, to determine whether the document is sufficiently complete to undergo review. If the draft assessment is judged complete, the draft assessment and supporting materials would be distributed to the STAR panel and relevant MT and AP representatives two weeks prior to the STAR panel meeting. If the STAT brings a model to the STAR panel that differs from what was described in the pre-STAR document, ~~T~~the STAT should prepare and distribute a detailed errata sheet and/or list of changes ~~and/or an errata sheet~~ detailing how ~~from~~ the pre-STAR draft assessment ~~distributed to the STAR panel and~~ differs from the version that will be presented at the STAR panel. ~~(t~~To the

extent possible, there should not be extensive changes to an assessment after the pre-STAR draft is distributed). If the assessment document does not meet minimum criteria of the TOR, the review would be postponed to a subsequent assessment cycle or to the review at the mop-up meeting. There are no CPS mop up panels – assessments which do not meet the minimum criteria are deferred to the next year. The mop up panel generally is not able to review more than two assessments. Therefore, the review options are limited for assessments not completed on time.

The STAT is also responsible for providing model files and data (in digital format) to the STAR panel meeting so that they can be analyzed on site. For assessments conducted with Stock Synthesis the set of files provided by the STAT should include all files needed to run the model as well as the standard set of r4ss output files.

The STAT is responsible for providing ~~formal written~~ responses to any formal STAR panel requests with an explanation of how the new analysis affected model results. Providing figures with no written explanation is unlikely to be sufficient. The STAT is encouraged to provide extractable tables and/or figures with their responses to STAR Panel requests to facilitate their use in STAR Panel reports.

In most cases, the STAT should produce a revised draft of the assessment document within three weeks of the end of the STAR panel meeting. ~~The revised draft must include a point-by-point response of the STAT to each of the STAR panel's final recommendations.~~ The revised draft must be finalized before the briefing book deadline for the Council meeting at which the assessment is scheduled for review. Post-STAR drafts must be reviewed and approved by the STAR panel chair prior to being submitted to Council staff. This review is limited to editorial issues, verifying that all required elements are included, and confirming that the document reflects the discussion and decisions made during the STAR panel.

The final version of the assessment document is produced after the assessment has been reviewed and endorsed by the SSC. Other than changes recommended by the SSC, only editorial and other minor alterations should be made to the revised draft for the final version. Electronic versions of the final assessment document, model files, and key output files should be submitted by the STATs to Council staff (for CPS) and to Council staff and the SAC (for groundfish) for inclusion in a stock assessment archive. 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.

A STAT conducting an assessment for which no base model was endorsed by a STAR panel should, in most cases, provide the pre-STAR draft assessment (or corrected/ updated version thereof, as agreed upon with the STAR panel) to the Council by the briefing book deadline. If the STAR panel, nonetheless, recommends using outputs of certain sensitivity runs to bracket uncertainty in the assessment, the results of those runs should be appended to the draft assessment and provided to the Council and its advisory bodies.

STATs are strongly encouraged to develop assessments in a collaborative environment by forming working groups, holding pre-assessment workshops, and consulting with other stock assessment and ecosystem assessment scientists. STATs are encouraged to evaluate alternative models and analyses that incorporate ecosystem considerations and cross-FMP interactions that may affect stock dynamics. When new data sources or methods, which could be used in many assessments

or are likely contentious, are planned for inclusion in the assessment, they should ideally be reviewed by a methodology panel. STATs should identify whether such new data sources or methods will be proposed for inclusion in assessments as early as feasible so that it is possible to hold a methodology review panel if one is needed (Council Operating Procedure 25 for groundfish and Council Operating Procedure 26 for CPS guide the methodology review processes for these taxa). Irrespective of whether a methodology review panel takes place, the STAR panel should be provided with model runs with and without the new data sources so that it can evaluate the sensitivity of model outputs to these data sources.

STATs should coordinate early in the process with state agency representatives and other data stewards to ensure timely availability of data. ~~It is~~ Each STAT is strongly encouraged to ~~convene~~ participate in a pre-assessment workshop to evaluate the proposed methods and data considered for an assessment. The associated STAR panel chair, ~~STAT,~~ advisors to the STAR panel, Council staff, and relevant data stewards should participate in the workshop to interpret and critically evaluate potential data sources. One goal of the pre-assessment workshop is to provide quality control of the data that will be used in assessments; the STAT should present forms of data plots and analyses that will assure the data have acceptable quality (e.g., reasonable average values; no obvious outliers). ~~For some assessments it may be beneficial for the STAT to hold a data workshop with state representatives and other data stewards and interested parties to discuss which data will be used and which will be excluded, and how the assessment model will use the data. Data workshops might be needed for assessments of stocks that had not previously been assessed or stocks for which the STAT planned to use a data source not used in a previous assessment. The relevant SSC Subcommittee will recommend whether a data workshop will be needed for a stock assessment.~~ Final data must be provided to the STATs at least ~~seven~~ eleven weeks in advance of the STAR panel meeting, to allow sufficient time for data processing, assessment model development, ~~and~~ assessment document preparation, and document review[9]. STATs are not obliged to use data provided after the deadline. Deadlines for the 2019-2020 stock assessment reviews are provided in Appendix A.

STATs are also encouraged to organize independent meetings with industry and interested parties to discuss data and issues. The STAT should initiate contact with the AP representative early in the assessment process, keep the AP informed of the data being used and respond to any concerns that are raised. The STAT should also contact the MT representative and Council staff early in the process for information about changes in fishing regulations and spatial management issues that may influence model structure and the way data are used in the assessment. The latter is particularly important for nearshore stocks, for which each state has different regulatory histories. The STAT should be well represented at the STAR panel meeting to ensure timely completion of the STAR panel requests. Barring exceptional circumstances, STAT members who are not attending the STAR panel meeting should be available remotely to assist with responses when needed. Each STAT conducting a full assessment should appoint a representative to attend the Council meeting where the assessment is scheduled to be reviewed and give presentations of the assessment to the SSC and other Council advisory bodies. In addition, the STAT should be prepared to respond to MT or Council staff requests for model projections to facilitate development of ACL alternatives.

[9] Assessment documents produced by NMFS staff require an internal agency review. All assessment documents require a review by Council staff to confirm completeness and compliance with the Terms of Reference.

~~The STAT should specify how the buffer for scientific uncertainty in the estimate of ending biomass (sigma) is calculated. The STAT should provide the equations for calculating sigma, whether it is based on asymptotic uncertainty estimates and/or decision tables (i.e., the difference in estimated biomass assuming the base case and low state of nature models). The SSC will determine the appropriate sigma value (e.g., a proxy sigma value for the stock category or a stock-specific sigma) to apply to estimates of acceptable biological catch based on these calculations.~~

When developing an assessment model the STAT should follow accepted best practices. However, for some technical issues there is not yet general agreement on what constitutes best practice. To produce greater consistency among assessments in the approaches taken to common technical problems, the groundfish STATs should follow accepted practices guidelines that will be developed by the SSC and distributed to the STATs and STAR Panels following the November ~~2016~~ 2018 meeting. An outline of topics that will be covered in the *2019 Accepted Practices Guidelines for Groundfish Stock Assessments* is provided in Appendix G. ~~The STAT should standardize the number of significant digits when reporting outputs, assuming fixed values from priors, and applying buffers.~~ The STATs may diverge from the guidelines if they provide adequate justification to the STAR panel and in the assessment document.

