STAR Lite Panel NWFSC Montlake Lab, Seattle

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Name and Affiliation of Panelists.

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Ray Conser, SWFSC, SSC Member
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This report summarizes the work of a Stock Assessment Review (STAR) panel that met to evaluate the suitability of three stock assessments for use in management by the Pacific Fishery Management Council. The panel was operating under the "Terms of Reference for Expedited Stock Assessment Updates," which was developed by the Council's Scientific and Statistical Committee (SSC). The panel was composed of 6 members of the SSC's Groundfish Subcommittee, with additional representatives from the Groundfish Management Team (GMT) and Groundfish Advisory Panel (GAP). The purpose of Expedited Stock Assessment Updates, as stated in the Terms of Reference is to review stock assessments:

> "where a model has already been critically examined and the objective is to simply update the model by incorporating the most recent data. In this context a model refers not only to the population dynamics model *per se*, but to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points, the allowable biological catch (ABC) and optimum yield (OY)."

The three stock assessments that were reviewed by the panel were for darkblotched rockfish (*Sebastes crameri*), yellowtail rockfish (*Sebastes flavidus*), and cowcod (*Sebastes levis*).

Stock Assessment: Darkblotched rockfish

STAT team: Jean Rogers

Comments on the technical merits and/or deficiencies of the update

Data. Significant changes since the last assessment (see Figure 1 of the original STAT team document) include: 1) an updated and revised fishery catch data time series, including new estimates of the darkblotched rockfish catch in foreign fisheries (Rogers *et al*., In Press), 2) new fishery length and age composition information, 3) a new NMFS triennial survey data point, 4) new AFSC slope survey data, and 5) new NWFSC slope survey data.

Model. The Panel found the original STAT team document to be difficult to follow with respect to model nomenclature. The Panel worked with the STAT team to establish the following model identification scheme to facilitate the Panel discussion:

Model 1: The original STAT team model (Rogers *et al.* 2000).
Model 2: The original STAR Panel approved model (Rogers *et al.* 2000).
Model 3: The model used for the rebuilding analysis (with fixed parameters) (labeled as "2001" in the original STAR Lite document) (see Methot and Rogers 2001).
Model 4: The Methot and Rogers (2001) model with parameters estimated.
Model 5: Model 4 with new catch statistics and weighted length compositions.
Model 6: Model 5 extended to 2002 (labeled as "2003 fit" in original STAT document).
Model 7: Model 3 (with fixed parameters) extended to 2002 (with new catch time series and weighted length compositions).

The Panel discussion focused on Model 6. Questions asked by the Panel included:

1) Why were the new fishery age compositions not included in Model 6? An investigation conducted by the STAT team revealed that age reading issues led to concerns about the validity of the new age data. In particular, Figure 2 of the STAT team document compared the new length at age data with the old growth curve, and showed evidence of a bias in length at age. There appears to be approximately a 1 to 2 year age discrepancy between the old and new data. With the new data, fish are generally larger at age. Investigations by the STAT team were not able to resolve whether the discrepancy could be attributed to a change in growth (environmental hypothesis) or a change in age reading (age reading drift). The panel concurred with the STAT team that the NWFSC slope survey data should be considered a new data source, and therefore cannot be used in an expedited assessment update.

2) Why were the new NWFSC slope data not included in Model 6? The STAT team had concerns about the validity of the NWFSC slope survey data for darkblotched rockfish, given: a) an anomalously high value in 2000 (over 6 times the 1999 value), b) year to year inconsistencies in the NWFSC slope survey length composition data, and c) inconsistencies between the NWFSC slope survey and the AFSC slope survey. The panel concurred with the STAT team that the NWFSC slope survey data should not be used in the model pending a full review of this issue.

3) What is the effect of weighting the fishery length composition information? The Panel requested the STAT team to run a model without weighting the length compositions (comparable to the way data were prepared for the previous model used for management). The result of this model run was presented in Table 18 of the revised STAT team document. The model without re-weighting the fishery length compositions resulted in a lower ending biomass, but it was not possible to evaluate changes in the model's fit to the data. The Panel concurred with the STAT team, and agreed that using the weighted length compositions is a model improvement. The Panel recommended that the weighted data should be used in the model.

4) What is the effect of the change in the assumed value of M for darkblotched rockfish? The STAT team brought to the Panel's attention a newly published estimate of darkblotched rockfish natural mortality rate and completed some exploratory analysis using the new estimate (Table 17 of the revised STAT team document). The Panel noted that, in the spirit of the Terms of Reference for Expedited Stock Assessments, an important parameter value such as M should not be changed without a full review. The Panel recommended using the previous value of M in the new assessment.

