

SUMMARY MINUTES
Scientific and Statistical Committee

Pacific Fishery Management Council
Hilton San Diego/Del Mar Hotel
Triple Crown Room
15575 Jimmy Durante Blvd
Del Mar, California 92014
858-792-5200

November 13-14, 2006

Call to Order and Scientific and Statistical Committee (SSC) Administrative Matters

The meeting was called to order at 8 a.m. Dr. Donald McIsaac briefed the SSC on priority agenda items.

Subcommittee assignments for 2006 are detailed in the table at the end of this document.

Members in Attendance

Mr. Tom Barnes, California Department on Fish and Game, La Jolla, CA
Mr. Robert Conrad, Northwest Indian Fisheries Commission, Olympia, WA
Dr. Ramon Conser, National Marine Fisheries Service, La Jolla, CA
Dr. Michael Dalton, National Marine Fisheries Service, Seattle, WA
Dr. Martin Dorn, National Marine Fisheries Service, Seattle, WA
Dr. Owen Hamel, National Marine Fisheries Service, Seattle, WA
Mr. Tom Jagielo, Washington Department of Fish and Wildlife, Olympia, WA
Dr. Peter Lawson, National Marine Fisheries Service, Newport, OR
Dr. André Punt, University of Washington, Seattle, WA
Dr. Hans Radtke, Yachats, OR
Dr. Stephen Ralston, National Marine Fisheries Service, Santa Cruz, CA
Dr. David Sampson, Oregon State University, Newport, OR
Ms. Cynthia Thomson, National Marine Fisheries Service, Santa Cruz, CA

Members Absent

Mr. Steve Berkeley, University of California, Santa Cruz, CA

Scientific and Statistical Committee Comments to the Council

The following is a compilation of November 2006 SSC reports to the Council. (Related SSC discussion not included in written comment to the Council is provided in *italicized text*).

Coastal Pelagic Species Management

F.2. Stock Assessment Terms of Reference

The Scientific and Statistical Committee (SSC) discussed the draft Coastal Pelagic Species Stock Assessment Review Panel Terms of Reference (TOR) for 2007. The primary difference from the previous version is that the draft TOR specifies a process to accommodate assessment updates. The proposed mechanism for dealing with assessment updates was based on the approach that has been adopted for groundfish updates which provides a desirable degree of consistency between the assessment review processes for species under the two fishery management plans. Also, clarification is given in the draft TOR for the roles of various advisory bodies and participants in organizing and carrying out the reviews. The SSC has identified a few minor edits to correct typographical errors and improve readability, but the potential changes do not affect content. It is desirable to keep the draft document on track for potential adoption at the March 2007 meeting of the Pacific Fishery Management Council so that it may be in place for the 2007 assessments. The SSC recommends that the Pacific Fishery Management Council adopt the document for public review.

F.1. Pacific Sardine Assessment and 2007 Harvest Guideline

Dr. Kevin Hill (Southwest Fisheries Science Center) discussed the stock assessment of Pacific sardine with the Scientific and Statistical Committee (SSC). The SSC Coastal Pelagic Species (CPS) subcommittee reviewed the Pacific sardine assessment during a joint meeting with the Coastal Pelagic Species Management Team (CPSMT) and Coastal Pelagic Species Advisory Subpanel (CPSAS) on October 17, 2006, based on the draft terms of reference for CPS assessments (see Agenda Item F.2). The assessment of Pacific sardine is based on the same modeling software (Age-Structured Assessment Program (ASAP)), specifications, and data sources as the 2005 assessment, except that the landings data for Ensenada, the landings and catch-at-age data for California and the Pacific Northwest, and an additional estimate of spawning biomass based on the April 2006 survey were included in the assessment.

The assessment has followed the draft terms of reference for CPS stock assessment updates because the assessment carried forward the previously reviewed structure and the model results are consistent with previous data and results. The SSC therefore supports the continued use of the base model in the development of management advice. The SSC highlights that the two main indices of abundance remain inconsistent. In particular, the SSC is concerned that two indices appear to give contradictory signals, and not having 2006 data for the spotter index may have influenced the results towards the signal from the egg production indices, which was at an all time high in 2006. This issue needs to be addressed for the next assessment.

The assessment update led to an increase in both the estimate of the 2003 recruitment and 2005 age

1+ biomass. The SSC endorses the use of the harvest guideline (152,564mt) estimated using the fishery management plan control rule and the biomass estimate of 1.32 million mt for the management of the Pacific sardine fishery for 2007. This harvest guideline is 28% larger than the 2006 harvest guideline of 118,937 mt.