For stocks that are estimated to be below ~~overfished thresholds~~the minimum stock size threshold (or those previously declared overfished and not yet rebuilt), the STAT must complete a rebuilding analysis according to the SSC's TOR for Rebuilding Analyses and prepare a document that summarizes the analysis results (unless the SSC explicitly recommends against preparing a rebuilding analysis). Groundfish rebuilding analyses are typically reviewed at the mop-up panel.

Finally, STATs are responsible to conduct model runs requested by the MTs and/or Council staff for use in the harvest specification process. STATs are also responsible for updating assessment model projections upon the Council's request for use in ecosystem, socioeconomic, or other related analyses.

5.5. National Marine Fisheries Service Responsibilities

The NMFS Northwest Fisheries Science Center (NWFSC) and the Southwest Fisheries Science Center (SWFSC) assist in organizing stock assessment reviews of groundfish and CPS, respectively. For groundfish, NMFS provides a stock assessment coordinator (SAC) to facilitate and assist in overseeing the STAR process. For CPS, the SWFSC provides a staff member to facilitate and assist in the STAR process.

NMFS (through the SAC for groundfish and a designated SWFSC staff member for CPS) works with the STATs and other STAR process participants to develop a proposed list of stocks to be assessed for consideration by the Council. NMFS also develops a draft STAR panel schedule for the Council review. NMFS and Council staff identify STAR panel members based on criteria for reviewer qualifications, and, for groundfish, makes every effort to designate one independent reviewer who can attend all STAR panel meetings to provide consistency among reviews. The costs associated with these reviewers are borne by NMFS for federal or CIE reviewers and the Council for other reviewers not affiliated with a federal agency or the CIE. NMFS also helps organize STAR panel meetings and develops meeting schedules.

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

NMFS also assists Council staff in a pre-review of assessment documents to assure they are complete, and in a post-STAR review of the revised assessment document for consistency with the TOR.

NMFS is encouraged to develop stand-alone documentation of key data sources that inform assessments (e.g., descriptions of NMFS trawl and hook-and-line surveys) that can be incorporated by reference in stock assessments. Such documentation should include digital maps of the geographical areas covered by surveys. There should also be thorough stand-alone documentation of stock assessment software and associated analytical methods (e.g., the Vector Autoregressive Spatial Temporal (VAST) delta-GLMM model) that have been endorsed by the SSC. Such documentation ~~that~~ can be incorporated by reference in stock assessments and ~~. Such documentation~~ will aid reviewers at STAR panels who may be unfamiliar with key data sources or modeling approaches and serves to maintain transparency in the STAR process.

NMFS is strongly encouraged to organize and convene pre-assessment workshops to evaluate the proposed methods and data considered for upcoming assessments.

5.6. Council Staff Responsibilities

The role of Council staff is to coordinate, monitor, and document the STAR process to ensure compliance with these TOR.

Council staff coordinates with the STAR panel chair and NMFS (the SAC in the case of groundfish; a designated SWFSC staff member for CPS) in a pre-review of assessment documents, to assure they are complete. If an assessment document is not in compliance with the TOR, Council staff returns the assessment document to the STAT with a list of deficiencies, a notice that the deadline has expired, or both. Council staff also coordinates with the STAR panel chair, STAT, and NMFS in a post-STAR review of the revised assessment document for consistency with the TOR. When inconsistencies are identified, the STAT is requested to make appropriate revisions in time for briefing book deadlines.

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

For reviews of groundfish assessments (all assessment types) Council staff is responsible for providing the STAT with the information needed to conduct projections, including the default harvest control rules and the multipliers needed to buffer for scientific uncertainty for the default projections. Council staff will also collaborate with the GMT advisor and the STAT regarding removal assumptions, particularly for the initial two years for which there are approved harvest specifications, which should be made when developing projections. Default assumptions for specifying removals in projections and decision tables (e.g., use ACL or OFL values) will be specified in the *Accepted Practices Guidelines*. Any deviations from using the default removal assumptions must be requested and justified in writing: prior to the end of the STAR panel meeting

for full stock assessments and prior to the SSC review for all other stock assessment types.

Council staff is responsible for timely issuance of meeting notices and distribution of stock assessments and other appropriate documents to relevant groups. Council staff also collects and maintains electronic copies of assessment documents and relevant reports from the STAR panel, SSC, MT, AP and CIE reviewers, as well as letters from the public and any other relevant documents. These documents are typically posted on the Council's web site.

5.7. Management Team Responsibilities

The MT is responsible for identifying and evaluating potential management actions based on the best available scientific information. Particularly, the MT uses stock assessment results and other information to make ACL, HG (for CPS) and ACT recommendations to the Council.

A MT representative, usually appointed by the MT chair, attends the STAR panel meeting and serves as an advisor to the STAT and STAR panel on changes in fishing regulations that may influence data used in the assessment and the nature of the fishery in the future. The MT representative does not serve as a member of the STAR panel. The MT should be involved early on in the stock assessment process to provide guidance on fishing regulations to ensure the STAT accommodates regulatory changes as best as possible in the modelling framework. In particular, MT's should provide catch levels to be used in the assessments for the first two years of the projections (prior to the assessment in question being used in management, here: 2019 and 2020), as well as, as appropriate, the last year of the model (the year previous to the year in which the assessment is conducted, here: 2018). Any recommended deviations from default removal assumptions should be accompanied by written justification. This limits discrepancies between the STAT and MT that could arise in the STAR panel.

Successful separation of science (e.g., STAT and STAR panels) from management (e.g., MT) depends on assessment reviews being completed by the time the MT meets to discuss preliminary ACL, HG (for CPS) and ACT recommendations. The MT should not seek revision or additional review of the stock assessments after they have been endorsed by the STAR panel. The MT chair should communicate any unresolved issues to the SSC for consideration. The MT, however, can request additional model projections from the STAT, to fully evaluate potential management actions.

For reviews of groundfish assessments the GMT representative (and/or Council staff) has the responsibility of providing the STAT with catch streams needed to conduct projections. The GMT representative will also collaborate with Council staff and the STAT regarding removal assumptions and resulting catch streams, particularly for the initial two years for which there are approved harvest specifications, which should be made when developing projections. The GMT should review the "revised draft" assessment to verify that the removal assumptions they requested were used in the assessment and projections provided in the assessment document.

5.8. Advisory Panel Responsibilities

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

The AP representative (along with STAT and STAR panel chair, if requested) is expected to attend the MT meeting at which preliminary ACL and ACT recommendations are developed. The AP representative is also expected to attend subsequent MT and Council meetings where the relevant harvest recommendations are discussed.

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

Most stock assessments rely on data collected by state and tribal agency staff as part of their routine fishery monitoring and sampling activities. Although these data are generally housed and available from the PacFIN and RecFIN data repositories, some data from special collections may only be available directly from the state or tribal agencies or may require special consideration (e.g., because of unusual sampling protocols). State and tribal data stewards or other knowledgeable representatives from the state and tribal agencies should be tasked with working with the STATs to provide relevant stock assessment data. These individuals should (a) provide the STATs with information on available data that might be relevant to upcoming assessments, (b) provide data requested by the STATs in a timely manner, (c) provide guidance on any special attributes of the data that may need consideration for their correct analysis and interpretation, and (d) attend any pre-assessment workshops organized for the assessments. Data stewards should provide STATs with final data at least eleven weeks prior to the start of the STAR. Specific deadlines for data are specified in Appendix A.

