

Revised Groundfish Stock Assessment Definitions

NOAA Alaska Fisheries Science Center

Discussion Paper

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Introduction

In February 2023, in response to October 2022 North Pacific Fishery Management Council (NPFMC) Science and Statistical Committee (SSC) requests ([SSC Report October 2022](#)), the AFSC presented proposed definitions for groundfish stock assessment products, and the expected level of review effort by the Council review bodies for these products. Relevant SSC comments and recommendations from the October 2022 meeting include:

- “The SSC requests that the AFSC and JGPT develop definitions of partial, full, and benchmark assessments and specify what documentation and level of review are needed for each.”
- “The SSC endorses the reproducibility and streamlining processes. The SSC encourages efforts in automating rote tasks to promote standardization and efficiency in communication.”

Dialogue at the February 2023 meeting resulted in Council agreement with SSC recommendations on groundfish stock assessment definitions ([SSC Report February 2023](#)), which noted “**The SSC supports these categories and looks forward to clear definitions**”. The SSC suggested several refinements to the definitions for groundfish stock assessment products that are incorporated into this document, including alternative names for Partial catch projections (‘harvest projections’) and Catch monitoring updates (‘catch report’). Additionally, discussion of the differences between national next generation stock assessment categories (NGSAIP 2018) and the specific categories of models and reviews used by the NPFMC led to the SSC recommendation to add a “**5th analysis category ‘Research assessments’ which would include analyses/methods undergoing external peer review (e.g., CIE) but not immediately feeding into management actions (e.g., assessments in between scheduled analyses and analysis products such as GMACS)**”. This document presents the Alaska Fisheries Science Center’s (AFSC’s) revisions to the definitions of groundfish stock assessment products for the NPFMC based on the above feedback. Clear definitions will help AFSC provide streamlined assessment products that promote efficiency, standardized assessment schedules, and improve the review process.

Note that new Stock Assessment Guidelines are being developed based on these stock assessment product definitions to provide stock assessment authors detailed guidance on the baseline content and format of the required stock assessment products, based on assessment type. The Stock Assessment Guidelines will provide direction to authors on the structure of the stock assessment products, address required contents for new stock assessment products, provide guidance on how to reference new stock assessment products, and provide direction for streamlining and increasing efficiency in delivery of these products. The overarching goal of this effort will be to promote standardization and efficiency in communicating stock assessment products to the NPFMC audience and review bodies. Table 1 shows how these assessment definitions apply to the stock assessment Tiers. The AFSC plans to produce revised Stock Assessment Guidelines for NPFMC review in September and October 2023.

Groundfish Assessment Definitions

North Pacific Fishery Management Council Stock Assessment Products

In the past, the nomenclature applied to groundfish stock assessment products used by the NPFMC have been somewhat fluid and lacking documentation. The purpose of this document is to explicitly define the types of groundfish stock assessment products used by the NPFMC and to illustrate how the NPFMC assessment types translate to national stock assessment definitions used in the NMFS [Next Generation Stock Assessment Improvement Plan](#) (NGSAIP, 2018) (Figure 1). This document reflects recommendations from previous participants in the groundfish stock assessment process, including Council advisory bodies, and stock assessment teams. Nevertheless, **the groundfish stock assessment products described here may not address every contingency and will need to be flexible to address new issues as they arise.**

Stock assessments are conducted to assess the abundance and trends of fish stocks and provide the fundamental basis for management decisions regarding appropriate harvest levels. In most cases, assessments use statistical population models to integrate and simultaneously analyze survey, fishery, and biological data. Environmental and ecosystem data may also be integrated in stock assessments. Hilborn and Walters (1992) define stock assessments as “the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices.” In this document, the term “stock assessment” includes activities, analyses and reports, beginning with data collection and continuing through to scientific recommendations presented to the Council and its advisors. To provide the Best Scientific Information Available (BSIA) for fishery managers, stock assessments must attempt to identify and quantify major uncertainties, balance realism and parsimony, and make best use of the available data, with the ultimate goal of producing reliable short-term stock predictions of stock status, trends, and catch levels. This document focuses most heavily on “operational” stock assessment products for use in management by the NPFMC, recognizing that “research” stock assessments may eventually become operational models, and may be used to provide additional contextual insight in the NPFMC decision making process. The NPFMC harvest control rules are defined by a Tier system described in [Amendment 56](#) in both the BSAI and GOA Fishery Management Plans. The specifications of Acceptable Biological Catch (ABC) and the Overfishing Level (OFL) are defined for 6 Tiers based on data availability. The assessment products described below can be applied to any NPFMC Tier levels. These definitions are focused on the assessment products that will be delivered for NPFMC fishery management, and do not specify specific review processes for each stock assessment product.

