Agenda Item G.1.b
Attachment 2
November 2007

Pacific Sardine

STAR Panel Meeting Report

NOAA / Southwest Fisheries Science Center
La Jolla, California
September 18-21, 2007

STAR Panel
André Punt, University of Washington (Chair)
Tom Barnes, CDF&G (SSC representative)
John Casey, Cefas (CIE)

PFMC
Diane Pleschner-Steele (CPSAS)
Brian Culver (CPSMT)

STAT
Kevin Hill, NOAA / SWFSC
Emmanis Dorval, NOAA / SWFSC
Nancy Lo, NOAA / SWFSC
Bev Macewicz, NOAA, SWFSC
Christina Show, NOAA / SWFSC

1) Overview

The Pacific Sardine STAR Panel (Panel) met at the Southwest Fisheries Science Center, La Jolla, CA Laboratory from September 18-21, 2007 to review a draft assessment by the Stock Assessment Team (STAT) for Pacific Sardine. Introductions were made (see list of attendees, Appendix 1), and the Panel chair (André Punt) reviewed the Terms of Reference for CPS assessments with respect to how the STAR Panel would be conducted. A draft assessment document and background material were provided to the Panel in advance of the meeting on an FTP site. The Panel received the draft assessment four days before the STAR Panel. Although the draft assessment was received later than the deadline of two weeks before the STAR Panel, and this added to difficulties preparing for the meeting, the Panel was nevertheless able to conduct a thorough review of the draft assessment following the Terms of Reference for CPS assessments.

Kevin Hill (SWFSC) presented the assessment methodology and the results from an initial base-model utilizing SS2. The previous sardine assessment, used for PFMC management decisions for the period July 1, 2005 to July 30, 2007, employed a forward projection age-structured assessment model (ASAP) to estimate the 1+ biomass of Pacific sardine. The ASAP model has several deficiencies which the SS2 model can, in principle, overcome: (a) some sardine spawn in their first year of life, (b) ASAP is unable to deal with the timing of the fisheries throughout the range of the species, (c) the initial conditions had to be pre-specified in ASAP (and the CANSAR model) - ASAP (and CANSAR) produced unrealistic results when the initial numbers-at-age were treated as estimable parameters, (d) weight-at-age varies among the fisheries and between the fisheries and population, but ASAP is unable to account for this, (e) ASAP does not include the log-normal bias correction factor for the stock-recruitment relationship, and (f) the parameterization of selectivity in ASAP leads to very high correlation among the parameters of the model in the starting year.

The Panel evaluated the draft base-model in terms of: (a) why there were differences from the ASAP base-model used for the 2006 assessment, in particular why the 1997 and 1998 year-classes were much stronger in the SS2 assessment than in the ASAP assessment (these year-classes are also strong in the catch-at-age data), and (b) whether it is possible to remove the patterns in the residuals about the fit to the length-frequency data. The STAT made use of the R code to display diagnostics for alternative model configurations developed by Dr Ian Stewart (NWFSC) and modified for seasonal SS2 models by Ms Christina Show (SWFSC). Having software to rapidly display alternative model runs made the task of the Panel considerably easier.

The Panel was able to identify a model configuration that performed adequately and recommends that this model configuration form the basis for the 2007 assessment and hence harvest guideline for 2008.

The Panel commended the STAT for their excellent presentations, well-written and complete documentation, and their willingness to respond to the Panel's requests for additional analyses.

The stock assessment methodology for Pacific sardine has changed substantially in recent years. The Panel notes that, given this, as well as its recommendations for further model development, consideration should be given to holding the next STAR Panel for this species in 2009 rather than 2010 as envisaged in the Terms of Reference for CPS assessments.

2) Discussion and Requests Made to the STAT during the Meeting

Set #1

A. Identify the sampling units (strata) on which the catch-at-length data are based and determine whether it is necessary to weight the data for each stratum. If a weighting scheme is required, recalculate the length-compositions with a STAT-preferred stratum weighting and aggregate the resulting data by quarter, and then run the base model using new length-frequency data. Compute the length- and age-composition residuals and determine if the patterns in the residuals evident in the draft stock assessment remain.

   Reason: The draft assessment was based on raw (unweighted) length-frequency data, but the Panel was concerned that the catch length-frequency distributions may differ among months and ports.

   Response: Length composition data were re-calculated by the STAT for California by weighting the data for the northern and southern California ports by month, based on tons landed by port area. The model was re-run with the re-weighted length-composition data. The length-composition likelihood improved. However, the residuals about the fit to the data for Ensenada and the Pacific Northwest continued to exhibit trends. The Panel agreed that the re-weighted length-frequency data would form the basis for all further model runs.