5.10. Scientific and Statistical Committee Responsibilities

The Council's SSC plays multiple roles within the STAR process and provides the Council and its advisory bodies with technical advice related to the stock assessments and the STAR process. The SSC, in coordination with NMFS and Council advisory bodies, is responsible for developing the Terms of Reference and the SSC provides guidelines with accepted practices for data and modeling approaches for developing stock assessments. ~~Accepted practices should not be re-evaluated during STAR panels (excepting when an addressable error is found).~~

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

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

~~The STAR panel chair presents the STAR panel report at the SSC and Council meetings at which stock assessments are reviewed. If requested, the STAR panel chair also attends the MT meeting, at which preliminary ACL, HG (for CPS) and ACT recommendations are developed, to discuss the STAR panel report and assist with interpreting the assessment results.~~

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

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

The SSC is responsible for making OFL recommendations to the Council. The SSC is also responsible for assigning species managed by the Council to a specific category based on definitions of species categories in Appendix ~~E~~F, as well as determining the scientific uncertainty in estimating the OFL (i.e., the value for sigma). It is also the SSC's responsibility to determine when it is appropriate to make changes to proxies or the use of estimated values of F_{MSY} and B_{MSY}.

For groundfish species, the SSC (for assessments reviewed by the SSC in June) or SSC Groundfish Subcommittee (for other assessments) reviews the STAR panel report and stock assessment document and recommends whether an assessment should be further reviewed at the end of the assessment cycle (i.e., mop up review panel) by the SSC's Groundfish Subcommittee during a meeting that occurs after all of the STAR panels, primarily to review rebuilding analyses for overfished/rebuilding stocks. Soon after completion of all STAR panels, the SSC Groundfish Subcommittee will meet by teleconference, webinar, or, if needed, in person to recommend which assessments, if any, will be sent to the mop-up panel and to prioritize further analyses. At this late-summer meeting the SSC Groundfish Subcommittee will also review all assessments endorsed by STAR panels, consider their own endorsement of these assessments in advance of the SSC's review in September, and recommend which STATs should attend the full SSC review in September. The STATs for stocks that STAR panels have recommended for mop-up review are required to participate in the late-summer Groundfish Subcommittee meeting; authors for the other

assessments are strongly encouraged to attend. This meeting will be noticed in advance as one where the SSC Groundfish Subcommittee makes the decision which stocks would be subsequently reviewed at the mop-up panel and which stock assessments are approved for final consideration by the SSC and the Council at their September meeting. Since only two assessments can be adequately reviewed in a one-week review panel, the SSC Groundfish Subcommittee will also have the authority to decide which two assessments are reviewed at the mop-up panel in cases where there are more than two candidate assessments for further review. The full SSC and Council can then decide in September whether to schedule a second mop-up panel before the November Council meeting to review any remaining assessments that were not reviewed in the first mop-up panel.

For CPS, if an assessment is found not to be acceptable for use in management, a full assessment would be conducted the following year.

6. FULL ASSESSMENTS

Full stock assessments are the ~~most complicated~~ least restricted type of stock assessment used by the Council. Full stock assessments apply statistical models that are age- or size-structured to "data-rich" stocks, meaning the available data are adequate to produce estimates of year-class strength and there is information from surveys or fisheries to resolve trends in biomass and estimate stock status. Each full assessment model has underlying equations to mimic the dynamic processes of fish growth, maturation, reproduction, and mortality (due both to natural causes and related to fishing). The models produce annual estimates of age-specific abundance, biomass, and catch that are compared to the available observational data to find sets of parameters that best-fit the available data. A full assessment in its simplest form might be used with a stock having genders with identical size-at-age, a single fishery (with an associated series of annual catches, age-specific fishery selection coefficients, weights-at-age, and age-compositional data), and a single survey (with an associated series of annual biomass index values, age-specific survey selection coefficients, and age-compositional data). Most of the Council's full stock assessments have been conducted using the Stock Synthesis software and most have received a category 1 designation (Appendix F).

~~6.~~7. UPDATE ASSESSMENTS

An update assessment reruns an approved assessment model with the data series extended to include new data. For sardine, update assessments typically occur during two years out of every three. For mackerel, update catch-only assessments occur every four years, alternating with full assessments. For groundfish, the initial recommendation whether the next assessment should be full or update is made by the STAR panel during the STAR panel meeting. The final recommendation is made by the SSC.

An update assessment is generally restricted to the addition of new data that have become available since the last full assessment. It must carry forward the fundamental structure of the last full assessment reviewed and endorsed by a STAR panel, the SSC, and the Council. Assessment structure here refers to the population dynamics model, data sources used as inputs to the model, the statistical platform used to fit model to the data, and how the management quantities used to set harvest specifications are calculated. Particularly, when an update assessment is developed, with the exceptions noted below, no substantial changes should be made to:

1) the particular sources of data used. It is not uncommon that data sources are updated to correct data entry errors or include additional historical data. It is acceptable to use the most up-to-date data from the sources used in the original assessment.
2) the software used in programming the assessment. It is acceptable to use a newer version of Stock Synthesis (or other assessment software used). A comparison should be provided to illustrate the newer software version produces adequately similar results when used with the same model files as in the original assessment.
3) the assumptions and structure of the population dynamics model underlying the stock assessment.
4) the statistical framework for fitting the model to the data and determining goodness of fit.
5) the analytical treatment of model outputs in determining management reference points.

Major changes to the assessment should be postponed until the next full assessment. Alterations to the assessment can be considered as long as the update assessment clearly documents and justifies the need for such changes and provides a step-by-step transition (via sensitivity analysis) from the last full assessment to an update assessment under review.

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

It is acceptable for the STAT to change the major axis of uncertainty when conducting an update assessment if the STAT provides adequate rationale for making that change and the SSC endorses the change. The STAT should ~~prepare~~ submit two versions of the decision table to the SSC for their review, one assuming the axis of uncertainty in the original full assessment and one with the new proposed axis of uncertainty. The SSC will ultimately decide which axis of uncertainty best characterizes the uncertainty in the update assessment.

Examples of other allowable alterations include: 1) the weighting of the various data components (including the use of methods for tuning the variances of the data components); when data weightings in the assessment were chosen based on a repeatable process, it is allowed to repeat this same process rather than to use identical weighting as in the original assessment; 2) changes in the time periods for the selectivity blocks; 3) correcting data entry errors; and 4) bug fixes in software programming; 54) ~~I~~improved estimates of parameters such as steepness or the natural mortality rate due to new research or updated meta-analyses. This list is not meant to be exhaustive, and other alterations can be considered if warranted. Ideally, improved data or methods used to process and analyze data would be reviewed by the SSC prior to being used in assessments.

Review of Update Assessments

Update assessments are reviewed by members of the relevant SSC subcommittee (Groundfish or CPS), during a single meeting. Reviews typically require one or two days with an option of early dismissal of a STAT. The STAT is responsible for producing the update assessment document and submitting it to Council staff in a timely manner, before the relevant SSC subcommittee reviews the assessment. The document should follow the outline in Appendix B and include an Executive Summary based on the template in Appendix C. The STAT, however, can reference the last full assessment (or other relevant documentation) for a description of methods, data sources, stock structure, etc., given that they have not been changed. Any new information to the assessment must be presented in sufficient detail for the subcommittee to determine whether the update meets the Council's requirement to use the best available scientific information.