A Stock Assessment Review Panel is scheduled for September 19-21, 2007, to review the Pacific sardine assessment. Dr. Hill informed the SSC that he planned to move the model software for the assessment from ASAP to Stock Synthesis 2, to explore starting the model prior to 1983, and to examine the implications of alternative assumptions about stock structure. Dr. Hill is also planning to continue to collaborate with Mexican scientists to obtain catch data, catch-at-age data, and indices of larval abundance for Baja California.

CPS Subcommittee report and notes:

Dr Kevin Hill presented the draft assessment of the Pacific sardine resource on behalf of the STAT. The SSC CPS Subcommittee reviewed the assessment in the spirit of a stock assessment update, as defined in the draft Terms of Reference for CPS Stock Assessment Reviews. Specifically, the review focused on whether the assessment carried forward the previously reviewed structure and on whether the new input data and model results are consistent with previous data and results.

The specifications of the stock assessment were identical to those for the 2005 assessment, except that the landings data for Ensenada (2005), the landings and catch-at-age data for California and Pacific Northwest (2005-06), and an additional estimate of spawning biomass based on the April 2006 survey and the daily egg production (DEPM) were included in the assessment. Two estimates of spawning biomass were available from the DEPM; the base model includes the estimate for the 'core area' (San Diego-San Francisco).

The SSC CPS Subcommittee agreed that the assessment qualifies for review as an update assessment. In order to more fully understand the reasons for changes in assessment outcomes between the 2005 and 2006 assessments, the Subcommittee requested the following additional analyses.

- 1. Construct a set of sensitivity tests based on the 2005 model configuration and show the impact of each modification to the specifications of the assessment on the assessment outcomes (investigate the impact of: a) shifting σ_r for the terminal year-classes and hence imposing less constraint on the size of the 2003 year-class, b) adding the core area DEPM index for 2006, c) adding and revising the landings data, and d) adding the 2005-06 catch-at-age data for California and the Pacific Northwest). [Reason: The 1+ biomass for 2005-06 is notably different than that from the 2005 assessment.]*
- 2. Conduct sensitivity tests ignoring each of the DEPM and spotter indices in turn and show results in which the "old" rather "new" spotter index is used in the assessment. [Reason: The DEPM and spotter data appear to be in conflict and may be contradictory.]*
- 3. Examine the sensitivity of the model outcomes to reducing the emphasis factor placed on the F_{multi} penalty from 1 to 0.1 [Reason: Forcing smooth changes in fishing mortality may impact the trends in abundance.]*

4. *Conduct a sensitivity test in which the DEPM index for 2006 is set to the estimate for the entire survey area rather than just for the core area [Reason: The DEPM index for 2006 is based on the core area. However, spawning sardine were found north of this during the survey.]*

The results of these sensitivity tests are summarized in Table 1. Increasing σ_R for the recent year-classes and including the 2006 DEPM estimate leads to higher estimates of 2003 recruitment and 2006-07 1+ biomass and hence the 2007 harvest guideline. Conversely, adding in the 2006 catches-at-age leads to the opposite effects. Excluding the index based on the spotter data leads to more optimistic results while excluding the index based on the DEPM data leads to less optimistic results. The results are fairly insensitive to the treatment of the F_{multi} penalty.

The SSC CPS subcommittee did not attempt to assign probabilities to the models in Table 1. However, the DEPM estimates should provide estimates that are in theory close to absolute estimates of abundance, which suggests that the sensitivity test based on ignoring the DEPM data is less plausible than that in which the spotter index is ignored.

The SSC CPS Subcommittee supports the continued use of the base model in the development of management advice, noting that the assessment has followed the terms of reference for CPS stock assessment updates, but highlights that the two main indices of abundance are inconsistent, and hence that uncertainty regarding 1+ biomass is under-estimated by the reported confidence intervals.

A full assessment of Pacific sardine is planned for 2007 (to be reviewed by a STAR Panel scheduled for 19-21 September 2007). The Subcommittee discussed aspects of the assessment that should be examined as part of the 2007 assessment.

