

COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON
PACIFIC SARDINE STOCK ASSESSMENT AND COASTAL PELAGIC SPECIES (CPS)
MANAGEMENT MEASURES FOR 2011

Pacific sardine

The Coastal Pelagic Species Management Team (CPSMT) received presentations from Dr. Kevin Hill concerning the Pacific sardine stock assessment conducted in 2010, and from Mr. Tom Jagielo regarding the results of the aerial survey conducted in 2010 that were incorporated into the stock assessment. The CPSMT recommends that the Pacific Fishery Management Council (Council) adopt the update assessment (model 10w) that resulted in a stock biomass (ages 1+) estimate of 537,173 mt, which results in a harvest guideline (HG) of 50,526. This represents a 23 percent decline in biomass from the previous stock assessment adopted by the Council (November 2009). The CPSMT notes that there are a number of factors indicating that the HG should not exceed 50,526 mt:

1. Total abundance of sardine has decreased in recent years:
 - a. Recruitments have been low since 2006 (Agenda Item I.2.b, Attachment 2, Page 119 of stock assessment, Figure 40);
 - b. Indices of abundance collectively indicate the population is currently lower than observed in previous years:
 - i. Daily Egg Production Model (DEPM) data since 2006 (Agenda Item I.2.b, Attachment 2, page 23 of stock assessment, Table 4);
 - ii. Aerial Survey (Agenda Item I.2.b, Attachment 2, page 12 of stock assessment, line 4 and paragraph 3, line 2):
 1. 2009 estimate: 1,236,910 mt;
 2. 2010 estimate: 173,390 mt;
 - c. Additional data sources, not included in the assessment, also indicate that sardine abundance has declined in recent years:
 - i. Southwest Fisheries Science Center hydroacoustic survey;
 - ii. Canada Department of Fisheries and Oceans (swept area) trawl survey.
2. The combined international harvest has contributed to a recent increase in the total exploitation rate exerted on the population at large (Agenda Item I.2.b, Attachment 2, Page 116 of stock assessment, Figure 37b); however, the CPSMT notes that overfishing is currently not occurring in the US fishery.

Aerial Survey

In regards to the industry sponsored aerial survey, the CPSMT commends the Exempted Fishing Permit (EFP) applicants for their dedicated efforts in achieving a high degree of completion of the study design specifications. However, there were two inadequacies: 1) the previously specified range of school biomass was not fully sampled; 2) point sets were not located in the corresponding geographic area of observed biomass. The CPSMT understands that weather and other logistical limitations precluded these two aspects from occurring as designed. Because of the lack of representative point sets, the data provided in the south were not included in the stock assessment.

Harvest Specifications for 2011

Table 1 contains harvest formula parameters and a range of acceptable biological catch (ABC) values based on various P-Star (probability of overfishing) values. The CPSMT recognizes that the Council will select a P-Star. The CPSMT recommends that the annual catch limit (ACL) equal the ABC resulting from the Council's P-Star choice.

Table 1. Pacific sardine Amendment 13 Harvest Formulas Parameters

Harvest Formula Parameters	Value			
BIOMASS (ages 1+, mt)	537,173			
Pstar (probability of overfishing)	0.45	0.40	0.30	0.20
BUFFER _{Pstar} (Sigma=0.36)	0.95577	0.91283	0.82797	0.73861
F_{MSY} (upper quartile SST)	0.1985			
FRACTION	0.15			
CUTOFF (mt)	150,000			
DISTRIBUTION (U.S.)	0.87			

Amendment 13 Harvest Formulas	MT
OFL = BIOMASS * F_{MSY} * DISTRIBUTION	92,767
ABC _{0.45} = BIOMASS * BUFFER _{0.45} * F_{MSY} * DISTRIBUTION	88,664
ABC _{0.40} = BIOMASS * BUFFER _{0.40} * F_{MSY} * DISTRIBUTION	84,681
ABC _{0.30} = BIOMASS * BUFFER _{0.30} * F_{MSY} * DISTRIBUTION	76,808
ABC _{0.20} = BIOMASS * BUFFER _{0.20} * F_{MSY} * DISTRIBUTION	68,519
ACL=LESS THAN OR EQUAL TO ABC	TBD
HG = (BIOMASS - CUTOFF) * FRACTION * DISTRIBUTION	50,526
ACT=EQUAL TO HG OR ACL, WHICHEVER VALUE IS LESS	50,526

The CPSMT recommends that the incidental catch for CPS fisheries in each of the three allocation periods should be set to 1,000 mt (Table 2). To account for management uncertainty, an additional 2,000 mt should be reserved in the third period. The CPSMT recommends that the incidental landing allowance for CPS fisheries be no more than 30 percent Pacific sardine by weight. The CPSMT recommends setting aside 4,200 mt for potential sardine EFPs.

Table 2. Allocation scheme for 2010 Pacific Sardine HG

HG = 50,526 mt; Potential EFP set aside = 4,200 mt; Adjusted HG = 46,326 mt				
	Jan 1- Jun 30	Jul 1- Sep 14	Sep 15 – Dec 31	Total
Seasonal Allocation (mt)	16,214	18,530	11,582	46,326
Incidental Set Aside (mt)	1,000	1,000	1,000	
Management Uncertainty (mt)			2,000	
Adjusted Allocation (mt)	15,214	17,530	8,582	41,326

