

**Report for the Center of Independent Experts  
on the Stock Assessment Review (STAR) Panel  
of Cowcod and Darkblotched rockfish  
(June 16 to 20, 2007)**

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## **Stock Assessment Review (STAR) Panel of Cowcod and Darkblotched rockfish**

NOAA Western Regional Center  
7600 Sand Point Way, NE  
Seattle, Washington 98115  
July 16–20, 2007

### **Executive Summary**

Assessments of stock status of cowcod and darkblotched rockfish on the western coast of the United States in 2007 were reviewed by a STAR Panel. The cowcod assessment was added after errors in the selectivity curve used were discovered in the 2005 assessment. While the initial concern was with the apparent increase in harvest rate when the selectivity curve was corrected, corrections to the method used for estimating the harvest rate indicated that the impact of using the wrong selectivity curve was minor. The darkblotched and cowcod rockfish assessments were judged to be the best available given the data and time available, and were determined to be adequate for management purposes. However, neither assessment captured the full range of uncertainties identified during the review. Research recommendations were provided by the Panel that will help to account for or diminish these uncertainties for the next assessment.

### **Background**

A STAR Panel (Panel) was convened at the NOAA Sand Point facility from July 16–20, 2007 to review draft assessments of cowcod rockfish and darkblotched rockfish. Originally, only the darkblotched rockfish assessment was scheduled to be reviewed. However, the recent update to the cowcod assessment presented to the SSC in June of 2007 indicated errors with the 2005 assessment. In particular, the selectivity curve had been incorrectly set to the maturity ogive in the 2005 assessment. Correction of this error resulted in large changes from the previously estimated harvest rate. As a result, the SSC recommended that a full assessment should be conducted in the limited time available for review at the July 16<sup>th</sup> meeting. Official participants are listed below. Members of the STAR Panel were in attendance the full week and STAT members were present for much of time dependent upon the amount of extra work they had been assigned.

#### Reviewers:

Tom Jagielo, Scientific and Statistical Committee (SSC) Representative, STAR Panel Chair

Patrick Cordue, Center for Independent Experts (CIE)

Stephen Smith, Center for Independent Experts (CIE)

Larry Jacobson, Northeast Fisheries Science Center (NEFSC)

#### Advisors:

Pete Leipzig, Groundfish Advisory Subpanel (GAP) Representative

John Wallace, Groundfish Management Team (GMT) Representative

Stock Assessment Teams:

Darkblotched rockfish – Owen Hamel, Northwest Fisheries Science Center (NWFSC)

Cowcod – E.J. Dick, Southwest Fisheries Science Center (SWFSC)

### **Review activities**

Stacey Miller (NOAA Fisheries, NWFSC, Seattle) emailed the cowcod assessment document on July 2<sup>nd</sup>, and the assessment document for darkblotched rockfish arrived the next day. A revised version of the darkblotched rockfish document was emailed to the panel on July 11. The complete suite of materials for the STAR Panel was distributed by CD sent via FEDEX and I received the package on July 9. The CD included the draft stock assessments for the two species and a very comprehensive set of background information including previous assessments for these two species, reports from recent workshops on pre-recruit surveys, data/modeling issues and survey analysis (see Appendix 1). The CD also contained the executable file, manual and example files for Stock Synthesis 2 (SS2) the software package used for both species in addition to a set of R functions to manipulate and analyze the output files from SS2. Stacey Miller also emailed me a PowerPoint presentation on calculating effective sample size authored by her and Ian Stewart. Unfortunately, the presentation contained an error in one of the equations which was not cleared up until the presentation of the darkblotched rockfish assessment. I had a brief email exchange with Owen Hamel the week before the STAR Panel meeting to clarify the content of some of the figures in the revised darkblotched document.

The chair of the meeting was Tom Jagielo who preferred assigning members of the review team as rapporteurs for the stock assessments but Patrick Cordue convinced him that it was difficult to be both rapporteur and reviewer. In the end, Pete Leipzig and John Wallace shared the role of rapporteurs. The recording of specific requests for more work from the panel and the subsequent responses by the STAT with associated discussion was shared by Patrick (darkblotched) and me (cowcod). Larry Jacobson assisted the chair by compiling the rapporteur reports plus the notes Patrick and I had taken for the extra work requests.