B. Better explain why the additional surveys (Oregon, British Columbia, and Mexico) that are available were not used in the assessment.

   Reason: Several data sources in addition to DEPM and TEP were available for possible inclusion in the assessment.

   Response: The STAT provided the STAR with extracts from the report of the Sardine Trinational Forum. This information does not suggest that these other data sources should be included in the assessment at this time. Full details of these alternative series and why they cannot be included in the assessment need to be included in the assessment document.

C. Plot the DEPM estimates of spawning biomass against the TEP estimates for the years for which it is possible to estimate both DEPM and TEP estimates.

   Reason: TEP is assumed to be related linearly to spawning biomass and this analysis would help to evaluate the validity of the assumption.

Response: A comparison was provided. The slope was 0.79 and the intercept was near zero. R^2 was 0.9178. The Panel agreed that the assumption of linearity between DEPM and TEP is not violated to any substantial extent.

D. Compare the model-predictions of the catch age-compositions to the age-compositions implied by the length-frequencies and the conditional age-at-length information. To avoid the age-composition data informing the model the effective samples sizes for the "implied" age-compositions should be set very close to zero.

Reason: The Panel noted what appear to be cohort-related patterns in the residuals about the fits to the length-frequency data and wanted to confirm that these reflected cohorts.

Response: A run was made to allow this comparison. The fits to the age-composition data for California were quite good, and did not exhibit troublesome patterns. However, for the Ensenada fishery, the residuals about the catches of age-0 animals varied substantially among years. More importantly, the residuals for the 1998 and 2004 cohorts in the Pacific Northwest were systematic and suggested that the model was underestimating the sizes of these cohorts (see request #H) .

E. Provide egg density estimates for California and Mexico for April, and show available data (CUFES and historical CalCOFI) for north of San Francisco and offshore.

Reason: The DEPM estimates are based on the "standard" area, and are assumed to be proportional to total spawning biomass, but changes over time in stock abundance may have led to changes in the spatial distribution of spawners, potentially leading to changes in q for the DEPM estimates.

Response: Charts depicting this information were provided. Ten percent of the total spawning biomass was estimated to be north of the survey area in 2006. However, there does not appear to be a systematic bias, i.e. there is no evidence, for example, that the surveys consistently missed spawning to the north of the "standard" area. The extension of the egg and larval survey to the north of the "standard" area has proven very useful in terms of quantifying the overall distribution of spawning in April, and should be continued.

F. Provide information on the location of samples relative to catches.

Reason: There was a concern that the observer sampling for the Pacific Northwest might not be reflective of catches.

Response: Plots were provided that showed that the samples appeared to be representative of catch location, with one or two exceptions (the sampling missed fishery expansion to the north in 2006).

G. Examine whether data exist on slippage and discard.

Reason: The draft assessment ignored any discard mortality.

Response: Information from the 2000-4 WDFW observer program estimated that discard mortality in the Pacific Northwest ranged up to nearly 20%, but declined to just over 1% in the final year of the study. The 5-year average discard mortality was approximately 10% (see request #M).

Set #2

H. Explore a dome-shaped selectivity pattern for the Pacific Northwest fishery after 2003. If this run leads to a better residual pattern, it should become the base-model.

Reason: The Panel noted comment from the public that markets have been identified for smaller fish in the Pacific Northwest in recent years.

Response: Selectivities were changed to allow for dome-shaped selectivity, with two time blocks separated between 2003 and 2004. A logistic function was assumed for the years up to 2003, and a double normal thereafter. The estimated selectivity pattern for the post-2003 period had a lower length-at-50%-selection, and selectivity dropped off for older ages. Total likelihood improved by over 200 points, and there was a slight improvement for the indices of abundance. The Panel and STAT agreed that allowing for two selectivity blocks for the Pacific Northwest fishery was warranted.

I. Consider the implications of dome-shaped (double-normal) selectivity for the California and Ensenada fisheries before 1991. If this run leads to a better residual pattern, it should become the base-model.

Reason: There is a poor fit to the data for the earliest years of the assessment period – this might reflect the impact of the assumption of asymptotic selectivity during these years.

Response: While this run did improve the fit of the model, it resulted in an unreasonably low q for the DEPM indices (0.03). This model configuration was not pursued further.