1. *The selectivity pattern for the spotter plane index is pre-specified based on the selectivity pattern of the California fishery. However, these two selectivity patterns are not identical, and the selectivity pattern for the spotter planes may have changed in response to changes in the distribution of the resource and fishery targets.*
2. *The reliability of the DEPM index depends on the sampling for eggs and biological parameters adequately capturing the entire spawning season. Analyses should be conducted to assess whether the ability to use the DEPM estimates as indices of abundance (or as estimates of absolute abundance) is compromised due to, for example, spatial variability in the time of spawning. The impact of changes in the spatial distribution of the population on whether DEPM estimates from the core region provide an index that is linearly related to spawning biomass should be examined.*
3. *The historical CALCOFI data should be examined to explore seasonal patterns in spawning and decadal scale variability in egg production.*
4. *The available survey data should be assessed to determine whether they support time-varying weight- and maturity-at-age.*
5. *The possibility of including sea surface temperature as a covariate when fitting the stock-recruitment relationship should be explored.*
6. *Given the inconsistency among the indices, there needs to be a clear rationale for the inclusion of each index in the assessment. Specifically, inclusion and weighting of indices of*

abundance should be based on consideration of experimental design. The possibility of inconsistency between the indices of abundance and the age-composition of the catches should be examined.

7. The CVs assigned to abundance indices appear to be too small because too few of the 95% confidence intervals are intersected by the population trajectory
8. The acoustic data collected during the 2006 survey should be analyzed with a view towards the development of an alternative index of abundance.

The Subcommittee reiterated that the fishery has, in recent years, caught large quantities of age-0 fish while the current harvest control rule is based on 1+ biomass. Furthermore, the parameters of the harvest control rule were determined using simulations based on stock and recruitment data for the years 1935-1990 and the fraction of the population in the U.S. EEZ in recent years (as inferred from the ratio of U.S. catch to total catch) may be much smaller than that assumed by the control rule. Any review of the current harvest control rule for Pacific sardine should consider these factors. It should be noted, however, that reviewing (and possibly revising) the harvest control will involve a considerable amount of technical analysis as well as staff time.

The STAT is commended for the high quality of the draft assessment, and Dr Hill is thanked for his efforts to respond to the requests by the Subcommittee during the meeting

Table 1. Estimates of 2003 recruitment, the 1+ biomass in 2005-06 and 2006-07, and the 2006 and 2007 harvest guidelines for a) the 2005 final model, b) the 2006 base model, and c) the sensitivity tests based on modifying the assumptions regarding the data inputs and assumptions of the assessment model.

	2003 Recruitment (Billions)	2006-07 1+ biomass(mt)	2007 HG (mt)	2005-06 1+ biomass (mt)	2006 HG (mt)
2005 final model	10.04	-	-	1,061,391	118,937
2005 σ_R values					
+ Landings	10.14	886,888	96,164	1,068,636	119,882
+ catch-at-age	8.30	743,976	77,514	895,365	97,270
+ DEPM	12.01	1,198,244	136,796	1,377,556	160,196
2006 σ_R values					
+ Landings	13.24	1,010,210	112,257	1,236,957	141,848
+ catch-at-age	9.70	817,036	87,048	970,195	107,036
+ DEPM (base model)	14.37	1,319,072	152,564	1,503,871	176,680
Ignore DEPM	5.60	246,595	12,606	361,455	27,595
Ignore Spotter	17.12	1,625,193	192,513	1,844,860	221,179
$F_{multi\ pen} = 0.1$	14.82	1,361,620	158,116	1,550,159	182,721
DEPM - total SSB	14.87	1,368,373	158,998	1,556,995	183,613

Groundfish Management

D.3. Stock Assessments

The Scientific and Statistical Committee (SSC) reviewed the draft plan for Groundfish Stock Assessments for 2007 and discussed several proposed changes to the schedule.

Cowcod: Dr. Steve Ralston noted that an improved time series of historic catch data are now available for cowcod. Additionally, it was noted that there was an error in the way selectivity was modeled in the previous assessment. Since changes in catch data and the correction of errors are permitted under the Terms of Reference, the SSC agrees that this assessment should proceed as an update.

Blue Rockfish: Mr. Tom Barnes stated the California Department of Fish and Game is prepared to conduct a stock assessment for blue rockfish. The SSC noted that the Stock Assessment Review (STAR) Panel process for 2007 can accommodate an additional species in the schedule. Preliminary evidence suggests that blue rockfish may be two separate species. The SSC recommends proceeding with a stock assessment to summarize existing information and to evaluate stock status.

Black Rockfish: In lieu of conducting a spiny dogfish stock assessment, Washington Department of Fish and Wildlife (WDFW) has offered to conduct an assessment of the northern stock of black rockfish. The SSC recommends that this assessment, the black rockfish assessment by Oregon Department of Fish and Wildlife, and the blue rockfish assessment should be reviewed together. Similarities in biology and catch statistics will result in an improved STAR Panel review if these assessments are reviewed jointly.