The meeting followed the draft agenda very closely (Appendix 2). The documentation for both stock assessment reports was quite complete and their authors made clear and informative presentations of their material. We went through three rounds of requests for extra work and the authors presented timely and detailed responses to almost all of the requests.

The cowcod assessment was conducted with SS2 using information from a biomass estimate from the cowcod conservation area (CCA) derived from a 2002 line-transect submersible survey (herein referred to as a visual survey) and a recreational fishery (Commercial Passenger Fishing Vessel, CPFV) logbook data series that ended for this species in 2000 due to closure of the fishery. The selectivity curve was set to the maturity ogive as had been intended for the 2005 assessment. The STAT discovered that the calculation of cowcod exploitation history (relative harvest rates) was incorrect in the 2005 assessment due to an error in the choice of denominator when calculating relative

harvest rates ( $HR / HR_{MSY}$ ). As a result, the selectivity error in the 2005 assessment was only partly responsible for the dramatic change in perception regarding exploitation history, as was stated in the draft assessment document. There was actually little difference in fishing intensity between the 2005 model with the misspecified selectivity curve and the corrected 2005 model.

As noted in the following sections, we were concerned that the only abundance index available for cowcod after 2000 was the sole estimate from the 2002 visual survey which was also influential in fitting the model. The estimated population after 2000 indicates some recovery in the biomass of cowcod but this was recovery was a product of the dynamics of the population model and was not anchored by any observations. We need to have some source of monitoring data to verify that a recovery is really occurring. Some suggested data sources are given in the Recommendation section of the STAR panel report.

The darkblotched rockfish assessment used data from all of the trawl surveys on the west coast. While we had a number of issues to consider, three issues stand out as being significant. The survey estimates from all of the surveys (NWFS triennial shelf survey, NWFS slope and shelf surveys and AFSC slope survey) were obtained from fitting GLMM models to each of the surveys. Panel members were familiar with using the GLMM structure to correct for vessel changes over time in the NWFS surveys by characterizing vessels as a random effect but we were unsure why the mixed model approach was being used for the single vessel surveys such as the triennial survey. No model diagnostics or details on the model fits in general were available in the document.

The concept of effective sample size and its application when dealing with conditional age-at-length composition used in this assessment generated much discussion and requests for more details and sensitivity runs. Ian Stewart gave a brief presentation of the material that he and Stacey Miller (and others) have been working on concerning empirical methods for calculating effective sample size. We resolved very little but the Panel concluded that the results of alternative models were not sensitive to effective sample sizes within the range that were explored.

While working through a table of likelihoods produced over a range of  $R_0$  to determine the most influential terms, we identified a component labeled catch that appeared to be influential but we could not identify why a term would be associated with catch. An email exchange with SS2 author Dr Methot revealed that the landings data were being fitted because the option for continuous F (as opposed to Pope's approximation) had been selected by the STAT for the catch equation (i.e., Baranov catch equation). The STAT changed the control file to select Pope's approximation and reran the likelihood profiles on  $R_0$ . The results from the altered model were almost identical to the original profiles but the range of depletion increased somewhat as did the "preferences" of the other likelihood components (i.e., the  $R_0$  value at which they were minimized). This feature was recently implemented and was not covered in the technical manual supplied to the panel. Continuous F calculations should not require estimation of landings and an option should be added to SS2 to turn off this requirement.

Draft versions of the STAR Panel reports for each species were prepared for review on Friday afternoon but we only had time to complete the first review for the cowcod document and to make a start on the darkblotched rockfish document. Further editing and discussion by the panel is being done via email after the meeting. The chair has requested all editing to be complete by August 6.

### **Summary of findings**

- 1) Comment on the primary sources of uncertainty in the assessments.

#### Cowcod:

The recently recovered port sample data for 1983–1985 for California commercial landings were used to estimate the proportion of cowcod in the historical landings of rockfish in California back to 1916. These proportions seemed high even for the 1983 to 1985 period but even more so for the historical period. It was difficult to evaluate these estimated landings without having any data on the number of vessels or amount of effort during the historical period.