Operational full assessment: In the past, the terms “benchmark” or “full” assessment were commonly used in the NPFMC process, though neither term has been formally defined. The least restricted operational assessment type is a full assessment, which considers all available data and multiple model configurations or new modeling platforms, and includes any new unreviewed data sources that are not considered in other assessment types. A full assessment can be applied to a stock that has not been previously assessed or re-applied to a previously assessed stock, in which case the full assessment involves a re-examination of the underlying assumptions, data, and model parameters previously used to assess the stock.

A non-exhaustive list of examples of model processes or inputs that could be considered in a full assessment includes, but isn’t limited to:

- The functional form of selectivity curves (e.g. logistic to dome-shaped, a new length at 50% selectivity)
- Priors, parameterizations, or treatment of life history processes (e.g. a new prior on M based on life-history meta-analysis; moving from single-sex to two-sex length-at-age parameters)

- The aggregation or inclusion of datasets (e.g. dropping a survey index, aggregating fixed-gear fisheries)

For review purposes, a full assessment would require the most intensive review of all the assessment types by NPFMC review bodies before being recommended for management advice. All full assessments should be introduced and reviewed at the September/October Plan Team and SSC meetings prior to setting specifications for the next fishing year in November/December. Extenuating circumstances will be considered on a case-by-case basis.

Operational update assessment: Prior to this document update stock assessments were sometimes referred to as “full assessments”. Resource limitations constrain the number of full assessments that can be conducted and reviewed during an assessment cycle. For assessments that have relatively few outstanding modeling or data issues and provide relatively stable results as new data are added, an operational update assessment may be preferable when updating current information is desired and there are other priorities for full assessments. In the past, the NPFMC process has not adopted the update stock assessment approach but this additional assessment category will streamline both author and reviewer responsibilities.

An operational update assessment is defined as an assessment that maintains the model structure of the previous full assessment, with additions generally restricted to data that have become available since the last assessment added to previously evaluated time series, along with limited allowable minor model changes required to fit the model to the new data. Update stock assessments must carry forward the fundamental structure of the last operational full assessment reviewed and endorsed through the NPFMC review process. Major changes to the assessment must be postponed until the next operational full assessment. If more substantial changes to the model are contemplated by the authors, the assessment may be elevated to an operational full stock assessment in the following year. Assessment structure here refers to the population dynamics model, data sources used as inputs to the model, the statistical platform used to fit the model to the data, and how the management quantities used to set harvest specifications are calculated. Minor changes to the model beyond data revisions are restricted to changes needed to fit the new data. Examples of permissible changes include:

1. The updating of data sources used in the previous operational full assessment. It is common 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 previous assessment.
2. Reweighting of data using the same data weighting methods implemented in the last full assessment.
3. Changes needed to ensure parameters are not estimated on bounds.
4. Changes in time blocks needed to capture, for example, changing size distributions of catch.
5. The stock assessment modeling software used in programming the assessment. It is acceptable to use a newer version of assessment software or adapt an alternative standardized modeling package reviewed by Council Science and Statistical Committees or via the Center for Independent Experts. A comparison should be provided to illustrate the newer software produces adequately similar results when used with the same model data, model structure, and model assumptions, as the most recent full assessment.

Authors are encouraged to incorporate data preparation and methods sections by reference to the previous operational full assessment where methods do not differ appreciably.

It is expected that these types of accepted models have already been submitted for a thorough review by a CIE or multiple Plan Team/SSC reviews. For review purposes, an update assessment would require a less intensive review, compared to a full assessment, by NPFMC review bodies before being recommended

for management advice. Update assessments are generally introduced and reviewed at the November Plan Team and December SSC meetings prior to setting specifications for the next fishing year.