The document must include a retrospective analysis illustrating the model performance with and without the most recent data (new to the update assessment) and discuss whether the new data and update assessment results are sufficiently consistent with those from the last full assessment. The assessment document should include a detailed step-by-step transition from the last full assessment to the update under review. The updated decision table, if there is one, should ~~be of~~ follow the same ~~format~~ structure as in the last full assessment.~~;~~ In particular, it should highlight differences among alternative models defined using the same axes of uncertainty as those in the last full assessment or provide good justification for changing the axes of uncertainty.

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

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

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

If the answer to either of these questions is negative, a full stock assessment for the species would typically be recommended for the next assessment cycle (for groundfish) or the next year (for CPS). For groundfish, if the subcommittee agrees that the update assessment results require additional, but limited exploration before being endorsed for management use, further review at the mop up meeting could be recommended. In cases like this, the subcommittee needs to develop a list of requests for the STAT to address before the mop-up meeting.

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

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

~~7.~~8. CATCH-ONLY PROJECTIONS

In some circumstances, a STAT may be asked to produce an update assessment using only recent fisheries catch information and generate catch-only projections for the stock. ~~Such update a~~Assessments of this type do not include the most recent survey abundance index estimates and have no new data to inform the stock-recruitment relationship in the model. The catch-only projections become more uncertain as the length of the projection period increases. This is particularly an issue for short-lived CPS species, for which recruitment is highly variable, and predictive power of catch-only projections is particularly low. Additional requests can also be made to the STAT if the amount of uncertainty associated with assessment results (e.g., due to highly variable recruitment) should be evaluated further. Catch-only projections are initially reviewed by the relevant SSC subcommittee with public notice, and subsequently reviewed by the full SSC.

The selection of sets of catch streams when conducting catch-only projections for CPS should be made by the STAT. The set should include full attainment of Harvest Guidelines as well as lower levels, for example based on recent average catches. The STAT is encouraged to obtain feedback on assumptions regarding catch streams from the CPSMT.

Technical guidance on conducting catch-only projections for groundfish species will be given in the *Accepted Practices Guidelines* (outline in Appendix G).

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

- Title page, using the same format as for a full or update stock assessment.
- Introduction explaining the need for the catch-only projection.
- Stock description.
- Catches, including comparison plots (if needed) of changes in the catch series.
- Data and assessment.
- Stock biomass and dynamics.
- Recruitment.
- Exploitation status.
- Ecosystem considerations.
- Reference points (groundfish) / harvest control rules (CPS).
- Management performance.
- Unresolved problems and major uncertainties.
- Decision table and 10-year projections (groundfish only).
- Research and data needs.
- Table with summary time series for the base model.

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

~~8.~~9. DATA-MODERATE ASSESSMENTS FOR GROUNDFISH SPECIES

Data-moderate assessments for groundfish species are a refinement over ~~the adopted~~ data-poor methods (described below) in that a data-moderate assessment includes abundance trend information in addition to the data informing a data-poor form of the assessment (catch series plus

prior information on productivity and status). Data-moderate assessments are used for category 2 stocks; one defining distinction between category 2 and category 3 stocks is that abundance trend information is incorporated in a category 2 assessment enabling an estimate of stock status (Appendix ~~E~~F).

Two data-moderate assessment methods have been endorsed since the 2013-14 assessment cycle: 1) extended DB-SRA (XDB-SRA) and 2) extended Simple Stock Synthesis (XSSS). In both cases, abundance trend information (e.g., survey or fishery CPUE indices) is included in the assessment.

XSSS assumes that recruitment is related deterministically to the stock-recruitment relationship and allows index data to be used within a Bayesian framework~~ and has been recently updated to include more flexible stock-recruit relationships (Punt and Cope in press)~~. The Markov chain Monte Carlo (MCMC) or Sample Importance Resample (SIR) algorithm (perhaps implemented using Adaptive Importance Sampling) is used to quantify uncertainty for XSSS-based assessments. XDB-SRA is implemented within a Bayesian framework, with the priors for the parameters updated based on index data. The additional parameters in XDB-SRA compared with DB-SRA include the catchability coefficient (q), and the extent of observation variance additional to that inferred from sampling error (a). The priors for these parameters are a weakly informative log-normal and a uniform distribution, respectively.

Comparison of alternative methods (XDB-SRA and XSSS) is encouraged, but it is acceptable to present an assessment using a single modeling approach. The STAR panel can make requests of the STATs for additional runs, but should not impose an alternative method if STATs consider this is not appropriate for the stock concerned. In the event that more than one model is presented, the panel should recommend adoption of a preferred model, if one can be identified, for use in management.

Data-moderate stock assessment reports should follow the template in Appendix ~~D~~E.

~~9.~~10. DATA-POOR ASSESSMENTS FOR GROUNDFISH SPECIES

Data-poor assessment methods to assess groundfish species were adopted by the Council in 2011 to inform harvest specifications for category 3 stocks (Appendix ~~E~~F). These adopted methods include: 1) Depletion Corrected Average Catch (DCAC), 2) Depletion Based Stock Reduction Analysis (DB-SRA), and 3) Simple Stock Synthesis (SSS).

DCAC provides estimates of sustainable yield on long lived species based on catches and associated number of years, as well as the relative reduction in biomass during that period, the natural mortality rate (M), and the assumed ratio of MSY fishing rate (F_{MSY}) to M (MacCall 2009). DB-SRA combines DCAC and stock reduction analysis to produce probability distributions of management reference points concerning yield and biomass (Dick and MacCall 2011). DB-SRA is based on estimates of historical annual catches, natural mortality rate (M) and age at maturity. A production function is specified based on the relative location of maximum productivity and the ratio of F_{MSY} to M. Unfished biomass, the only unknown parameter, is then calculated based on a designated relative depletion level near the end of the time series. Uncertainties in natural mortality, stock dynamics, optimal harvest rates, and recent stock status are incorporated using Monte Carlo exploration. SSS utilizes a similar approach as DB-SRA using the Stock Synthesis modeling platform (Cope 2013).

Data-poor stock assessment reports should follow the template in Appendix E.

~~10.~~11. CATCH REPORTS

In certain cases (e.g., cowcod in ~~2015~~2017) only limited new data are available to inform the assessment. In such cases, it is appropriate for the STAT to provide a catch report, which documents recent removals and compares them to the ACLs established for the stock. For a catch report, if the estimated removals of a species are near the value projected by the previous assessment/rebuilding analysis, the STAT does not need to conduct model runs since no new insight would be obtained by rerunning the assessment model.

Catch reports are reviewed by the relevant SSC subcommittee (Groundfish or CPS) during a single meeting (typically June of odd years when update assessments are reviewed). The STAT is responsible for producing the catch report and submitting it to Council staff in a timely manner, before the relevant subcommittee reviews it. The report should be brief, but provide enough details on how total removals were estimated. It should provide only essential information about the stock and refer to the last assessment (or other relevant documentation) for full description of methods, data sources, model structure, etc. used to estimate the status of the stock and generate projections.

In common with a review of an assessment update, Council staff will provide the subcommittee with the catch report, along with a copy of the last full stock assessment reviewed via the STAR process, and the associated STAR panel report. The chair of the subcommittee will designate a lead reviewer from the subcommittee members for each catch report to document the meeting discussion, produce a review report, and ensure that each review is conducted according to the TOR. The report is subsequently reviewed by the full SSC. The MT and AP representatives, as well as Council staff, also participate in the review.