J. Conduct a sensitivity test in which age-readings are assumed to be correct.

Reason: The Panel wished to assess the implications of allowing for ageing error in the current assessment when fitting to the conditional age-at-length data.

Response: Results from this sensitivity run conformed to expectations: ignoring ageing error weakened the large year classes, and strengthened the small ones. Current age 1+ biomass decreased to 814,000 mt. The base-model continued to include age-reading error.

K. Plot fecundity as a function of length for the 4^{th} quarter and compare this relationship with weight as function of length. Run SS2 using fecundity based on this relationship.

Reason: The assumption that reproductive output is proportional to weight may over-estimate the reproductive value of small fish.

Response: This sensitivity run did not change the outcome of the assessment substantially. Age 1+ biomass remained about the same, while the absolute value of "spawning biomass" was reduced for the entire time series because of the change in unit. *q* for the TEP increased from roughly 0.4 in the base case to 1.2 in this run (although the model units were eggs rather than spawning biomass).

L. Run SS2 with the same survey weighting as used in the 2006 ASAP model and with lower weights on the length and conditional age-at-length data.

Reason: The SS2 assessment led to much higher estimates for the sizes of the 1997 and 1998 cohorts than ASAP, although the year-classes in the SS2 runs better match those evident in the catch-at-age matrix used in the ASAP runs.

Response: An initial version of this analysis involved changing the CVs for the indices to 0.3. The model results were not changed markedly. Request # O considers this issue further.

M. Conduct a sensitivity test in which catches are increased by 10%.

Reason: The observer data for the Pacific Northwest indicates that discard mortality averaged approximately 10% during a 5-year study. This sensitivity test reflects an extreme case, because all catches were inflated even though there is no suggestion of noteworthy amounts of discard in fisheries outside the fishery in the Pacific Northwest. In addition, discard mortality trended sharply downward during the final years of the study.

Response: As expected, biomass increased by 10%. The Panel was satisfied that there were no major management consequences of discard in the range observed in the Pacific Northwest, but noted that discard mortality warranted further consideration in future assessments. Continued monitoring to inform this consideration would be useful.

N. Conduct a sensitivity analysis leaving out the catch in 1st quarter of 1985 for the Ensenada fishery.

Reason: While this catch clearly occurred, the Panel was concerned that it reflected a possible influx of southern fish. The Panel was interested to assess whether this catch had any noticeable impact on management-related quantities.

Response: Dropping this catch had a major impact the estimate of current age 1+ biomass. The fit to the data was marginally better, but the estimate of current age 1+ biomass was reduced from 1,039,000 mt to 856,000 mt. This issue is examined further in request Q.

Set #3

O. Run SS2 with the same survey data and weightings as used in the 2006 ASAP model and with lower weights on the length and conditional age-at-length data.

   Reason: The SS2 assessment led to much higher estimates for the sizes of the 1997 and 1998 cohorts than ASAP. Compared to ASAP, SS2 better identified the strong year-classes in the catch-at-age matrix.

   Response: Irrespective of how the data were weighted, SS2 estimated stronger 1997 and 1998 cohorts. Moreover, the fits to the DEPM data were consistently better in SS2 than in ASAP.

P. Compare the empirical annual weights-at-age by fleet with the weights-at-age by fleet predicted by SS2.

   Reason: Weight-at-age differs among fisheries, and the Panel wanted to assess whether differences in selectivity-at-length and the timing of the fisheries is adequate to account for these differences.

   Response: Weight-at-age is year-specific for ASAP, while for SS2 weight-at-age differs among fisheries, quarters and selectivity blocks. The STAT compared empirical weight-at-age with the weights-at-age estimated by SS2 for the last selectivity block. For the Pacific Northwest and Ensenada, the SS2 weights-at-age are within the range of empirical weights-at-age (although the empirical weights-at-age for Ensenada are very variable among years). For California, the SS2 weights-at-age are somewhat higher than those used in ASAP for the ages that constitute the bulk of the catch. The Panel was satisfied that there were no major concerns with the use a single weight-at-age vector for each selectivity block and quarter.

Q. Re-run the assessment with a start date of July 1985.

   Reason: Starting the assessment in July 1985 eliminates the catches prior to July 1985, including the potentially anomalous catch for the 1st quarter of 1985.

