JOINT SCIENTIFIC STATISTICAL COMMITTEE/COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON CENTRAL SUBPOPULATION OF NORTHERN ANCHOVY OVERFISHING LIMIT PROCESS

At its November 2016 meeting, the Pacific Fishery Management Council (Council) tasked the Scientific and Statistical Committee (SSC) with providing information regarding potential approaches to a new overfishing limit (OFL) for the Central Subpopulation of Northern Anchovy (CSNA), and likely timelines associated with each approach. This information is being provided as a report for consideration by the Council during the April 2017 meeting. After preliminary discussions, it was determined that the report would be best developed as a joint SSC and Coastal Pelagic Species Management Team (CPSMT) report.

This report describes several possible options for identifying a new OFL. The approaches vary in terms of robustness, precision, inputs, and the timeframe required. The current OFL for the CSNA is based on an estimate of the long-term maximum sustainable yield (MSY) for the stock. That approach (i.e., a static MSY intended to apply over many years) could be used again, with an updated estimate of MSY, such as with option A described below.

A different approach would be to compute annual OFLs using a biomass estimate and an estimate of F_{MSY}, such as options B, C, or D described below. This approach is similar to the OFL harvest control rules currently in place for Pacific sardine and Pacific mackerel.

All options would likely require a fishery management plan (FMP) amendment, but the amendments and the analyses necessary to implement them will vary in complexity and the time required to complete. For example, changing from an MSY-based OFL to a biomass-based OFL and the probable need to revise the acceptable biological catch (ABC) control rule would likely require more analysis than continuing with the status quo approach and only updating the current estimate of MSY.

This report provides descriptions of the various options and the necessary data inputs, timeframe required for scientific analyses, and other notes. Some activities and needs identified below (such as acoustic-trawl methodology [ATM] surveys and resultant abundance indices) will happen regardless of any new or changed approach to how the OFL is computed. However, other activities (e.g., stock assessment and literature reviews) may require additional staff time, financial resources, and review time.

[A] OFL based on status quo

The status quo sets the OFL as MSY based on Conrad's (1991) analysis, which includes an MSY of 123,336 mt. If a decision is made to review and/or update the status quo OFL (i.e., extend the input data time-series to include more recent data), the following would apply:

Needs: SSC review of the method, including the basis for the estimates of B_{MSY} and MSY
Timeframe: Approximately one year for research and SSC review.

Notes: Earlier estimates of MSY include Radovich and MacCall (1979) and Huppert (1981), which were 408,237 mt and 471,741 mt, respectively. The default monitored species control rule computes ABC as 25 percent of MSY, and was first incorporated for coastal pelagic species (CPS) management with the adoption of Amendment 8. It was subsequently endorsed by the SSC during the adoption of Amendment 13 in 2010. No analyses or simulations were conducted to develop this control rule.

[B] OFL based on an F_{MSY} and biomass estimate from a stock assessment

This option would derive an OFL that is based on an estimate of F_{MSY} and a biomass estimate from a stock assessment. It would involve developing an integrated assessment model and fitting the model to data such as a time series of age data, the trend in indices of abundance, and a recent and historical estimate of absolute abundance. Conducting a full integrated assessment would be a substantial undertaking and would likely involve several assumptions such as time-invariant biological parameters, an evaluation of the representativeness of indices of abundance, and accounting for the impact of ageing error. Section 6.1 of the Anchovy Assessment Workshop Report provides additional information (see September 2016 Agenda Item E.2.a, Assessment Workshop Report).

Needs: Integrated stock assessments require age-compositions, catch series, ATM time series, and biological metrics/assumptions.
Timeframe: 1-3 years after the completion of the ATM review.
Notes: Estimation of F_{MSY} using an integrated assessment could be achieved by:

1. Sub-option 1. Fixing the "steepness" based on a meta-analysis of anchovy stocks
2. Sub-option 2. Estimating "steepness" within the assessment
3. Sub-option 3. Assuming steepness equals 1 (i.e., recruitment is independent of spawning biomass).

[C] OFL based on F_{MSY} (from an assessment or proxy) multiplied by an estimate of absolute abundance (not from an assessment)

This option would be similar to option B, except the biomass estimate would come from a single survey or index of absolute abundance, such as the ATM survey. Only the estimate of absolute abundance would be updated annually. The updating of F_{MSY} could take place on some regular basis or as needed in response to significant new information on the biology of the stock.

Needs: SSC evaluation of the utility of ATM indices and the resulting abundance estimates. ATM biomass estimates need to be available on a consistent, annual, and timely basis. The 2016 ATM estimate will be available mid-2017. The Southwest Fisheries Science Center (SWFSC) has proposed a methodology review for the ATM in early 2018, and an inshore correction factor would need to be derived.[1] Also, there would be a need for a decision on F_{MSY} choice, as outlined in the sub-options below.

[1] The recent estimate of absolute abundance would be from the ATM. A sub-option would be to extrapolate the estimate into inshore waters, similar to the suggestions for sardine (2011 ATM review, pp. 5 and 13-14). Comparing the innermost CalCOFI and SCOOS sampling stations might also be informative.

Timeframe

1. Sub-option 1. Estimate F_{MSY} based on the Jacobson assessment (already done). An F_{MSY} would need to be selected from Table 6 in the NMFS MSST Report (September 2016 Agenda Item E.1.a, Supplemental NMFS Report). Timeframe: 1-2 months (after conclusion of ATM methodology review).
2. Sub-option 2. Estimate F_{MSY} (but not current biomass) based on a new stock assessment (similar to option B above, but with the F_{MSY} applied to new biomass estimates as they are completed). It would also be possible to use current biomass from the assessment in the first year this method was applied and then base subsequent OFL determinations on biomass estimated from surveys. Timeframe: 1-3 years (after conclusion of ATM methodology review).
3. Sub-option 3. Set F_{MSY} based on analogy with other CPS. Timeframe: less than 1 year (after conclusion of ATM methodology review).
4. Sub-option 4. Set F_{MSY} based on a meta-analysis of the productivity of other anchovy stocks, along with assumptions about natural mortality, selectivity, fecundity, and growth. Timeframe: 1 year (after conclusion of ATM methodology review).
5. Sub-option 5. Set F_{MSY} based on natural mortality (M) multiplied by a constant (e.g., Thompson 1993 or NMFS 1996). Timeframe: less than 1 year (after conclusion of ATM methodology review).

[D] OFL based on F_{MSY} multiplied by an estimate of biomass obtained by applying a statistical smoother to recent estimates of absolute abundance

This option is similar to option C, except that the abundance estimate would be generated based on a smoother applied to several years of biomass estimates.

Needs: SSC evaluation of the utility of ATM estimates (same as for options B and C above) plus a management strategy evaluation or other analysis to choose how to perform the smoothing.
Timeframe: Depends on the sub-option selected to specify F_{MSY}. If required, and depending on its complexity, a management strategy evaluation (MSE) would take at least a year to conduct.

Other matters

- Average-catch based approaches were discussed, but excluded from further consideration because landings vary depending on non-biological factors (markets, other fisheries, etc.). Catch is consequently, not necessarily, indicative of stock status.
- Options B, C, and D would likely require analyses be conducted to estimate growth, natural mortality, fecundity, and selectivity for the CSNA although analyses for some factors may not be required under some sub-options.
- Options B, C, and D would also require the development and review of an ABC control rule. This is likely to take 1-2 years, which could fall within the time for OFL development. The ABC control rule for option A would also be reviewed if this option is adopted, with the time for review included in the time for revising the OFL.

References

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