APPENDIX A: 2019 GROUNDFISH AND CPS STOCK ASSESSMENT REVIEW CALENDAR

Review Meeting	Data Distribution Deadline	Initial Review Deadline	Document Distribution Dates	STAR Panel Dates	Location	Species
SSC CPS Subcm. Update Assessment Review	Dec. 2018 to Jan. 2019 TBD	March TBD		NA	TBD	Pacific Sardine
CPS STAR	Feb. 11	April 8	April 15	April 29 – May 2	La Jolla, CA	Pacific Mackerel
GF STAR 1	Feb. 18	April 15	April 22	May 6-10	Seattle, WA or Newport, OR	Cabezon (OR & CA)
GF STAR 2	March 18	May 13	May 20	June 3-7	Seattle, WA or Newport, OR	Longnose Skate Big Skate
SSC GF Subcm. assessment review	April 2 for updates	May 28	June 4	June 18	San Diego, CA	Cabezon (full assessment) Petrale Sole (update assessment) Widow Rockfish (update assessment)
GF STAR 3	April 22	June 17	June 24	July 8-12	Santa Cruz, CA	Gopher/Black-and-Yellow Rockfish Cowcod
GF STAR 4	May 6	July 1	July 8	July 22-26	Seattle, WA	Sablefish
GF Mop-up, if needed	~~July 15~~TBD	Sept. 9	Sept. 16	Sept. 30-Oct. 4	Seattle, WA	TBD

APPENDIX B: OUTLINE FOR FULL AND UPDATE STOCK ASSESSMENT DOCUMENTS

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

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

A. Title page and list of preparers—

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

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

   This report may be cited as:
   Stewart, I.J., Thorson, J.T., ~~Wetzell~~Wetzel, C., 2011. Status of the U.S. Sablefish Resource in 2011. Pacific Fishery Management Council, Portland, OR. Available from http://www.pcouncil.org/groundfish/stock-assessments/

B. Executive Summary (should follow the template in Appendix C). *** Not required in draft assessment undergoing review.**

C. Introduction

1. Scientific name, distribution, the basis for the choice of stock structure, including regional differences in life history or other biological characteristics that should form the basis of management units.
2. A map showing the scope of the assessment and depicting boundaries for fisheries or data collection strata.
3. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography).
4. Ecosystem considerations (e.g., ecosystem role and trophic relationships of the species, habitat requirements/preferences, relevant data on ecosystem processes that may affect stock or parameters used in the stock assessment, and/or cross-FMP interactions with other fisheries). This section should note if environmental correlations or food web interactions were incorporated into the assessment model. The length and depth of this section would depend on availability of data and reports from the IEA, expertise of the STAT, and whether ecosystem factors contribute quantitative information to the assessment.
5. Important features of current fishery and relevant history of fishery.
6. Summary of management history (e.g., changes in mesh sizes, trip limits, or other management actions that may have significantly altered selection, catch rates, or discards).

7. Management performance, including a table or tables comparing Overfishing Limit (OFL), Annual Catch Limit (ACL), Harvest Guideline (HG) [CPS only], landings, and catch (i.e., landings plus discard) for each area and year. For groundfish assessments, include total mortality estimates from the West Coast Groundfish Observer Program; if the assessment model produces estimates of dead discarded catch, include text explaining the rationale for modeling discard mortality and why the model estimates could differ from the WCGOP estimates of discard mortality.
8. Description of fisheries for this species off Canada, Alaska and/or Mexico, including references to any recent assessments of those stocks. STATs are strongly encouraged to include a summary of catches and estimates of stock size and stock status for the most recent ten years, if such information can be assembled without excessive difficulty.

D. Data

Description of all data and sources, which are used in the assessment; if not all data sources are used, provide the rationale for excluding particular data sources; report on consulting with AP and MT representatives regarding the use of various data sources.

1. Fishery-dependent data: Commercial fisheries landings by state, year and gear (PacFIN is the standard source for recent domestic commercial landings), historical catch estimates, discards, recreational fisheries catches, foreign removals; sample size information for length and age composition data by state, year and gear, including both the number of trips and fish sampled. Include complete tables and figures and date of data extraction.
2. Fishery-independent data: Description of surveys used in the assessment, description of methods to estimate abundance indices, sample size information for length and age composition data by survey and year, including both the number of tows and fish sampled. Include complete tables and figures and date of data extraction. Include the swept-area biomass estimates (if available and appropriate) and their associated coefficients of variation.
3. Sources used to estimate biological parameters (e.g., natural mortality, growth, maturity schedules, etc.)
4. Environmental or ecosystem data used. If environmental or ecosystem data are incorporated, report of consultations with technical teams that evaluated ecosystem data or methodologies used in the assessment.

E. Model

1. History of modeling approaches used for this stock.
2. Response to the most recent previous STAR panel recommendations for remedying deficiencies in ~~from~~ the most recent previous full assessment.
2.3. For groundfish update assessments, point by point response to the current Groundfish Subcommittee recommendations. * **Not required in draft update assessment undergoing review.**
3.4. Description of new modeling approaches and changes made from the last assessment, with rationale.
4.5. General model specifications:

   Assessment program and its version used for the assessment (i.e., date executable program file was compiled), description of model structure, definitions of fleets and areas. Description of how the first year that is included in the model was selected and how the

population state at the time is defined (e.g., B_0, stable age structure, etc.).

~~5.~~6. Model parameters: estimated and fixed parameters, constraints on parameters, selectivity assumptions, natural mortality, treatment of age reading bias and/or imprecision, and other fixed parameters, description of stock-recruitment constraints or components, critical assumptions and consequences of assumption failures.

F. Base model(s) selection and evaluation

1. Table showing step-by-step changes when bridging from the most recent previous assessment model to the new base model. If the old and new base models have major structural differences, start the step-by-step construction of the new base model from the ending year of the old base model. Further guidance on the level of detail to include in the bridging analysis will be provided in the 2019 *Accepted Practices Guidelines*.

~~1.~~2. Evidence of search for balance between model realism and parsimony. Key model assumptions and structural choices (e.g., asymptotic vs. domed selectivities, constant vs. time-varying selectivities). Summary of alternate model configurations that were examined but rejected.

~~2.~~3. Evaluation of model parameters. Likelihood profile for the base model over key parameters (e.g., natural morality, stock-recruit steepness, survey catchability). The profile should indicate all likelihood values for individual components (e.g., indices by survey, compositional data for each type and fleet). Are parameter estimates (e.g., survey catchability) consistent with estimates for related stocks?

~~3.~~4. Residual analysis for the base-run configuration, e.g., residual plots, time series plots of observed and predicted values, etc.

~~4.~~5. Convergence status and convergence criteria for the base-run model (or proposed base-run). Randomization run results or other evidence of search for global best estimates.

~~G. Point-by-point response to the STAR panel recommendations.* **Not required in draft assessment undergoing review.**~~

~~H.~~G. Base-model(s) results

1. Table listing all explicit parameters in the stock assessment model used for base model, their purpose (e.g., recruitment parameter, selectivity parameter) and whether or not the parameter was actually estimated in the stock assessment model. Include the associated asymptotic standard error estimates.
2. Population numbers and biomass at age × year × sex (if sex-specific M, growth, or selectivity) (may be provided as a text or spreadsheet file).* **Not required in draft assessment undergoing review.**
3. Time-series of total biomass, 1+ (if age 1s are in the model), summary biomass, and spawning biomass (and/or spawning output), depletion relative to B_0, recruitment and fishing mortality (1-SPR) (or exploitation rate estimates if fishing mortality not available) (table and figures).
4. Selectivity estimates (if not included elsewhere).
5. Stock-recruitment relationship.
6. OFL, ABC and ACL (and/or ABC and OY or HG) for recent years.
7. Clear description of units for all outputs.
8. Description of how discard is included in yield estimates.
9. Description of environmental or ecosystem data if included in the assessment.