   Response: This sensitivity run was based on an alternative approach to dealing with the issue associated with request "N", above. As is the case for request "N", the results from this run fit the index data better than for the base-case model. However, in this case the age 1+ biomass in the ending year was 1,469,000 mt, i.e. larger than the base-case value. In addition to excluding the potentially anomalous catch off Ensenada, this sensitivity test also excluded the composition data for July 1981-June 1985. However, there is no clear basis to select between removing the catch for the 1st quarter of 1985, starting the assessment in July 1985, and the base-model choice of including this datum. Moreover, although this catch may reflect fish from the southern subpopulation being off Ensenada, removing it would not address the issue whether similar events have occurred in other years. The Panel and STAT were reluctant to "cherry pick" and remove this one catch and agreed to retain this catch in the base-model. "Prospective analyses" are undertaken to illustrate the impact of

changing the start year of the model (see request S), and this issue is further discussed under "Future Work" (see Section 7).

Following discussion of request #Q, the Panel and STAT agreed on a modification of the original base model in which selectivity for the Pacific Northwest fishery changed in 2004 and in which the re-weighted length-frequency data are used.

Set #4

R. Conduct the revised base-model, including tuning the effective sample sizes.

Reason: The Panel wanted to confirm that the final base-model did not exhibit any anomalous patterns that were not identified before.

Response: The residual patterns for the final base-model were similar to those for the original base-model.

Set #5

S. Construct likelihood profiles for *M*, steepness, and σ_R.

Reason: To further examine the properties of the base-model and provide a basis for suggesting a way to bracket uncertainty.

Response: The lowest value for the likelihood function occurred for values of *M* larger than base-model value ($0.4yr^{-1}$; which also formed the basis for the development of the control rule). However, there is a conflict between lower values for *M* (better fits to the index data) and higher values for *M* (better fits to the composition data). Increasing *M* leads to higher estimates of current 1+ biomass and *vice versa*. The fit of the model to the data (and the estimates of 1+ biomass) are relatively insensitive to value assumed for steepness. The base-model value of σ_R (0.765) was chosen so that the input value for σ_R matched the standard deviation of the recruitment deviations. Higher values for σ_R lead to higher estimates of current 1+ biomass.

T. Conduct a "retrospective" analysis by removing recent data from the assessment (show sensitivity to using the DEPM estimate for 2006 on which the 2006 assessment was based).

Reason: To further examine the properties of the base-model, to provide a basis for suggesting a way to bracket uncertainty, and to assess some of the reasons for the change in 1+ biomass in 2006 from 1,300,000 mt (ASAP) to 1,100,000 mt (SS2).

Response: The assessment exhibits a retrospective pattern in that as more data are included in the assessment, the estimates of 1+ biomass for the most recent years increase.

U. Conduct a "prospective" analysis to changing the start year of the assessment.

Reason: To further examine the properties of the base-model and provide a basis for suggesting a way to bracket uncertainty. Changing the start year was postulated to be particularly important in this case because the stock is estimated have increased from a low population level (rather being fished down from average unfished conditions).

Response: The estimates of current (1 July 2007) 1+ biomass are sensitive to the first year considered in the model. In particular, increasing the first year from 1984 to 1985 leads to a 12% increase in current 1+ biomass.

3) Technical Merits and/or Deficiencies of the Assessment

Conducting the assessment using SS2 addresses the concerns identified by previous STAR Panels with earlier assessments (CANSAR and ASAP). In particular, SS2 does allow: (a) some sardine to spawn in their first year of life, (b) for differences in the timing of the fisheries throughout the range of the species, (c) the initial conditions to be estimated, (d) weight-at-age to vary among the fisheries and between the fisheries and population, and (e) for the log-normal bias-correction factor for the stock-recruitment relationship. The Panel therefore agreed with the STAT that SS2 provides a better basis for future assessments of Pacific sardine.

The final base-model incorporates the following specifications:

1. Year ("season") based on a July 1 birth date (assessment years 1981-82 to 2006-07).
2. Four quarters per "season" (July-Sept, Oct-Nov, Dec-March, April-June).
3. Use of conditional age-at-length and length-frequency data for Mexico, California and the Pacific Northwest (re-weighted based on revised strata).
4. Time-invariant growth (estimated).
5. $M = 0.4yr^{-1}$; $\sigma_R = 0.765$.
6. Length-specific selectivity (California & Ensenada: double normal; Pacific Northwest: logistic) with time-blocking:
    a. Mexico: 1981-91, 1992-98, and 1999-present
    b. California: 1981-91, 1992-98, and 1999-present
    c. Pacific Northwest: 1981-2003, and 2004-present
7. Ricker stock-recruitment relationship
8. Initial recruitment estimated; recruitment residuals estimated for 1975-2006.
9. DEPM and TEP indices treated as relative indicesof spawning biomass.