Harvest Projections: In the past, the term “partial” assessment was commonly used in the NPFMC process to reflect stock assessment models that are projected forward in time with recent catches for Tier 1 to 3 assessments or use catch/biomass ratios or the REMA model for Tier 4-6 assessments. The number of harvest projections has increased as stock assessment frequency has decreased as a result of the 2017 prioritization analysis.

Harvest projections for Tier 1 to 3 groundfish with age-or-length structured models used to estimate stock status and project ABCs and OFLs for future years implement harvest projections that are stock projections updated with recent catch data and do not include the most recent survey abundance index estimates. Note that harvest projections for Tier 1 to 3 assessments do not estimate new parameters so parameter estimates and recruitment time series remain unchanged from the last operational full or update assessment.

Harvest projections for Tiers 4 to 5 stocks do not have projection models, so use catch/biomass ratios in years without new survey data, and re-run the random effects model (REMA) during years with new survey data. Note that Tier 4 to 5 stocks that rerun the REMA model would estimate fits to data that could update the ABC. Harvest projections for Tier 6 default to catch monitoring updates (discussed below).

Harvest projection documents are short, consisting of a brief update of management advice for review by the NPFMC. Plan Teams and SSCs may request that all harvest projections be reviewed together, with any large changes in catches or surveys flagged for further consideration.

Catch Report: In response to Plan Teams and SSC requests to ensure that sudden changes in the fishery or stock are not missed during years when the above stock assessment products are not produced, we recommend a new product called a “catch report”. A catch report tabulates fishery removals for recent years to ensure that they are below specified annual catch limits (ACLs and ABCs) and are not showing a significant change or concern in fishery catch.

This category provides information for the category previously reported as “nothing”, and applies to Tiers 4 to 6 groundfish stocks. If a substantial change is noted in an un-assessed stock, this could serve as a trigger for an operational update or full assessment.

Catch reports should be brief and provide total catch relative to recent catches and ABC (landings and discards). A table would capture all stocks scheduled for a catch report for a particular year and would be reviewed annually by the Plan Teams and SSC.

Research assessment: In practice, there is a continuum between research stock assessments and operational full stock assessments that has resulted in an unclear distinction between the two stock assessment products. Authors will commonly utilize research assessments to explore model configurations, implement novel analyses, test new data, explore new software or methods (e.g. multi-species stock assessment models), investigate Ecosystem and Socioeconomic Profiles (ESP) indicators, or provide additional context for consideration in NPFMC decision making such as alternative models. Research assessments may provide supplemental information to the NPFMC, but are not reviewed or endorsed for providing management advice. Any research assessment substantially different than the existing operational full assessment that would be elevated for management advice would likely benefit from an external CIE review prior to NPFMC review.

Linking assessment products to the NGSaip

National stock assessment definitions have been developed as part of the NMFS [Next Generation Stock Assessment Improvement Plan](#) (NGSAIP, 2018) (Figure 1). Council management styles differ by region, thus aligning national definitions within regional context is difficult. The NPFMC definitions developed here address NPFMC needs but also utilize guidance from the national stock assessment improvement plan. The NPFMC has adopted a maximum frequency of four years between assessments which differs from other regions and is reflected in how these definitions were established. Operational full assessments are the foundation of the NPFMC management process and are required for the majority of assessment products and review. Creating the operational update assessment category allows both the agency and the Council to streamline the products and reviews needed to approve harvest recommendations for management purposes. The harvest projections and catch reports are similar to the national stock monitoring updates and meant to support operational assessments in off-years and require minimal work and review. The NPFMC research assessment category is broader in comparison to the national framework but is consistent with exploration of new methods and techniques with the intent to better inform or replace existing operational assessments. The NPFMC provides a rigorous level of review annually before adopting harvest recommendations, and the intent is for the agency to take advantage of both internal and external peer review of operational full assessments to ensure best advice is put forward. In all cases, the NPFMC assessment categories defined here are designed to provide the best management advice for setting harvest recommendations while also streamlining and making the process more efficient.