10. ~~A table summarizing major values of interest that vary by age, for males and females, e.g. length, weight, % mature, and % selected in major surveys and fleets. *(an example of the format has been added at the end of the document)*~~

~~I.~~H. Evaluation of uncertainty in model results.

1. Sensitivity to assumptions about model structure, i.e., model specification uncertainty.
2. Sensitivity to data set choice (e.g., using emphasis factors to selectively remove data sources) and weighting schemes ~~(e.g., emphasis factors)~~ (e.g., MacAllister & Ianelli weighting versus Francis weighting vs. Dirichlet weighting for compositional data), which may also include a consideration of recent patterns in recruitment.~~vs. Dirichlet weighting~~
3. Parameter uncertainty (variance estimation conditioned on a given model, estimation framework, data set choice, and weighting scheme), including likelihood profiles for important assessment parameters (e.g., natural mortality, steepness, and R_0). The likelihood profiles can be shown in graphs but should also be reported in tabular format and include likelihood components for major data sources (e.g., survey indices and survey compositional data, fishing fleet compositional data). This element for evaluating uncertainty ~~also~~ includes expressing uncertainty in derived outputs of the model and estimating CVs using appropriate methods (e.g., bootstrap, asymptotic methods, Bayesian approaches, such as MCMC). Include the CV of spawning biomass in the first year for which an OFL has not been specified (typically end year +1 or +2).
4. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of input data being dropped.
5. Historical analysis (plot of actual estimates from current and previous assessments).
6. If a range of model runs is used to characterize uncertainty it is important to provide some qualitative or quantitative information about relative probability of each. If no statements about relative probability can be made, then it is important to state that all scenarios (or all scenarios between the bounds depicted by the runs) are equally likely.
7. 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 stock projections and decision table analyses.

~~J~~I. Harvest control rules (CPS only)

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

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

Implementation for Pacific Sardine

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

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

   where T is the temperature term derived from the CalCOFI sea surface temperature index. Under the harvest control rule, FRACTION is constrained and ranges between 5% and 20% depending on the value of T.
4. U.S. DISTRIBUTION is the percentage of BIOMASS in U.S. waters (87%).

Implementation for Pacific Mackerel

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

~~K~~J. Reference points (groundfish only).

1. Unfished spawning stock biomass, summary age biomass, and recruitment, along with unfished spawning stock output.
2. Reference points based on $B_{40\%}$ for rockfish and roundfish and on $B_{25\%}$ for flatfish (spawning biomass and/or output, SPR, exploitation rate, equilibrium yield).
3. Reference points based on default SPR proxy (spawning biomass and/or output, SPR, exploitation rate, equilibrium yield).
4. Reference points based on MSY (if estimated) (spawning biomass and/or output, SPR, exploitation rate, equilibrium yield).
5. Equilibrium yield curve showing various B_{MSY} proxies.

K. Unresolved problems and major uncertainties. *** Not required in draft assessment undergoing review.**

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

L. Harvest projections and decision tables (groundfish only). *** Not required in draft assessment undergoing review. ** Not applicable to assessments rejected by a STAR Panel or withdrawn by the STAT.**

1. Harvest projections and decision tables (i.e., a matrix of alternative models (states of nature) versus management actions) should cover the plausible range of uncertainty about current stock biomass and a set of candidate fishing mortality targets used for the stock. See section "*Uncertainty and Decision Tables in Groundfish Stock Assessment*" (this document~~, pp.12-13~~) on how to define alternative states of nature. Management decisions in most cases represent the sequence of catches including estimate of OFL based on F_{MSY} (or its proxy) and those obtained by applying the Council 40-10 harvest policy to each state of nature; however other alternatives may be suggested by the GMT as being more relevant to Council decision making. OFL calculations should be based on the assumption that future catches equal ABCs and not OFLs.
2. Information presented should include biomass, stock depletion, and yield projections of OFL, ABC and ACL for the two years of the current biennial harvest specifications cycle plus ten years into the future~~, beginning with the first year for which management action could be based upon the assessment~~. An example template for a table of harvest projections is provided below.
~~2.~~3. Include both years of the current bienni~~n~~um in ~~forecast~~projections / decision tables, so there is no gap shown in the tables between the ~~estimated~~current biennium and ~~forecast~~projection years ~~shown~~. Do not report model-~~forecast~~estimated OFLs and ABC~~'~~s (and ACLs) for years in the current biennium that have management specifications in place. Instead used the OFLs and ABCs (and ACLs) specified in regulation. For stocks with estimated 2018 *Depletion* greater than 40% the ABCs are equal to the ACLs.

~~10-year~~ Hypothetical projections of potential OFL, ACL, estimated summary biomass (age-1 and older), spawning output, and depletion ~~of darkblotched rockfish~~ based on target SPR of 50% for the OFL and under the ACL = ABC (P*=0.45) harvest control rule. Projections use assumed total ~~catch~~ removals of ~~338~~ 707 and ~~346~~ 744 mt (the Council's adopted ACLs) for ~~2015~~ 2019 and ~~2016~~2020, respectively ~~(from Gertseva et al. 2015)~~. Because this hypothetical table is for a stock that is not in the precautionary zone it does not require a separate column for the ABC values.

Year	OFL (mt)	ACL (mt) = ABC	Summary biomass (mt)	Spawning output (million eggs)	Depletion (%)
2019	739	707*	20,265	1,424	44%
2020	778	744*	20,503	1,468	46%
2021	778	744	20,606	1,512	47%
2022	759	726	20,624	1,548	48%
2023	738	706	20,597	1,574	49%
2024	721	690	20,544	1,592	50%
2025	708	678	20,478	1,604	50%
2026	699	669	20,403	1,611	50%
2027	693	662	20,334	1,615	50%
2028	688	657	20,264	1,617	50%
2029	684	653	20,193	1,617	50%
2030	681	649	20,123	1,617	50%

* Assumed removals consistent with 2019 / 2020 harvest specifications.

M. Evaluation of scientific uncertainty.

- Fully document the calculation of the base model's sigma.

~~M~~N. ~~-~~Regional management considerations.

- Discussion of whether there is biological evidence for a regional management approach. If a regional management approach is desirable for the stock, but there are insufficient data for it, what are the research and data needs to address this issue?
- For stocks where current practice is to allocate harvests by management area, a recommended method of allocating harvests based on the distribution of biomass should be provided. The MT advisor should be consulted on the appropriate management areas for each stock.

~~N~~O. Research and data needs ~~(prioritized)~~.

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

~~O~~P. Acknowledgments.~~:~~

~~i~~include STAR panel members and affiliations as well as names and affiliations of persons who contributed data, advice or information but were not part of the assessment team. *** Not required in draft assessment undergoing review.**

~~P~~Q. Literature cited.

~~Q~~R. Auxiliary files.