Questions had been raised at the 2005 STAR Panel about the use of CPFV catch rates as an index of abundance for cowcod and these questions were raised again at this STAR Panel. Delta GLM models were used to standardize the CPFV data but it was assumed that there were no interaction between region and time in the trends of cowcod abundance. These data were quite noisy but there appeared to be some evidence that trends did differ for some of the regions. However, the patterns were complex and may not be easily modeled.

The video survey consisted of a single year of data and would benefit from validation through replication.

The CPFV and visual data sets appeared to be contradictory and should not be used in the base model. Resolution of this problem would help to reduce uncertainty in final biomass estimates

As in other west coast groundfish assessments, there is considerable uncertainty associated with fixed and estimated parameters, including natural mortality and steepness. Alternative configurations of the model limiting uncertainty to a range of steepness parameter values and a combination of abundance indices does not fully capture uncertainty about current stock conditions.

As with many west-cost assessments, stock structure remains a major uncertainty.

#### Darkblotched:

The use of the triennial survey as an index of abundance for darkblotched rockfish was questioned because rocky habitats used by rockfish are not well sampled by trawl gear.

As in other west coast groundfish assessments, there is considerable uncertainty associated with fixed and estimated parameters including natural mortality and steepness.

2) Comment on the strengths and weaknesses of current approaches.

Cowcod:

The cowcod assessment is suitable for use by managers and the best available information at this time. However, it is not ideal in terms of capturing the range of uncertainties identified during the review. The reasons underlying the very high harvest rates in the mid-1980s were not adequately explored. As note above uncertainties in the catch history were not fully explored. A full evaluation of why the CPFV index should be used as an indicator of abundance for cowcod should be completed. The use of total rockfish catch as an explanatory variable in the GLM analysis of the CPFV data was not justified.

The abundance indices used in this assessment, CPFV (1963–2000) and the visual survey (2002) do not provide recent information on the potential recovery of this stock. Other abundance indices such as the NWFSC trawl survey, observer data from the CPFV trips post-2000, SCB hook and line survey in addition to data series used in previous assessments (e.g., CalCOFI, outfall) could have been used on at least a qualitative basis to corroborate conditions after 2000.

Darkblotched:

The use of conditional age-at-length data is technically superior to the common practice of using dependent length and age frequencies (i.e., where the length data have been sub-sampled for age). However, conditional age data from the fishery were not scaled to account for differences in age-at-length and landings in different regions along the coast. There was also a problem in assuming constant proportions at age in conditional age at length, particularly for small fish where fishery samples are aggregated annually. The bins used to aggregate conditional age at length from the fishery were expanded for small sizes to accommodate rapid growth during the year while samples were collected. This procedure does not completely solve the problem.

The procedure used to specify initial multinomial effective sample size for tuning the model with age and length composition data has the advantage of standardization between assessments, but questions remain about its applicability and especially to conditional age at length data.

Maps illustrating the spatial overlap of the various surveys, the fishery, and habitat were not available in the assessment but would have been useful in understanding and interpreting survey, fishery and other data.

Full uncertainty about model estimates was not explored as could have been done with an MCMC analysis. The asymptotic variances that were presented for the maximum

likelihood estimates likely understate uncertainty in biomass, fishing mortality and other model estimates.

- 3) Recommend alternative model configurations or formulations as appropriate during the STAR panel.

A number of alternative model configurations were explored during the meeting and details on these are given in the STAR Panel reports for each of the two species. Bayesian methods using the MCMC facility in ADMB/SS2 were suggested as a means of quantifying uncertainty in the two assessments. The STAT for cowcod did present a preliminary MCM run but there was not time to properly evaluate it or recommend modifications to look at assumptions about the landings and other sources of uncertainty listed above.

### **Conclusions/Recommendations**

Cowcod:

The final assessment represents the best information currently available for management purposes, but it is not an ideal assessment. The base model is unsatisfactory in terms of the plausibility of estimated exploitation rates and in the apparent contradiction between the CPFV time series and the visual survey estimate. Also, the assessment uncertainty is not adequately captured by the three presented runs. A full Bayesian assessment would be preferable for this stock but it was unable to be produced within the given timeframe.