Widow Rockfish/English Sole: At the recent Northwest Fisheries Science Center (NWFSC) Trawl Survey Workshop it was decided that combining the historical triennial trawl survey time series and the new NWFSC trawl survey time series would not be permitted for stock assessment updates. Should an assessment author wish to pursue combining data from the two sources, the burden of proof will reside with the author to demonstrate the validity of the pooled index in a full stock assessment. In the case of widow rockfish and English sole, the assessments are not expected to use the NWFSC shelf trawl survey data, and thus they will both continue to qualify as updates.

Yelloweye Rockfish: The SSC recommends that the yelloweye rockfish stock assessment continues to be conducted as an update. After discussing the WDFW concern related to yelloweye rockfish at the September Council meeting, the SSC concluded that it would be inappropriate to incorporate the catch per unit of effort (CPUE) time series that included Pacific halibut trips in an updated assessment. Specifically, the recently adopted Terms of Reference for Groundfish Stock Assessments stipulates that to qualify as an update “a stock assessment must carry forward its fundamental structure from a model that was previously reviewed and endorsed by a STAR Panel.” Instead, as a potential solution to this problem, it was decided that the Stock Assessment Team should proceed by: (1) preparing a stock assessment update that adheres to the existing Terms of Reference, (2) conducting sensitivity runs of the base model that incorporate altered time series of

CPUE and catch, and (3) presenting those findings to the SSC groundfish subcommittee during its review of stock assessment updates. Depending on the results of the sensitivity run, as well as on whatever other competing demands arise during the course of the five STAR Panels that are planned for the spring/summer of 2007, the groundfish sub-committee may elect to refer the issue to the “mop-up” panel for more thorough evaluation.

The SSC also discussed the concern that the groundfish subcommittee meeting to review updated assessments, tentatively scheduled for Wednesday during the week of the June, 2007 Council meeting, may not facilitate advisory body participation. The SSC is open to discussing an altered schedule for the updated assessment review to accommodate this concern. Additionally, the review of rebuilding analyses should be scheduled at a time that will permit advisory body participation. This activity could potentially be scheduled to occur during the “mop-up” STAR Panel tentatively scheduled for October, 2007.

The following tables summarize the recommended stocks for assessment, and a proposed STAR Panel schedule:

Revised List of Stocks Scheduled for Full Assessment	Lead Agency	Stocks Scheduled for Updated Assessment	Lead Agency
Bocaccio	SWFSC	Cowcod	SWFSC
Canary Rockfish	NWFSC	Widow Rockfish	SWFSC
Chilipepper Rockfish	SWFSC	Yelloweye Rockfish	NWFSC
Arrowtooth Flounder	NWFSC	Pacific Ocean Perch	NWFSC
Darkblotched Rockfish	NWFSC	English Sole	NWFSC
Sablefish	NWFSC		
Black Rockfish (South)	ODFW		
Black Rockfish (North)	WDFW		
Longnose Skate	NWFSC		
Spiny Dogfish	WDFW		
Blue Rockfish (South)	CDFG		
Pacific Whiting	NWFSC/CDFO		

Revised 2007 Groundfish STAR Panel Schedule as Discussed by the SSC

	Species 1	Species 2	Proposed Location	Proposed Dates (2007)	Lead Author Species 1	Lead Author Species 2
US – Canada Joint Panel	Pacific Hake/Whiting	NA	Seattle, WA Silver Cloud Hotel	Feb 5-9	Tom Helser and Steve Martell	NA
STAR Panel #1	Skates	Sablefish	Newport, OR	May 7-11	Vlada Gertseva	Michael Schirripa
STAR Panel #2	Black Rockfish(N&S)	Blue Rockfish	Portland, OR	May 21-25	David Sampson(S) Theresa Tsou (N)	Meisha Key
STAR Panel #3	Bocaccio	Chilipepper rockfish	Santa Cruz, CA	June 25-29	Alec MacCall Steve Ralston	John Field
STAR Panel #4	Darkblotched Rockfish		Seattle, WA	July 16-20	Owen Hamel	
STAR Panel #5	Canary Rockfish	Arrowtooth Flounder	Seattle, WA	July 30-Aug 3	Ian Stewart	Isaac Kaplan & Tom Helser
Mop-Up	If needed	If needed	Seattle, WA	Oct 1-5		

Council Administrative Matters

B.2. Research and Data Needs

The Scientific and Statistical Committee (SSC) discussed the current version of Research and Data Needs 2006-2008. Some points of the discussion included:

- A statement about the need for data on the size composition of recreational discards will be added to Sec. 2.2 (under “Fishery Monitoring and Data Collection”).
- The term “harvest refugia as a potential management tool” in Sec. 2.2 (under “Habitat”) will be clarified, and this statement will be moved to Sec. 7 (EBFM and MPAs). The statement on trophic interactions in Sec. 2.2 will also be moved to Sec. 7.
- The description of survey methods for rockfish in Sec. 2.2 (under “Resource Assessment Surveys”) will be revised to include consideration of the costs and benefits of these methods. Text in this subsection about the development of non-extractive methods for groundfish assessment will be revised to highlight the need for evaluation of these methods.
- A statement on the need to investigate the accuracy and precision of recreational catch and effort estimates among minor fishing modes (e.g. beach/bank, private access, night fishing) will be added to Sec. 2.3 (under “Fishery Monitoring and Data Collection”).
- A statement citing recent genetic work, which indicates that vermilion and blue rockfish may each represent two distinct but morphologically similar species, will be added to Sec. 2.2 (under “Biological Information for Fishery and Productivity Parameters”). Additional investigations of species classifications for other rockfish are also desirable. Another statement will be added to this subsection that cites the need for better estimates of discard mortality in nearshore waters. In particular, effects of barotrauma may vary among species, as could their ability to survive hooking or trapping injuries. Also, there may be long-term physiological effects due to capture and release on reproductive output, which could have stock productivity and management implications.

The SSC recommends that its subcommittee chairs work with Council staff to implement the revisions listed above, and incorporate comments from the Coastal Pelagic Species Management Team and Coastal Pelagic Species Advisory Subpanel (agenda item B.2.b). With these changes, the SSC considers the document to be ready for adoption.

SSC Administrative Matters

A.5. Off-Year Science Workshop Planning

The SSC confirmed the three objectives previously identified for the B_0 workshop: a) evaluate the performance of the 40-10 harvest policy for stocks with different life history and stock-recruit patterns, b) evaluate alternative methods to estimate B_0 and B_{MSY} proxies and provide recommendations on their use, and c) provide recommendations on the use of priors for key assessment parameters in stock assessment models. Participation by members of the SSC and other stock assessment scientists has also been confirmed. Although no CIE reviewers have been requested, several participants from outside the Council family (e.g. Mark Maunder, Steve Martell

and Jim Ianelli) are likely to attend the workshop.

The workshop will be held at the Southwest Fisheries Science Center and nine presentations are currently anticipated. Background documents will be identified by Martin Dorn and these, along with any draft papers for the meeting by participants, will be distributed two weeks before the meeting (4 Dec). John Devore (Council Staff) will be attending the meeting and will take primary responsibility for the minutes of the meeting.

The SSC discussed the amount of progress to be expected from the meeting. It was noted that the results of the work for objective c) should be made available to assessment authors by the March Council meeting, and the discussions related to objective a) should also likely be sufficient to draw useful conclusions. Conclusions related to objective b) are, however, likely to be preliminary. This is because the various presenters are going to be comparing different methods using somewhat different simulators. A useful outcome from the workshop would therefore be an agreed set of candidate methods for estimating B_0 and B_{MSY} proxies and an agreed framework to form the basis for the comparison of these methods.

The SSC plans to run the meeting as a workshop, and anticipates requests for additional model runs. Presenters should therefore come to the meeting with the software on which their analyses are based and be prepared to conduct additional analyses, if requested.

The SSC noted that it will not take three days to conduct the business of the workshop, and that 2.5 days will be sufficient. The SSC recommends that the workshop take place from 9am on Monday 18 Dec to noon on Wednesday 20 Dec.

Salmon Management

I.2. Salmon Methodology Review

The Scientific and Statistical Committee (SSC) Salmon Subcommittee and the Salmon Technical Team (STT) conducted a joint Salmon Methodology Review on October 10, 2006. Topics included a comparison of alternative ocean abundance forecasts for Columbia River fall Chinook salmon, the status of Fishery Regulation Assessment Model (FRAM) documentation, and a genetic stock identification (GSI) pilot program.

There remain difficulties in interpreting the “Ocean Abundance Forecasts for Columbia River Fall Chinook Salmon” document. The current method was compared to methods independent of the FRAM model. None of the three methods was clearly superior to the others. Further evaluation is warranted before any new method is adopted.