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

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

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

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

Stock	Species/area, including an evaluation of any potential biological basis for regional management.
Catches	Trends and current levels - include table for last ten years and graph with long term data.
Data and assessment	Date of last assessment, type of assessment model, data available, new information, and information lacking.
Stock biomass and dynamics	Trends and current levels relative to 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, or the annual SPR harvest rate) - include a table with the last 10 years of data and a graph showing the trend in fishing mortality relative to the target (y-axis) plotted against the trend in biomass relative to the target (x-axis).
Ecosystem considerations	A summary of reviewed environmental and ecosystem factors that appear to be correlated with stock dynamics, e.g., variability in the physical environment that directly or indirectly affects the vital rates (growth, survival, productivity/recruitment) of fish stocks, and/or trophic interactions that affect predators and prey. Note what, if any, ecosystem factors are used in the assessment and how.
Reference points (groundfish)/ Harvest control rules (CPS)	Groundfish: Management targets and definition of overfishing, including the harvest rate that brings the stock to equilibrium at $B_{40\%}$ (the B_{MSY} proxy) and the equilibrium stock size that results from fishing at the default harvest rate (the F_{MSY} proxy). Include a summary table that compares estimated reference points for SSB, SPR, Exploitation Rate and Yield based on SSB proxy for MSY, SPR proxy for MSY, and estimated MSY values. CPS: Results of applying the control rule to compute the harvest guideline, including specification of each of the quantities on which the harvest guideline is based (BIOMASS, CUTOFF, FRACTION, U.S. DISTRIBUTION)
Management performance	Catches in comparison to OFL, ABC, HG, and OY/ACL values for the most recent 10 years (when available), overfishing levels, actual catch and discard. Include OFL (encountered), OFL (retained) and OFL (dead) if different due to discard and discard mortality.
Unresolved problems and major uncertainties	Any special issues that complicate scientific assessment, questions about the best model scenario, etc.
Decision table and projections (groundfish only) * **	Projected yields (OFL, ABC and ACL), spawning biomass, and stock depletion levels for each year. OFL calculations should be based on the assumption that future catches equal ABCs and not OFLs.
Scientific Uncertainty	State the sigma value and the basis for its calculation.
Research and data needs	Identify information gaps that seriously impede the stock assessment.

Rebuilding Projections*	Reference to the principal results from rebuilding analysis if the stock is overfished. For groundfish, see Rebuilding Analysis terms of reference for detailed information on rebuilding analysis requirements.

APPENDIX D: CHECK LIST OF ELEMENTS TO BE INCLUDED IN FULL AND UPDATE ASSESSMENT DOCUMENTS ~~(GROUNDFISH ONLY)~~

Section	Element description
A	STAT names and affiliations
A	Citation instructions, on the back of the title page.
B	Executive Summary *** Not required in draft assessment undergoing review.**
B	Exec. Summ., Stock description: Species and area; basis for regional management.
B	Exec. Summ., Catches: Table with last 10 years; graph with long term information.
B	Exec. Summ., Data & assessment: Date and type of last assessment, model type, …
B	Exec. Summ., Stock biomass and dynamics: Trends and current levels relative to unfished; . . . table with last 10 years; graph with long term information.
B	Exec. Summ., Recruitment: Trends and current levels relative to unfished; . . . table with last 10 years; graph with long term information.
B	Exec. Summ., Exploitation status: Exploitation rates . . . ; table with last 10 years; Kobe (phase) plot with long term information.
B	Exec. Summ., Ecosystem considerations: Summary of relevant environmental and ecosystem factors . . .
B	Exec. Summ., Reference points (groundfish) or harvest control rules (CPS):
B	Exec. Summ., Management performance: Catches compared to OFLs, ABCs, . . . table with values for last 10 years.
B	Exec. Summ., Unresolved problems and major uncertainties: Special issues that complicate the assessment . . .
B	Exec. Summ., Decision table and projections (groundfish only): Projected yields, spawning biomass, and depletion levels . . .
B	Exec. Summ., Scientific uncertainty: Sigma and how calculated.
B	Exec. Summ., Research and data needs: Identify information gaps . . .
B	Exec. Summ., Rebuilding projections: Reference to principal results from the rebuilding analysis (if applicable) . . .
C	Introduction: 1. Scientific name, distribution, choice of stock structure, . . .
C	Introduction: 2. A map showing the scope of the assessment . . .
C	Introduction: 3. Important features of life history . . .
C	introduction: 4. Ecosystem considerations . . .
C	Introduction: 5. Important features of current fishery . . .
C	Introduction: 6. Summary of management history.
C	Introduction: 7. Management performance, including a table with OFLs ACLs, HGs, landings, and catch . . .
C	Introduction: 8. Description of fisheries for this species off Canada, Alaska and/or Mexico . . .

Section	Element description
D	Data: 1. Fishery-dependent data: Commercial fisheries landings by state, year and gear . . .
D	Data: 2. Fishery-independent data: Description of surveys used . . . Table with sample size information for length and age composition data . . . , including both the number of tows and fish sampled. Table with swept-area biomass estimates (if available) and associated CVs.
D	Data: 3. Sources used to estimate biological parameters (e.g., natural mortality, . . .
D	Data: 4. Environmental or ecosystem data used.
E	Model: 1. History of modeling approaches used for this stock.
E	Model: 2. Response to most recent past STAR panel recommendations . . .
E	Model: 3. (Groundfish updates only) Response to Groundfish Subcommittee recommendations. *** Not required in a draft assessment undergoing review.**
E	Model: 4. Description of new modeling approaches and changes from the last . . .
E	Model: 5. General model specifications: Assessment program, model structure, area and fleet definitions, initial conditions.
E	Model: 6. Model parameters: estimated and fixed parameters, parameter constraints, priors, selectivity assumptions, . . .
F	Base model selection: 1. Table with step-by-step changes when bridging from the previous to the new base model.
F	Base model selection: 2. Evidence of search for balance between model realism and parsimony . . .
F	Base model evaluation: 3. Evaluation of model parameters. Likelihood profile for natural mortality; Likelihood profile for steepness; Likelihood profile for R0.
F	Base model evaluation: 4. Residual analysis, residual plots, time-series of observed and predicted values.
F	Base model evaluation: 5. Convergence status and convergence criteria, randomization runs.
G	Base-model results: 1. Table with all explicit parameters in the base model and associated SDs.
G	Base-model results: 2. Table with population numbers at age × year × sex, which may be included as a text or spreadsheet file. *** Not required in a draft assessment undergoing review.**
G	Base-model results: 3. Table with time-series of total biomass, summary biomass, spawning biomass, depletion, recruitment, . . .
G	Base-model results: 4. Selectivity estimates (if not included elsewhere).
G	Base-model results: 5. Stock-recruitment relationship.
G	Base-model results: 6. OFL, ABC, and ACL . . . for recent years.
G	Base-model results: 7. Clear description of units for all outputs.
G	Base-model results: 8. Description of how discard is included in yield estimates.
G	Base-model results: 9. Description of environmental or ecosystem data.
H	Evaluation of uncertainty: 1. Sensitivity runs to evaluate assumptions about model structure.