A number of recommendations are given in the STAR Panel report. While all are important I would emphasize completing the work on evaluating any and all monitoring data currently available (e.g., outfall surveys, CalCOFI data, NWFSC bottom trawl data, observer data, and hook and line survey) or consider instituting a new series such as repeating the visual survey. As it stands now we have no idea if cowcod are recovering as predicted by the model.

Darkblotched:

The Panel and STAT discussed at length the value chosen for steepness during the meeting. Historical precedent, meta-priors, and model sensitivities were examined. The Panel and STAT did not reach full agreement on this issue.

Final characterization of the base case uncertainty was discussed and not fully resolved at the meeting. The major axes of uncertainty considered were steepness, and natural mortality. A full Bayesian MCMC analysis may provide a useful tool for evaluating the full range of uncertainty in the assessment. The Panel concluded that the final assessment represents the best information currently available for management purposes.

I do not have any recommendations to add to those in the STAR Panel report but would emphasize that due attention be given to evaluation of the GLMM survey models for the next assessment. At present the GLMM analysis as presented is too much of a black box.

Respectfully submitted on 6 July, 2005,

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## **Appendix 1: Bibliography**

### **I. Meeting Materials**

- A. Terms of Reference for Stock Assessments and STAR Panels
- B. Draft Agenda
- C. Meeting Location Information
- D. Driving Directions & Map
- E. List of Panel Participants

### **II. Previous Assessments, STAR Panel Reports and SSC Reports**

- A. Status of the Darkblotched Rockfish (*Sebastes crameri*) Resource in 2005  
Jean Beyer Rogers. June 20, 2005.
- B. Darkblotched Rockfish STAR Panel Meeting Report. May 16-20, 2005.
- C. Scientific and Statistical Committee Report on Stock Assessments for 2009-2010  
Groundfish Fisheries. *Please read the statement related to the June 9-10, 2007 review of the cowcod update on page 6-7.*
- D. 2005 Stock Status of Cowcod in the Southern California Bight and Future  
Prospects. Kevin Piner, Edward J. Dick and John Field. May 25, 2005.
- E. Cowcod STAR Panel Report. May 9-13 2005.
- F. Stock Assessment of Cowcod. John L. Butler, Larry D. Jacobson, J. Thomas  
Barnes, H. Geoffrey Moser, and Robson Collins.
- G. Cowcod STAR Panel Report. May 24-28, 1999.

### **III. 2006 “Off-Year” Workshop Reports**

- A. A Summary Report from the NWFSC Bottom Trawl Survey Workshop held  
October 31 – November 2, 2006 in Seattle, Washington. NOAA  
Fisheries, NWFSC, FRAM Division.
- B. A Summary Report from the WC Groundfish Data/Modeling Workshop  
held August 8-10, 2006 in Seattle, Washington. NOAA Fisheries,  
NWFSC, FRAM Division.
- C. Report of the Groundfish Harvest Policy Evaluation Workshop, Southwest  
Fisheries Science Center, La Jolla, California. December 18-20, 2006. A  
Workshop Sponsored by the Scientific and Statistical Committee of the  
Pacific Fishery Management Council
- D. Pre-Recruit Survey Workshop. September 13-15, 2006. Southwest Fisheries  
Science Center, Santa Cruz, California. A Summary Report Prepared by  
Jim Hastie NOAA Fisheries, Northwest Fisheries Science Center and  
Stephen Ralston, NOAA Fisheries, Southwest Fisheries Science Center.

### **IV. SS2 Documentation**

- A. SS2 Zip File – Includes User’s Manual, example files, powerpoint presentations  
and SS2 executable files (optimized and normal modes).
- B. R Software Zip File – Code developed by Ian Stewart to perform model  
diagnostics and plotting of SS2 output. This is not an official SS2 add-on  
and is not part of the NOAA toolbox. File contains User’s Guide,  
example files as well as powerpoint presentations.

