

## SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PACIFIC SARDINE STOCK ASSESSMENT AND MANAGEMENT MEASURES

Dr. Kevin Hill, the lead member of the Stock Assessment Team (STAT), presented the results of the sardine stock assessment update. Dr. André Punt provided a summary of the review conducted on October 7<sup>th</sup>, 2008 by members of the Scientific and Statistical Committee's (SSC) coastal pelagic species (CPS) subcommittee in a joint session with members of the CPS Management Team (CPSMT) and the CPS Advisory Subpanel (CPSAS). Dr. Samuel Herrick presented the viewpoint of the CPSMT.

The sardine assessment was conducted as an update to a stock assessment that had undergone a full stock assessment review (STAR) in 2007. Updates are appropriate in situations where no alterations to a stock assessment model have occurred, other than to incorporate recent data from sources already used in the full assessment. In this case the newly incorporated data included: (1) 2007-08 catches from the Pacific Northwest (PNW), California, and northern Baja fisheries, (2) 2007-08 compositional information (lengths and age-at-length data) from the PNW and California fisheries, and (3) a daily egg production method (DEPM) estimate of spawning biomass from a survey conducted during the spring of 2008. In addition the STAT made minor corrections to the 2006-07 catch statistics.

As specified in the "Terms of Reference for Coastal Pelagic Species Stock Assessment Review Process," the review focused on two central questions: (1) did the update maintain complete fidelity to the last full stock assessment, and (2) are the new input data and model results sufficiently consistent with previous data and results that the updated assessment can form the basis for Council decision-making? Although the update closely followed the exact structure of the 2007 model, results from the update were inconsistent with those from the previous assessment. For example, the peak biomass in the update model was only 59 percent of that in the 2007 model. This volatility in reconstruction of past dynamics affects interpretation of stock status and is unexpected for an assessment update. Due to these factors, the update assessment failed to meet the acceptance criteria specified in the terms of reference (TOR).

The subcommittee, and subsequently the SSC, considered a number of ways of proceeding, including: (a) accepting the substantial change in results and recommending that the update assessment represents the best available science, (b) requesting that a new full assessment be conducted and reviewed prior to setting the sardine harvest guideline, (c) developing a model that incorporates only a portion of the new data, and (d) using the accepted 2007 assessment model and projecting this forward using only the updated catch information. In addition, the SSC also considered not recommending any of the assessment models.

After lengthy discussion the SSC concluded that it was not possible to identify a single model representing the "best available science," although two results were identified that the Council could consider as reasonable scientific representations of Pacific sardine stock status. A selection between these choices, however, is viewed by the SSC as a policy, not scientific, decision.

- (1) If it is the intention of the Council to adhere as closely as possible to the TOR, the SSC agrees with the subcommittee that the most appropriate course of action is option (d), i.e., a run that used the 2007-STAR approved model without any model tuning or variance adjustments but with a simple update of the 2006-08 catches. The results from this run are virtually identical to those from the 2007 base model (as expected). In particular, this model estimates 586,369 mt of age-1+ biomass in 2008, which results in a harvest guideline of 56,946 mt when the control rule for Pacific sardine is applied. However, the SSC could not strictly endorse this option as best available science, due to an absence of specificity in the TOR about what to do when an update failed to meet the acceptance criteria.
- (2) If the Council wishes to incorporate all of the new data collected in the preceding year in making their decision it should use the results of the strict update, i.e., option (a). In particular, that model estimates 662,886 mt of age-1+ biomass in 2008, which results in a harvest guideline of 66,932 mt when the control rule for Pacific sardine is applied. However, the SSC could not strictly endorse this option as best available science because of substantial changes in the model output that could not be thoroughly reviewed in the available time.

Regardless of which option the Council elects, the CPS terms of reference should be updated to clarify the appropriate course of action in situations where an update fails to meet the existing acceptance criteria.

It should also be noted that the DEPM, the only index of abundance for sardine, was quite low in 2008. However, the index DEPM is influenced by environmental factors as well as abundance.

Given that a formal “update” could not be completed, the SSC recommends that the sardine assessment model be evaluated by a full STAR Panel in September 2009. The new assessment should explore the possibility of cohort targeting in the Pacific Northwest fishery, as well as consider using the results of the Pacific Northwest Sardine Survey. However, use of the survey results can only occur if the methodology on which it is based has been previously reviewed, for example during the Pacific mackerel STAR Panel scheduled for May 2009. The SSC further recommends that a spatial model with separate areas off of California and the Northwest be developed.

The SSC emphasizes that the considerable sensitivity of the model to what should be minor changes in the data inputs underscores the substantial uncertainty regarding sardine stock status and relative recruitment across years. The development of new indices of abundance would likely help to reduce this uncertainty, while the development of spatial models might resolve the apparent conflict in data between the southern and northern portions of the stock. In any case, full assessments should be conducted more frequently than the current three year timeframe until there is improvement in these issues.

The SSC would like to compliment Dr. Hill for his thorough documentation and his willingness to conduct supplemental analyses during the review meeting.

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