Section	Element description
H	Evaluation of uncertainty: 2. Sensitivity to data set choice and weighting schemes: removal of data sources; alternative weighting methods for compositional data.
H	Evaluation of uncertainty: 3. Parameter uncertainty . . . Uncertainty estimates for parameters and derived quantities; Likelihood profiles (tabular format) for M, h, and R0 . . .
H	Evaluation of uncertainty: 4. Retrospective analysis, . . .
H	Evaluation of uncertainty: 5. Historical analysis . . .
H	Evaluation of uncertainty: 6. If a range of models runs for characterizing uncertainty . . . information on their relative probability.
H	Evaluation of uncertainty: 7. Ranges depicting uncertainty should include at least three runs . . . for use in the decision table.
I	Harvest control rules (CPS only): 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: . . . *Implementation for sardine . . .* BIOMASS; CUTOFF; FRACTION; AND U.S. DISTRIBUTION. *Implementation for Pacific mackerel . . .* BIOMASS; CUTOFF; FRACTION; AND U.S. DISTRIBUTION.
J	Reference points (groundfish only): 1. Unfished spawning stock biomass, summary age biomass, . . .
J	Reference points (groundfish only): 2. Reference points based on $B_{40\%}$ for rockfish and roundfish and on $B_{25\%}$ for flatfish . . .
J	Reference points (groundfish only): 3. Reference points based on SPR proxy . . .
J	Reference points (groundfish only): 4. Reference points based on MSY . . .
J	Reference points (groundfish only): 5. Equilibrium yield curve showing various B_{MSY} proxies.
K	Unresolved problems and major uncertainties ~~(groundfish only)~~: Describe any special issues . . .
L	Harvest projections and decision tables (groundfish only): *** Not required in a draft assessment undergoing review.** **** Not applicable to assessments rejected by a STAR Panel or withdrawn by the STAT.**
L	Harvest projections and decision tables: 1. Harvest projections and decision tables should . . .
L	Harvest projections and decision tables: 2. Information presented should include biomass, stock depletion, . . .
L	Harvest projections and decision tables: 3. Fully document the calculation of the base model's sigma.
M	Evaluation of scientific uncertainty. Sigma and how it was calculated.
N	Regional management considerations. Discuss biological evidence for a regional management approach. . . . If regional management, recommend a method for allocating harvest to region . . .
O	Research and data needs: 1. Describe progress on research and data needs identified in the most recent previous assessment . . .
O	Research and data needs: 2. Describe new research & data needs and priority . . .

Section	Element description
P	Acknowledgments: Include STAR Panel members and affiliations . . . *** Not required in a draft assessment undergoing review.**
Q	Literature cited:
R	Auxiliary files: A list naming the required text files (. . .) and any other supplementary electronic files . . .

APPENDIX ~~D~~E: TEMPLATE FOR A DATA-MODERATE OR DATA-POOR ASSESSMENT DOCUMENT

1. Title page and list of preparers – the names and affiliations of the stock assessment team (STAT).
2. Introduction: Scientific name, distribution, basic biology (growth, longevity, ecology), the basis for the choice of stock unit(s) (no more than 1-2 paragraphs).
3. Development of indices (used and rejected). Novel approaches should be fully documented.
4. Survey of other data available for assessment: sample sizes by year and source of lengths, and ages (read and unread)--in case there is interest in conducting a full assessment in the future.
5. Selection of method (XSSS or XDB-SRA; authors are "encouraged" to do both).
6. Assessment model
    a. Specification of priors / production function (defaults OK)
    b. Initial runs using catch-only methods (DB-SRA or SSS (or both))
    c. Diagnostics
        i. Evaluation of convergence
        ii. Residual plots
        iii. Posterior predictive intervals (if Bayesian)
        iv. Time-trajectories of biomass, depletion, etc.
        v. Sensitivity analyses using alternative catch streams, alternative priors for depletion, etc.
7. Estimates of OFL (median of the distribution), and
8. Estimates of stock status.

APPENDIX ~~E~~F: DEFINITIONS OF SPECIES CATEGORIES FOR GROUNDFISH AND CPS ASSESSMENTS AND RULES FOR MAKING CATEGORY ASSIGNMENTS FOR FULL OR UPDATE ASSESSMENTS

Category 3: Data poor. OFL is derived from historical catch.	**a**	No reliable catch history. No basis for establishing OFL.
	b	Reliable catches estimates only for recent years. OFL is average catch during a period when stock is considered to be stable and close to BMSY equilibrium on the basis of expert judgment.
	c	Reliable aggregate catches during period of fishery development and approximate values for natural mortality. Default analytical approach DCAC.
	d	Reliable annual historical catches and approximate values for natural mortality and age at 50% maturity. Default analytical approach DB-SRA.
Category 2: Data moderate. OFL is derived from model output (or natural mortality).	**a**	M*survey biomass assessment (as in Rogers 1996).
	b	Historical catches, fishery-dependent trend information only. An aggregate population model is fit to the available information.
	c	Historical catches, survey trend information, or at least one absolute abundance estimate. An aggregate population model is fit to the available information.
	d	Full age-structured assessment, but results are substantially more uncertain than assessments used in the calculation of the P* buffer. The SSC will provide a rationale for each stock placed in this category. Reasons could include that assessment results are very sensitive to model and data assumptions, or that the assessment has not been updated for many years.
	e	Assessments of a complex of species cannot be designated as a category 1 assessment unless there is good evidence that the component species have very similar life-history characteristics and similar rates of biological productivity.
Category 1: Data rich. OFL is based on F_{MSY} or F_{MSY} proxy from model output. ABC based on P* buffer.	**a**	Reliable compositional (age and/or size) data sufficient to resolve year-class strength and growth characteristics. Only fishery-dependent trend information available. Age/size structured assessment model.
	b	As in 1a, but trend information also available from surveys. Age/size structured assessment model.
	c	Age/size structured assessment model with reliable estimation of the stock-recruit relationship.

Rules for Making Category Assignments for Full or Update Stock Assessments

If the measured value of sigma from the assessment (derived either from the estimated relative uncertainty in ending biomass or from the relative difference in ending biomass between the base model and the low state of nature) is greater~~less~~ than the default proxy sigma value specified by the SSC, then use the sigma from the assessment. Otherwise use the default proxy sigma value.

APPENDIX G: PROPOSED OUTLINE FOR 2019 ACCEPTED PRACTICES GUIDELINES FOR GROUNDFISH STOCK ASSESSMENTS

Presented below is a general outline of topics to be included in the set of *Accepted Practices Guidelines* that the SSC will finalize by the end of March 2019 for use with 2019 groundfish stock assessments. The guidelines will provide STATs with default approaches they should use for dealing with certain stock assessment data and modeling issues. The STATs may diverge from the guidelines if they provide adequate justification for doing so. The guidelines, which are not comprehensive, focus on certain issues the SSC has so far considered. The purpose of having guidelines is to lessen the time that might otherwise be spent during stock assessment reviews in discussions about how particular steps in the assessment process should have been conducted.

Input Data:

- Biomass indices from bottom trawl surveys.
- Biomass indices from fishery dependent sources (e.g., logbooks).
- Spatial stock structure for groundfish species.
- Prior distributions for natural mortality (M).
- Age- or gender-specific M.
- Weighting of compositional data.
- Data Extractions.
- Landings Data.
- Discard Data.
- Compositional Data.
- Recreational Catch-per-Unit-Effort Data.

Modeling:

- Selectivity.
- Fecundity.
- Diagnostics.
- Prior on Steepness – *Sebastes* species.
- Prior on Steepness – other species.
- Including *extra SD* parameters with an index (***NEW***).
- Jittering to verify convergence (***NEW***).
- Strategies for phase sequencing (***NEW***).
- Check for stability in length-at-age (***NEW***).
- Sensitivity to conditional age-at-length data (***NEW***).
- Approaches for getting states of nature with 25:50:20 probability ratios (***NEW***).
- Default assumptions for removals in projections and decision tables (***NEW***).
- Technical guidance on conducting catch-only projections (***NEW***).
- Guidance on justification needed for changing from how a previous assessment treated data (e.g., removal of a survey, splitting [or not splitting] the Triennial survey).

Documentation and Reporting:

- Number of significant digits to use and report for key parameters (e.g., steepness), outputs (e.g., depletion), and for calculating uncertainty buffers (***NEW***).