### **V. Additional Background Materials**

- A. GAO Report: Pacific Groundfish: Continued Efforts Needed to Improve Reliability of Stock Assessments. United States General Accounting Office, Report to Congressional Requesters. June 2004.
- B. ISM Research Memo 978: Minami, M., C.E. Lennert-Cody, W. Gao and M. Roman-Verdesoto. 2006. Modeling shark bycatch: the zero-inflated negative binomial regression model with smoothing. (This work also published in Fisheries Research Vol. 84(2), 210-221). Manuscript provided by EJ Dick.

## Appendix 2: Draft Agenda

Stock Assessment Review (STAR) Panel  
For Darkblotched Rockfish & Cowcod

NOAA Western Regional Center  
Building 9, Conference Room  
7600 Sand Point Way NE  
Seattle, Washington 98115  
July 16-20, 2007

Monday, July 16, 2007

12:30 pm Welcome and Introductions  
Review the Draft Agenda  
Review the STAR Panel Terms of Reference  
1:00 pm Stock Assessment Team (STAT) Presentation of Darkblotched Rockfish  
Assessment (Owen Hamel)  
3:00 pm Coffee Break  
3:15 pm Q&A Session with the Darkblotched Rockfish Rockfish STAT  
4:15 pm Panel Develops List of Model Runs / Analyses for the STAT  
5:00 pm Adjourn

Tuesday, July 17, 2007

8:30 am Review of Issues with Cowcod Update (Tom Jagielo)  
9:00 am STAT Presentation of Cowcod Assessment and (EJ Dick)  
10:30 am Coffee Break  
10:45 am Q&A Session with the Cowcod STAT  
11:45 am Panel Develops List of Model Runs / Analyses for the STAT  
12:30 pm Lunch  
1:30 pm Darkblotched Rockfish:  
STAT Presentation of Requested Model Runs / Analyses  
Panel Develops Second List of Model Runs / Analyses for the STAT  
3:00 pm Coffee Break  
5:00 pm Adjourn

Wednesday, July 18, 2007

8:30 am Cowcod:  
STAT Presentation of Requested Model Runs / Analyses  
Panel Develops Second List of Model Runs / Analyses for the STAT  
12:00 pm Lunch  
1:00 pm Darkblotched rockfish:  
STAT Presentation of Requested Model Runs / Analyses  
Panel Develops Third List of Model Runs / Analyses for the STAT  
5:00 pm Adjourn

Thursday, July 19, 2007

8:30 am Cowcod:  
STAT Presentation of Requested Model Runs / Analyses  
Panel Develops Third List of Model Runs / Analyses for the STAT

12:00 pm Lunch

1:00 pm Darkblotched rockfish:  
STAT Presentation of Requested Model Runs / Analyses  
Consideration of Remaining Issues as Needed  
Identification of Preferred Model(s)

3:00 pm Cowcod:  
STAT Presentation of Requested Model Runs / Analyses  
Consideration of Remaining Issues as Needed  
Identification of Preferred Model(s)

5:00 pm Adjourn

Friday, July 20, 2007

8:30 am Consideration of Remaining Issues / Panel Draft Report

12:00 pm Lunch

1:00 pm Panel Continue Drafting Report (If Needed)

5:00 pm Panel Adjourn

## **Appendix 3: Statement of work**

### **Consulting Agreement between the University of Miami and Stephen Smith**

#### **Statement of Work**

July 11, 2007

#### **General**

The Stock Assessment Review (STAR) meeting is a formal, public, multiple-day meeting of stock assessment experts who serve as a peer-review panel for one or more stock assessments. External, independent review of West Coast groundfish stock assessments is an essential part of the STAR panel process that is designed to make timely use of new fishery and survey data, analyze and understand these data as completely as possible, provide opportunity for public comment, and assure the best available science is used to inform management decisions.

The stock assessments will report the status of the darkblotched rockfish and cowcod resources off the west coast of the United States using age and/or size-structured stock assessment models. Specifically, the information includes a determination of the condition and status of the fishery resources relative to current definitions for overfished status, summaries of available data included in the models, and impacts of various management scenarios on the status of the stocks. The information is provided to the Pacific Fishery Management Council and NOAA's National Marine Fisheries Service to be used as the basis of their management decisions, which are subsequently approved and disseminated by the Secretary of Commerce through NOAA and NMFS.