Ecological considerations

In June 2010 the Council decided that it would include ecological considerations when adopting benchmarks of status determination criteria (SDCs), overfishing limits (OFLs), ABCs, and ACLs as part of implementing Amendment 13. Yet the Council did not provide the CPSMT guidance on the process for this provision. The CPSMT examined Pacific Coast Ocean Observing System (PACOOS) reports on the state of the California Current Large Marine Ecosystem (CCLME) and notes that following the El Nino event of 2008-2009 that a La Nina event is now underway. The North Pacific is also presently experiencing a negative Pacific Decadal Oscillation with cold water now along the Pacific Coast. How CPS stocks respond to these oceanographic conditions varies. The CPSMT examined stock assessment and population trend information available for a number of marine mammals and bird species from the following National Marine Fisheries Service (NMFS) and United States Fish and Wildlife Service (USFWS) sources:

<http://www.nmfs.noaa.gov/pr/sars/species.htm>

http://www.fws.gov/pacific/migratorybirds/Seabird_Conservation_Plan_Document_pdf_files.htm

The CPSMT did not find evidence of upper trophic level forage limitations attributable to CPS stocks managed under the FMP (Fishery Management Plan). In general, marine mammal stocks have been increasing with many of the pinniped species reaching carrying capacity. Most seabird populations examined appear to stable or increasing.

The CPSMT notes that there is a large body of information available on the CCLME, and that other FMPs include ecological considerations clauses. A dedicated ecological modeling effort focused on the effects of various oceanographic conditions and management policies would be beneficial. Such an effort could be part of the Ecosystem Fishery Management Plan (E-FMP) that the Council is considering. The CPSMT recommends that the Council provide guidance on the process for taking additional ecological considerations not already incorporated into current management into account when setting benchmarks.

Monitored Stocks

At its June 2010 meeting, the Council heard from its CPS advisory bodies, the Scientific and Statistical Committee (SSC), and the public, on the matter of establishing OFLs, ABCs, and ACLs for monitored stocks under Amendment 13 to meet the National Standard 1 (NS1) guidelines. After reviewing a range of alternatives, the Council adopted the following final action for monitored stocks under Amendment 13 (Table 3):

- The Council confirmed that SDC for the CPS FMP are to remain as currently specified, with the exception of the northern subpopulation of northern anchovy.
- Maintain the default harvest control rules for monitored stocks as modified to specify the new management reference points. The ACLs would be specified for multiple years, until such time as the species becomes actively managed or new scientific information becomes available. The harvest rate of 0.25 in the ABC control rule (i.e., a precautionary buffer of 75 percent) will remain in use until recommended for modification by the SSC and approved by the Council.

Control rules for monitored species

<i>OFL</i>	Stock-specific MSY proxy
<i>ABC</i>	OFL * 0.25
<i>ACL</i>	Equal to ABC or reduced by OY considerations

The CPSMT notes that the SDC for market squid do not fit the default control rule and that overfishing is not occurring in the market squid fishery, which is also managed under an accepted state-based fishery management plan. The CPSMT provided information on current management measures in place for this species (Agenda Item I.2.c, CPSMT Report 1). The CPSMT notes that the market squid life cycle is less than one year and is not experiencing overfishing. Therefore, it is exempt from the requirement to establish ACLs.

The CPSMT met with the CPS subcommittee of the SSC in La Jolla, CA on October 5-7, 2010 to discuss the newly required reference points for monitored species noted above. In addition, most CPSMT members attended the full SSC's discussion of reference points at its November 5, 2010 meeting. Finally, the CPSMT supports the conclusion the SSC noted regarding inherent difficulties developing meaningful reference points for monitored CPS stocks, given the paucity data necessary to determine biomass.

Northern Anchovy-Northern Subpopulation

The CPSMT presented a review of available data for the Northern anchovy-northern subpopulation (Agenda Item I.2.c, Supplemental CPSMT Report 1 Addendum), which included two methods for determining total abundance. The SSC in its review of reference points for monitored stocks (Agenda Item I.2.c, supplemental SSC Report), proposes the reference points below. The CPSMT supports the conclusion from the SSC that anchovy productivity is very likely as high (or higher) than that currently assumed for species such as Pacific mackerel; and recommends that the Council adopt the reference points specified in Table 3 until substantial new information warrants revision.

$OFL = 130,000 \text{ mt} * 0.30 = 39,000 \text{ mt}$

$ABC = 39,000 \text{ mt} * 0.25 = 9,750 \text{ mt.}$

Table 3. OFL and ABC of monitored stocks

Stock	OFL	ABC	ACL
Jack mackerel	126,000 mt	31,000 mt	Equal to ABC
Northern anchovy, northern subpopulation	39,000 mt	9,750 mt	Equal to ABC
Northern anchovy, central subpopulation	100,000 mt	25,000 mt	Equal to ABC
Market squid	F_{msy} proxy resulting in Egg Esc $\geq 30\%$	F_{msy} proxy resulting in Egg Esc $\geq 30\%$	Exempt

Monitored Stock Fishing Seasons

The CPSMT recommends that the regulatory fishing seasons for monitored stocks be:

1. Finfish: Calendar Year
2. Market squid: April 1 to March 31 of the following year

Future work

The CPSMT has learned of a very recent publication by McClatchie et al. (Can. J. Fish. Aquat. Sci. 67: 1782–1790, November 2010), which re-evaluates the stock-recruit and temperature recruit relationships that determine fraction in the current Pacific sardine harvest control rule. This publication indicates that sea-surface temperature data collected from Scripps Pier are no longer a reliable predictor of sardine recruitment success. The CPSMT requests that this publication be reviewed by the SSC in the near future, and that the paper’s principal author (Dr. Sam McClatchie, Southwest Fisheries Science Center-La Jolla) be present for the discussion.

The CPSMT recommends that the Council encourage NMFS to continue to fund comprehensive coastwide annual CPS research. The CPSMT continues to believe strongly that coordinated international management of CPS fisheries is essential to avoid the potential for coastwide overfishing. The CPSMT encourages the Council, NMFS, and the State Department to continue working to achieve timely receipt of biological research data from Mexico.

PFMC
11/7/10