**SUPPLEMENTAL SSC REPORT, NOVEMBER 2010**

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON
PACIFIC SARDINE STOCK ASSESSMENT AND COASTAL PELAGIC SPECIES
MANAGEMENT MEASURES FOR 2011

The Scientific and Statistical Committee (SSC) reviewed and discussed the assessment and resulting overfishing fishing limits (OFLs) and acceptable biological catches (ABCs) for Pacific sardine, and the OFLs and ABCs for monitored stocks. Mr. Tom Jagielo presented the 2010 aerial survey results. 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 5-6, 2010 by members of the SSC Coastal Pelagic Species Subcommittee in a joint session with members of the CPS Management Team (CPSMT) and the CPS Advisory Subpanel (CPSAS). Mr. Greg Krutzikowsky presented the CPSMT's analysis and recommendations for OFLs and ABCs for monitored species, focusing on northern subpopulation of Northern anchovy.

The sardine assessment was an update to one that had undergone a full stock assessment review (STAR) in 2009. 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 updated catch data coastwide, length composition data for all regions except Ensenada, the 2010 spawning stock biomass index (DEPM), and the 2010 aerial survey estimate. In addition, the assessment update included a new estimate of the coefficient of variation (CV) for the 2009 aerial survey, based on a corrected analysis requested by the 2009 STAR Panel.

As specified in the "2009 Terms of Reference for Coastal Pelagic Species Stock Assessment Review Process," the review focused on two central questions: (1) did the assessment carry forward its fundamental structure from a model that was previously reviewed and endorsed by a STAR Panel, 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. The assessment model presented (denoted "10w" in the assessment document) satisfies the criteria for assessment updates and the SSC recommends adoption of it as the best available science for the management of Pacific sardine in 2011.

The estimated biomass of 537,173 (ages 1+, mt), an $F_{MSY}$ of 0.1985 based on a relationship between temperature and $F_{MSY}$, and an estimated distribution of 87% of the stock in U.S. waters lead to an OFL (U.S. only) for 2011 of 92,767 mt. The SSC has recommended that scientific uncertainty ($\sigma$) be set to the maximum of the CV of the biomass estimate for the most recent year or a default value of 0.36. The model CV for 2010 sardine biomass was 0.31; therefore scientific uncertainty ($\sigma$) was set to the default value. The Amendment 13 ABC buffer depends on the probability of overfishing level determined by the Council (P*). The following table shows how the ABC varies according to P*:

Table 1. Allowable Biological Catch estimates for an illustrative range of probability of overfishing (P*) values.

| ***OFL=92,767mt*** | ***P*=0.5*** | ***P*=0.45*** | ***P*=0.4*** | ***P*=0.3*** | ***P*=0.2*** |
|---|---|---|---|---|---|
| BUFFER | 1.0 | 0.956 | 0.913 | 0.828 | 0.739 |
| Allowable Biological Catch (ABC, mt) | 92,767 | 88,664 | 84,681 | 76,808 | 68,519 |

Note: the selected value of P* must be less than 0.5 to assure that the ABC<OFL

The SSC noted a number of aspects of the assessment that the Council may wish to consider when choosing a P* for sardine and setting harvest specifications:

- There is a need to re-evaluate the assumption that selectivity for the aerial survey in the northern region is dome-shaped but the selectivity for the fishery in the same area is asymptotic. Assuming that survey selectivity is asymptotic and that survey catchability (q) is 1.0 leads to a more pessimistic appraisal of stock status. Changing the selectivity pattern for the survey selectivity is, however, outside of the CPS Terms of Reference for assessment updates and should be considered during the next full assessment in fall 2011.
- The estimate of absolute biomass from the assessment is sensitive to how the aerial survey data are included in the assessment.
- All model configurations examined in the assessment indicate a declining trend in abundance over recent years. Due to recent low recruitment, this decline is likely to continue.

The SSC also recommends that the full assessment in 2011 should examine how the CV for the 2009 survey is estimated based on results from the 2010 aerial survey and those of a 2011 aerial survey, if such a survey takes place. In addition, the 2011 assessment should examine the assumption that natural mortality, *M*, is constant and equal to $0.4yr^{-1}$.

**OFLs and ABCs for Monitored Species**

Reference points for monitored CPS stocks are difficult to determine due to limited data to estimate biomass and productivity. The northern subpopulation of the northern anchovy is currently lightly fished, with inconsistent effort, making the time series of catch an unreliable indicator of stock status. The CPSMT compiled all the scientific information on northern anchovy and found only two estimates of biomass: egg and larval production estimates from the 1970s and a recent acoustic survey by researchers at the Southwest Fisheries Science Center. The average of these two estimates is approximately 130,000 mt. Following considerable discussion, the SSC recommended that the OFL be set by multiplying the biomass estimate of 130,000 mt by 0.3, the $F_{MSY}$ value for Pacific mackerel. This was considered appropriate because anchovy are likely to be as productive as Pacific mackerel. With the established uncertainty buffer of 75%, this gives an OFL of 39,000 mt and an ABC of 9,750 mt. These estimates are uncertain because productivity is poorly known, the abundance estimates are dated, and the acoustic survey methodology has yet to be reviewed (see Item I.3). This OFL and ABC should be updated when new biomass estimates or information on productivity become available.

The SSC recommends the OFLs and ABCs developed by the CPSMT advice for the other monitored stocks (Table 2). The OFL and ABC for market squid is the $F_{MSY}$ proxy of $\geq$ 30% egg escapement. Since this a fishing mortality rate, and not an annual catch amount, as required by NMFS guidelines, the SSC requests that the CPSMT provide justification or further analysis showing why it is considered appropriate. In addition, the ABC was set equal to the OFL, which is allowed under NMFS guidelines, but justification or further analysis is required to show why scientific uncertainty does not need to be taken into account when setting the ABC.

The SSC wishes to acknowledge the solid work done by the CPSMT and the Pacific Sardine Assessment Team.

Table 2. OFL and ABC for CPS Monitored species in U.S. waters.

| **Stock** | **OFL** | **ABC** |
|---|---|---|
| Jack Mackerel | 126,000 mt | 31,000 mt |
| Northern Anchovy, Central Population | 100,000 mt | 25,000 mt |
| Market Squid | $F_{MSY}$ proxy resulting in Egg Esc $\geq$ 30% | $F_{MSY}$ proxy resulting in Egg Esc $\geq$ 30% |
| Northern Anchovy, Northern Population | 39,000 mt | 9,750 mt |

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