The consultant will participate in the Stock Assessment and Review (STAR) Panel of the Pacific Fishery Management Council (PFMC) for the review of the darkblotched rockfish and cowcod stock assessments. The 2005 cowcod assessment was updated in June, 2007 and corrections and changes to the data and model specifications resulted in substantial changes in depletion and historical exploitation rates. The Pacific Fishery Management Council requested that a full assessment for cowcod be developed and considered for review during a STAR Panel.

The consultant should have expertise in fish population dynamics with experience in the integrated analysis type of modeling approach, using age- and size-structured models, use of MCMC to develop confidence intervals, and use of Generalized Linear Models in stock assessment models. The Pacific Fishery Management Council's Scientific and Statistical Committee requests that "all review panelists should be experienced stock assessment scientists, i.e., individuals who have done actual stock assessments using current methods. Panelists should be knowledgeable about the specific modeling approaches being reviewed, which in most cases will be statistical age- and/or length-structured assessment models" (SSC's Terms of Reference for Stock Assessments and STAR Panel Process for 2007-2008)

Documents to be provided to the consultants prior to the STAR Panel meeting include:

- Current draft of the darkblotched rockfish and cowcod stock assessments;
- Most recent previous stock assessment and STAR panel report for darkblotched rockfish (2005);
- Cowcod stock assessment and STAR Panel report from 2005 as well as SSC groundfish subcommittee report and SSC statement on 2007 updated cowcod assessment;
- An electronic copy of the data, the parameters, and the models used for the assessments (if requested by reviewer);
- The Terms of Reference for the Stock Assessment and STAR Panel Process for 2007-2008;
- Summary reports from the West Coast Groundfish “Off-Year” stock assessment improvement workshops held in 2006;
- Stock Synthesis 2 (SS2) Documentation; and
- Additional supporting documents as available.

### **Specifics**

Consultant’s duties should not exceed a maximum total of 14 days: several days prior to the meeting for document review; the 5-day meeting; and several days following the meeting to complete the written report. The report is to be based on the consultant’s findings, and no consensus report shall be accepted.

The consultant’s tasks consist of the following:

- 4) Become familiar with the draft stock assessments and background materials.
- 5) Actively participate in the STAR Panel to be held in Seattle, Washington, July 16-20, 2007. Participants are strongly encouraged to voice all comments during the STAR Panel so the assessment teams can address the comments during the Panel meeting.
- 6) Comment on the primary sources of uncertainty in the assessments.
- 7) Comment on the strengths and weaknesses of current approaches.
- 8) Recommend alternative model configurations or formulations as appropriate during the STAR panel.
- 9) Complete a final report after the completion of the STAR Panel meeting.
- 10) No later than August 3, 2007 submit a written report consisting of the findings, analysis, and conclusions (see Annex I for further details), addressed to the “University of Miami Independent System for Peer Review,” and sent to Dr. David Die, via e-mail to [ddie@rsmas.miami.edu](mailto:ddie@rsmas.miami.edu), and to Mr. Manoj Shivilani, via e-mail to [mshivilani@rsmas.miami.edu](mailto:mshivilani@rsmas.miami.edu).

### **Submission and Acceptance of Reviewer's Report**

The CIE shall provide via e-mail the final reports of the consultants in pdf format to Dr. Lisa L. Desfosse for review by NOAA Fisheries and approval by the COTR, Dr. Stephen K. Brown by August 17, 2007. The COTR shall notify the CIE via e-mail regarding acceptance of the report. Following the COTR's approval, the CIE shall provide the COTR with pdf versions of the final report with digitally signed cover letters.

## **ANNEX 1: Contents of Panelist Report**

1. The report shall be prefaced with an executive summary of findings and/or recommendations.
2. The main body of the report shall consist of a background, description of review activities, summary of findings (including answers to the questions in this statement of work), and conclusions/recommendations.
3. The report shall also include as separate appendices the bibliography of all materials provided by the Center for Independent Experts and a copy of the statement of work.