The 2007 SS2 assessment is less optimistic about stock status than the 2006 ASAP assessment. Specifically, SS2 estimates that the 1997 and 1998 cohorts were stronger and the 2003 cohort was weaker than ASAP does. Recent cohorts also appear to be weak. The reasons for the differences between the 2007 SS2 and 2006 ASAP assessments are partially data-driven, but could not be fully determined as it is not possible to move from ASAP to SS2 by making incremental changes. However, they relate (to varying degrees) to: (a) different weightings, (b) different model structure, (c) revised index data, (d) a different way of entering the composition data, and (e) allowance for ageing error. The Panel supported SS2 as the preferred assessment platform for the 2007 assessment: a) because it allows for features identified as missing from ASAP at the May 2007 STAR

Panel, b) because it better captured the cohorts that were strong based on a visual examination of the data, and c) because it fitted the indices of relative abundance better.

The Panel recommends that uncertainty be bracketed by runs in which M=0.3yr^{-1} and 0.5yr^{-1}. The Panel and STAT could not assign probabilities to the base-model and the two bracketing runs.

4) Areas of Disagreement
There were no areas of disagreement between the STAT and Panel.

5) Unresolved Problems and Major Uncertainties
The stock assessment for Pacific sardine relies on indices based on egg and larval surveys conducted off southern and central California. The aerial spotter index used in previous assessments is not included in the assessment, owing to uncertainty about selectivity and anomalous assessment results when this data source is included in the assessment. The assessment includes northern California, the Pacific Northwest and Mexico as well as southern California. California (southern and central combined), the Pacific Northwest and Mexico are treated as separate "fleets". The assessment relies on the assumption that indices of spawning biomass for the "standard" survey area are linearly proportional to total spawning biomass. While there is no direct evidence for failure of this assumption (see request #E), there is indirect evidence that this assumption is violated to some extent (e.g. some spawning in the Pacific Northwest, cohorts recruiting in different proportions to different areas). The STAT attempted to address this issue by allowing selectivity to change over time, but this did not fully resolve the issue. This problem can (potentially) be overcome by moving to a spatial model, but SS2 does not have the capability at present to include both movement and local recruitment patterns.

Access to recent Mexican data remains a concern. The assessment reviewed by the Panel assumed that the 2006-07 catch for Mexico equalled that for 2005-06. Moreover, there are no composition data for the Mexican catches after 2002 and before 1989.

The concern expressed during the June 2004 STAR Panel that stock structure is uncertain continues to be a major issue. Although there are several hypotheses for stock structure of Pacific sardine, the working hypothesis is still that Pacific sardine off northern Mexico, southern California, northern California and the Pacific Northwest constitute a single biological stock with substantial mixing / migration. At present, the assessment is based on the assumption that all of the catches from Ensenada north are from the northern subpopulation. However, it is conceivable that temporal changes in the distribution of the southern and northern subpopulations mean that some of the catches used in the assessment may have been from the southern subpopulation. The impact of including catches and composition data from the southern subpopulation in the assessment has not been determined.

The results of the assessment are sensitive to the potentially anomalous catch in the first quarter of 1985 off Ensenada. The STAT and Panel suspect that this catch *may* reflect intrusion of fish from the southern subpopulation, but there are no data (e.g. CalCOFI data) for this quarter to support this hypothesis. The Panel support keeping this catch in

the base-model, noting that its exclusion may be warranted once additional analyses (e.g. based on relationships between distribution and temperature) have been completed.

6) Concerns raised by the CPSMT and CPSAS representatives during the meeting
Data to inform the stock structure and relative spawning contributions of Pacific sardine by area are still incomplete. The CPSMT continues to recommend that coastwide synoptic surveys be conducted twice per year to help address these questions. The CPSMT notes that length and age samples from the fisheries off the Pacific Northwest have fallen off in recent years and recommends that sampling be increased to previous levels. The CPSMT also endorses an inter-agency ageing workshop to better define the ageing error incorporated into the current SS2 model.

The CPSAS representative emphasized the importance, when presentations are made to the public, of explaining what in the assessment has been changed and why the changes were made. In addition, she emphasized the need for such presentations to reflect the uncertainty associated with the assessment and its outcomes, and the need to include information for the Pacific Northwest in a more substantive way in the assessment. She concurs with the CPSMT regarding the need for the collection and incorporation of additional data, specifically synoptic cruises including the Pacific Northwest during the summer (e.g. a July CalCOFI survey) to capture the extension of the spawning biomass. She noted that the assessment is currently based on only one source of survey data, which pertains only to California.