For three years the Model Evaluation Workgroup (MEW) has been working on the FRAM documentation. As of summer 2006, they have produced an extensive set of documents. Due to the voluminous nature of the documentation, a full review of the documents has not yet been accomplished, but such a review or other appropriate next steps can now be planned. The time may be approaching for the model to be rewritten in a newer programming language. Among other things, this would allow for the incorporation of GSI data into the model. The SSC commends the MEW for

producing this substantial body of documentation for the FRAM model. It is clear that these documents have made the FRAM more transparent, accessible, and useful.

The document “Pilot Program to Apply Genetic Stock Identification in Pacific Salmon Fisheries in 2007” outlines a program to collect tissue samples for genetic analysis from Chinook salmon caught in ocean fisheries off the coasts of Oregon and Northern California. The goal of this program is to provide data describing the distribution of Chinook stocks among various time and area strata during the 2007 through 2009 fishing seasons. A series of years with this stock-specific distributional data will provide important information to help in the conservation and management of Chinook stocks, especially for those stocks that have conservation concerns. Several years of data collection will be necessary before these data will be adequate for management support.

If salmon fisheries for Chinook are greatly restricted during the coming seasons, as occurred in 2006, the proposed project will need to apply for one or more exempted fishing permits (EFP) from the Pacific Fishery Management Council to allow the collection of tissue samples from all area and time strata identified in the experimental design for the project.

If the project goes forward, the SSC requests that future project operational plans presented to the Council address the following technical issues:

- There is a concern about the collection of samples by commercial boats with no on-board observer. Specifically, there is a concern that some fishers may incorrectly report data (e.g., the location of capture of sampled fish) or may non-randomly select fish for sampling. There should be some explanation of why this will not be a problem, or some methods should be considered for “ground-truthing” the data collected by the fishers, using either test fisheries, on-board observers, or other methods. Because a large number of different commercial boats will be used to collect the tissue samples, there is concern that a “boat-effect” may influence the results. For example, the fishing practices of a particular boat (gear used, method the gear is fished, location the gear is fished) may affect the stock composition of the Chinook caught by the boat. The possibility of a boat-effect needs to be considered during the analysis.
- To be useful for stock assessment, age data (i.e., scale samples) will need to be comprehensively collected as part of the sampling program. The area-and-time distribution information that the project provides for stocks will be much more valuable if it can be associated with specific brood years.
- The spatial and temporal resolution of the baseline will need to be reviewed to determine how useful the data from the project will be for management purposes.
- A more thorough analysis of experimental design should be undertaken to optimize the value of the data collection.

While the proposed project may provide information that could be valuable to salmon management, there are a number of issues that need to be better defined: (1) what types of information will the project provide for management, (2) how could this information be used by management, (3) what is the timeline for information being appropriate for management use, and (4) more details on the experimental design.

Until these issues are addressed, the SSC views the GSI pilot project as promising, but cannot conclude whether it will be able to accomplish all of its stated goals. The SSC supports the consideration of an EFP, if necessary, for the continuation of this research in 2007.

SSC Salmon Subcommittee reports:

Review of "Ocean Abundance Forecasts for Columbia River Fall Chinook Salmon"

At the joint meeting (Oct 2006) of the SSC Salmon Subcommittee and the Salmon Technical Team (STT) Mr. Henry Yuen (U.S. Fish and Wildlife Service), on behalf of the Model Evaluation Workgroup (MEW), answered questions on two proposed methods for forecasting ocean abundance for several Columbia River Chinook salmon stocks. An earlier report on the methods was reviewed by the SSC/STT during its 2005 methodology review. The current report was simpler in concept than the 2005 report but was difficult to review because of unclear terminology and some apparent internal inconsistencies.

The procedure currently used for management uses pre-season FRAM scalars to estimate ocean cohort abundance from river-mouth abundance estimates provided by the Technical Advisory Committee (TAC). There is concern that the ocean abundance estimates could be biased because the FRAM scalars are based on historical conditions in ocean fisheries, which may differ substantially from the fisheries experienced by the cohort being evaluated. There is a need for forecasts of ocean cohort abundance that are independent of FRAM.

The proposed methods use run reconstruction estimates of cohort abundance derived from terminal run estimates and Pacific Salmon Commission/Chinook Technical Committee estimates of ocean exploitation and survival rates. Regression models are used to forecast ocean abundance of age "a" fish in one year from the observed river-mouth returns of age "a-1" fish in the previous year. Both methods apply simple linear regression to the input data but one method uses raw input data and the other log-transformed data. The two methods, and a method similar to the current FRAM method but based on scalars from post-season validation runs, were evaluated for three stocks (LRH, SPR, and URB) relative to run reconstructions of ocean cohort abundance. In terms of accuracy (root mean square error) the proposed method based on linear regression forecasts seemed to perform better than the log-linear or FRAM methods, but in terms of bias (average percent error) the FRAM method generally performed better than either of the new methods. However, the FRAM method that was evaluated in the analysis is not identical to the pre-season method that the TAC uses; the post-season scalars that were used in the FRAM reconstructions should produce better forecasts than the pre-season scalars used in practice. If possible, the comparison of methods should be repeated using the historical pre-season FRAM estimates.