Tables

Tier \ Definition	Full	Update	Harvest Projection	Catch Report
1 - 3	New age structured model and data	Previously reviewed and accepted age structured model	Previously reviewed and accepted age structured model projection	NA
4-5	New REMA or alternative	Previously reviewed and accepted REMA	Previously reviewed and accepted REMA or Catch/Biomass Ratios	Catch monitoring
6	New catch history	Catch history	Catch monitoring	Catch monitoring

Figures

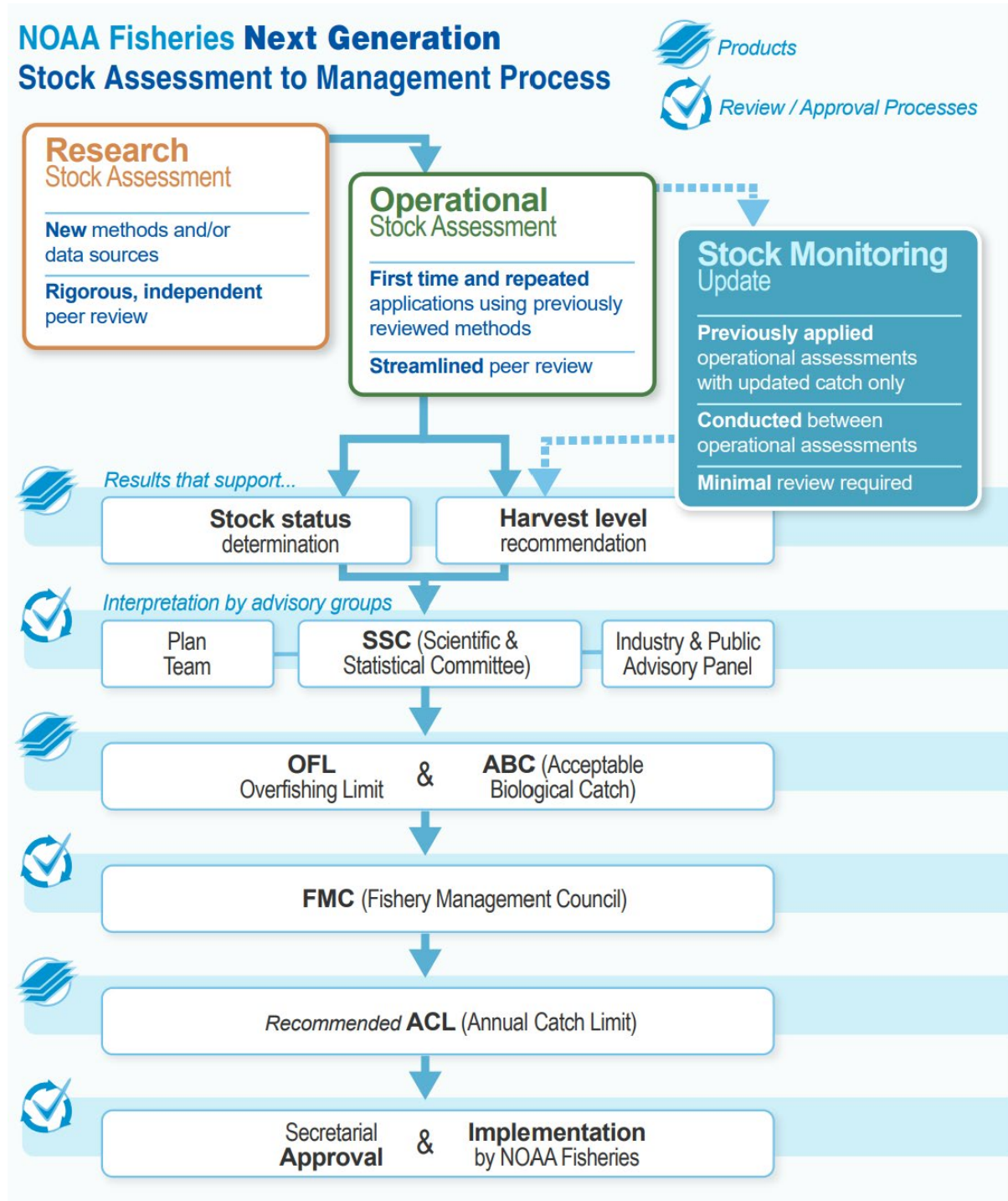


Figure 1. Stock assessment definitions and processes as outlined in the NMFS Next Generation Stock Assessment Improvement Plan (2018).