The Panel and STAT endorsed these comments.

7) Research Recommendations
A. Much of the Panel's time was spent dealing with data-related issues (see Section 2, requests A, B, E, F, G, K, and L) and the Panel recommends that standard data processing procedures be developed for CPS species, similar to those developed for groundfish species.
B. A sensitivity run of SS2 assuming no ageing error resulted in compression of the range of spawning biomass and recruitment estimates compared to those estimated assuming ageing error (i.e. strong year-classes were estimated to be lower and weak year-classes were estimated to be larger when ageing error is ignored). This highlights the importance of the precision of the age data on model outputs. The Panel therefore recommends that ageing comparisons be continued to determine the most appropriate estimates of ageing precision.
C. The results of SS2 runs which treated the egg survey data either as an index of egg production or as an index of spawning biomass did not affect the outcome of the assessment, although estimates of survey q were, unexpectedly, markedly different. The Panel recommends that SS2 be adapted to enable indices of egg production and spawning biomass to be fitted simultaneously.
D. Noting that there is potential for sardine from different stock subcomponents to recruit to adjacent stock areas, it would be desirable to account for this in the assessment model. To do so requires development of a new assessment model or modification of an existing one, and hence the Panel recommends that, if feasible,

SS2 be amended to include such an enhancement. Further, tagging experiments (or other means to facilitate the estimation of movement rates) should be considered.

E. The catch history for the Mexico and southern California fisheries should be examined to estimate the catch from the southern subpopulation. For example, use temperature and/or seasonality to separate catches by subpopulation. Based on the results of this analysis, determine the biological data (length- and conditional age-at-length) by subpopulation. The analysis of subpopulation structure should ideally be conducted in conjunction with a re-evaluation of the current harvest control rule.
F. The estimate of the catchability coefficient for the DEPM estimates was 0.4 (for the base model). This value seems low to the Panel. Analyses should be conducted, for example, based on prior distributions for the factors leading to differences between DEPM estimates and spawning biomass to assess the plausibility of values for DEPM-q of this magnitude.
G. Development of alternative (preferably coastwide) indices will enhance the ability to monitor changes in the abundance Pacific sardine. At present, the assessment relies on the indices of abundance from southern and central California, although these regions constitute the core of the distribution when the population is low, a substantial fraction of the catch is now taken from other areas.
H. Develop an index of juvenile abundance. The indices used in the assessment pertain only to spawning fish. An index of juvenile abundance will enhance the ability to identify strong and weak year-classes earlier than is the case at present.

Appendix 1

STAR Panel Members in Attendance
Dr. André Punt, (Chair), SSC - University of Washington
Mr Tom Barnes, SSC – CDF&G
Dr John Casey, CIE – CEFAS (UK)
Mr Brian Culver, CPSMT - WDFW
Ms. Diane Pleschner-Steele, CPSAS - California Wetfish Producers Association

STAT Members in Attendance
Dr Kevin Hill, NMFS, SWFSC
Dr. Emmanis Dorval, NMFS, SWFSC
Dr. Nancy Lo, NMFS, SWFSC
Ms Bev Macewicz, NMFS, SWFSC
Christina Show, NMFS / SWFSC

Others in Attendance
Mr. Dale Sweetnam, CDF&G
Mr Richard Carroll, Ocean Gold Seafoods
Mr Steve Joner, Makah Tribe
Dr. Ray Conser, NMFS, SWFSC
Dr. Paul Crone, NMFS, SWFSC
Ms. Jennifer McDaniel, NMFS, SWFSC
Dr. Sam Herrick, NMFS, SWFSC
Mr Kevin Piner, NMFS, SWFSC

Appendix 2

Additional Items for Inclusion in the Stock Assessment Document

The Panel identified the following items for inclusion in the stock assessment to be presented to the SSC at the November 2007 Council meeting:

1. Include catches of sardine for all subpopulations in the catch history table.
2. Add a table (or figure) that compares the annual total catch from the northern subpopulation with the annual stockwide HGs.
3. More detail is needed in the report to justify why the spotter index should not be used.
4. Include the fit of the logistic curve to the data on maturity-at-length.
5. Provide more detail on why the available additional surveys (OR, BC, and Mexico) were not used in the assessment.
6. Provide egg density estimates for California and Mexico for April, and show available data (CUFES and historical CalCOFI) data for north of San Francisco and offshore.
7. Include confidence intervals on the estimates of 1+ biomass.