The 2006 report addresses the concern of the SSC in 2005 that different methods were being applied to different stocks and age classes. The proposed methods are consistent for all stocks and ages and have the advantage over the current method of being reasonably transparent and independent of FRAM. However, the evaluation of the methods did not clearly indicate that one method was superior. Further evaluation is warranted before any new method is adopted. One technique for

evaluating the models is to use "dry run" forecasts based on the three proposed methods, then compare these pre-season estimates with post-season run reconstructions. The TAC produced such dry run forecasts for 2006 returns, but comparisons with run reconstructions won't be available for a few more months. It will take several years of dry runs to confidently evaluate the models' performance. It would be preferable to find a way to identify the best method so it can be used sooner.

The SSC recommends that the historical pre-season FRAM estimates should be extracted from pre-season model archives and used in a direct comparison with the new methods (similar to the comparison presented in the 2006 report) and the results from the comparison provided in an updated report for review by the SSC. Results from the 2006 dry run, including comparisons with the run reconstructions, should also be included in a revised report.

FRAM Documentation

The SSC salmon subcommittee and the STT reviewed the current FRAM documentation that has been prepared by the Model Evaluation Workgroup (MEW), with Mr. Andy Rankis and Mr. Jim Packer answering questions for the MEW. The review undertaken was for completeness and readability of the documentation, not a technical review of the FRAM model. The current set of FRAM documentation comprises a substantial body of work and the SSC commends the MEW for accomplishing the monumental task of documenting the FRAM model and computer program.

The SSC and STT were presented with 5 documents:

- \$An Overview for Chinook and Coho*
- \$Technical Documentation for Chinook and Coho*
- \$User Manual*
- \$Programmers Guide*
- \$Chinook FRAM Base Data Development*

Still to come, pending integration of Canadian stocks through the Pacific Salmon Commission, is:

- *Coho FRAM Base Data Development*

We also received a listing of "forms" and a listing of computer code.

Keeping track of this body of documentation in its most recent revision would be aided if a list with document and file names and revision numbers (or dates) accompanied any distribution. Tracking of revisions will be an important task given that there are likely to be on-going changes to the FRAM software.

The purpose of documenting the FRAM model is three-fold: (1) to help interested parties understand how the model functions and is used, (2) to enable inexperienced users to use the model, and (3) to enable technical review and evaluation of the model. It appears that the Overview will be useful for the first purpose and the User's Manual and Programmer's Guide will be useful for the second.

The current set of documentation seems to do a good job of presenting model algorithms and procedures, and the development of base data sets. However, conducting a technical review and evaluation of the FRAM model and its performance will require more information about the data that drives the models annually. With this caveat, the current set of documents is adequate to begin the task of reviewing the model.

Even at this early stage of FRAM model review, our reading of the technical documentation has given us a better understanding of what the FRAM does, and how. There are still unanswered questions about why certain approaches were taken and why specific analytical methods were used. We did not attempt a thorough review of the technical documentation itself. The test will come as we use these documents to review the model. As we do, we will also be reviewing the documentation more closely.

With this documentation in hand we discussed next steps in FRAM model review. The MEW was formed, in part, in response to the SSC's inability to review the implementation of processes and procedures to address selective fisheries for Chinook salmon. The SSC can now, in conversation with the MEW and the STT, determine how to conduct this review.

The future of the FRAM model was also part of our discussion. Examination of the computer code reveals that there is a lot of "legacy" code, designed to maintain compatibility with earlier model versions and now-discarded analytical approaches. Also, much of the stock-specific information is "hard-coded" in the model, which reduces the flexibility of the model and makes it more difficult to modify the modeled stock structure or to use FRAM to simulate different management strategies. To the extent possible, the model should be written with algorithms separate from the data. Mr. Packer suggested that it may be time to rewrite the model in a newer programming language, with data (input and output) managed through data base software. This would simplify the task of data management, make it easier to produce custom reports, and make the data available for uses other than fisheries management. If this project is undertaken it will have been simplified as a result of the documentation that has been produced.

If the model is to be redesigned, the use of GSI data in fisheries management should be considered. This would be the ideal opportunity to begin thinking about how to incorporate GSI data into the harvest models. We should consider whether and/or how to migrate base period data from CWT to a GSI basis and how use CWT and GSI data in tandem to improve management. In the short term, GSI data can be used as an independent estimate of stock composition for comparison with the CWT-based estimates to validate the model. This has already been done on a limited basis.

The model documentation is strong in describing the mechanics of the model, but weaker in providing justifications and rationales. For example, there is no justification or support for the level of spatial and temporal stratification in the model. Previous work has indicated that the data may not support the current level of stratification. This is likely to change with the incorporation of GSI data, however.

Other issues relate to the integration of the model in the larger management context. The

desirability of an economic component of the model was discussed, but not resolved. Interfaces between FRAM and other regulatory models still need to be documented. The base data development and validation, along with the data used to scale the model annually, are at least as important as the mechanics of the model. We spent very little time discussing these aspects, but it was pointed out that in the groundfish stock assessment process much of the review focuses on the data bases and how they are treated in the models.

Once again, we commend the MEW for producing this substantial body of documentation for the FRAM model. The usefulness of the documentation was evident in the kinds of forward-looking discussions that we had. It is clear that these documents have made the FRAM more transparent, accessible, and useful. They will also facilitate review and help with planning for future model improvements. Although there are still rough spots, and none of the review team can claim to have examined all of the documentation in detail, the portions we have looked at have given us a better understanding of the model and insights into its usefulness for salmon management.

Salmon Management, continued

I.3. FMP Amendment 15 (de minimis fisheries)

The Scientific and Statistical Committee (SSC) received a presentation from Mr. Ray Beamesderfer regarding revisions to the Stochastic Stock Recruitment Model (SSRM) and analytical work undertaken with the revised model since the September Council meeting. The Committee commends the analytical team for the significant additional work that was accomplished, which included adding greater realism in how forecast and implementation errors interact within the annual management process, evaluating the effects on sub-stock structure, and evaluating the sensitivity of model results to changes in a suite of key model parameters.

The revised SSRM provides an adequate basis for evaluating the relative effects of the different *de minimis* fishing alternatives on Klamath River fall Chinook salmon, but the absolute scale of the predictions remains uncertain. The methodology on which the SSRM is based is comparable to the methodology used for groundfish rebuilding analyses. With regard to the hindcast analysis, the SSC does not recommend using results from this analysis to evaluate the alternatives as this method is based on overly optimistic pre-season forecasts and does not consider the full effect of changes in management strategy.

Results from the SSRM indicate small differences between the *de minimis* fishery alternatives with regard to the probability of spawning escapement below the 35,000 natural spawner floor in any year and other key metrics, including the socioeconomic criteria. Even for the status quo (the most conservative option), the model predicts that spawning escapement will be below the floor 27% of the time, suggesting that poor performance of Klamath River stocks will be a recurring problem for the Council unless in-river Klamath River productivity is improved. The *de minimis* fishery alternatives simply exacerbate the problem. The SSC notes that all three *de minimis* fishery alternatives would permit fishing to occur even if spawning escapement should fall to zero.

Regarding the economic analysis, the SSC notes that the alternatives have quite different effects in a

Conservation Alert year but similar long-term average effects. The long-term analysis should show the effects of discount rates on changes in the future streams of revenues under the various alternatives. Also, the text should clarify that multiple and incompatible metrics were used to evaluate the economic effects to the different sectors (e.g., economic impacts, ex-vessel revenues, angler expenditures).

Public Comment

None.

Adjournment: The SSC adjourned at approximately 5 p.m., Tuesday, November 14, 2006.

PFMC
02/15/07

SSC Subcommittee Assignments for November 2006

Salmon	Groundfish	CPS	HMS	Economic	Ecosystem-Based Management
Robert Conrad	Steve Berkeley	Tom Barnes	Tom Barnes	Michael Dalton	Tom Barnes
Owen Hamel	Ray Conser	Michael Dalton	Steve Berkeley	Hans Radtke	Steve Berkeley
Pete Lawson	Michael Dalton	Ray Conser	Robert Conrad	Cynthia Thomson	Michael Dalton
Hans Radtke	Martin Dorn	Tom Jagielo	Ray Conser	David Sampson	Martin Dorn
David Sampson	Owen Hamel	André Punt	André Punt		Tom Jagielo
	Tom Jagielo	Steve Ralston	Hans Radtke		Pete Lawson
	André Punt				André Punt
	Steve Ralston				Steve Ralston
	David Sampson				Cynthia Thomson

Bold denotes Subcommittee Chairperson