5) Should the new model use revised estimates of discard based on the new observer information? The Panel requested the STAT team to do a model run where catch in the years 2000, 2001, and 2002 was doubled, to approximate estimates of discards from the new observer data. The results of this model run were presented in Table 18 of the revised STAT team document. Surprisingly, estimates of stock size increased with the new model run. The model thus appears to be sensitive to the level of discard. The panel recommends that new observer information be used to provide improved estimates of discard in the next full stock assessment.

6) The rebuilding analysis in the initial version of model 6 examined by the STAR panel was based on an estimate of virgin spawning biomass using average recruitment from 1963-96 and re-sampled recruitments from 1983-96 during the rebuilding period (i.e., the environmental hypothesis of Methot and Rogers 2001). The panel asked for and received from the STAT team a set of three analyses that utilized more recent recruitment estimates as the basis for rebuilding calculations. Specifically, these scenarios were: (a) B_0 based on 1963-1999 recruitments and rebuilding recruitments re-sampled from 1983-99, (b) B_0 based on 1963-2000 recruitments and rebuilding recruitments re-sampled from 1983-2000, (c) and B_0 based on 1963-2001 recruitments and rebuilding recruitments re-sampled from 1983-2001 (Table 16 of revised STAT team document). Because Model 6 estimates strong recruitments of age 1 fish in 2000 and 2001 (Figure 13) the Panel expected an increase in allowable catch through the progression of scenarios (a) → (b) → (c). However, the rebuilding output from scenario (b) showed lower catches than did the (a) model, which perplexed both the Panel and the STAT team. Pending resolution of this specific issue, the STAR panel reached a consensus that the (a) and (c) scenarios were likely to bracket the uncertainty in the assessment and the (b) scenario (B_0 based on 1963-2000 recruitments and rebuilding recruitments re-sampled from 1983-2000) could be construed as a base model. The STAT team assured the Panel they would report back concerning this issue.

Explanation of areas of disagreement among panelists and between the Panel and STAT team.

There were no substantive areas of disagreement, either among panelists or between the Panel and the STAT team. The Panel appreciated the responsiveness of the STAT team to issues brought up by the Panel, and thanked the STAT team for conducting model runs during the course of the STAR Lite meeting to resolve questions from the Panel. Specifically, the Panel complimented the STAT team for exploratory work done prior to the Panel meeting concerning: (1) the use of NWFSC slope survey data, (2) evaluating discrepancies in the most recent age data, (3) sensitivity analysis to a revision in the natural mortality rate, and (4) the effect of weighting length composition data by landings. In addition, the Panel appreciated the STAT team's analysis of three issues during the review, i.e., (1) evaluation of different time series of recruitments to use in the rebuilding analysis (see #6 above), (2) the affect of increased estimates of discard in recent years (#5 above), and (3) the effect of weighting compositional data by catch (#3 above).

Recommendation regarding the adequacy of the updated assessment for use in management.

The Panel found the updated assessment (specifically model 6) adequate for use in management, however, certain issues were identified that should be considered at the time of the next full stock assessment and review. These include: 1) An investigation of darkblotched age reading to resolve discrepancies in age reading data. This could possibly involve the re-reading of a substantial portion of the age structures. 2) Examination of the NWFSC slope survey data for its utility in assessment modeling. This could involve inter-calibration of the NWFSC slope survey with the AFSC slope survey. 3) Evaluation of the appropriate value of natural mortality (M) to use in the assessment model. In light of the newly published material on darkblotched rockfish natural mortality (Gunderson et al.2003), this issue needs to be revisited. 4) Incorporation of new estimates of discard based on the new observer data.

Stock Assessment: Yellowtail rockfish

STAT team: Han-Lin Lai[1], Jack Tagart, Jim Ianelli, and Farron Wallace

Comments on the technical merits and/or deficiencies of the update

The U.S. yellowtail rockfish fishery is divided into two areas (Fig. 1), north and south of Cape Mendocino. The northern area is further split into the Eureka/South Columbia area between Cape Mendocino and Cape Falcon; the North Columbia area from Cape Falcon to Cape Elizabeth; and the Southern Vancouver area from Cape Elizabeth to the U.S. boundary of the EEZ. The last full assessment of yellowtail in the northern area occurred in 2000.

Data. Information, particularly biological data, are scarce for the area south of Cape Mendocino. Since the last assessment, there have been several revisions to the historical estimates of landed catch. Three sets of fishery dependent data on catch of yellowtail were extended from the 2000 assessment and were used in the update (Tables 1-4, Lai *et al*., 2003):

Pacific Fisheries Information Network (PacFIN) data from 1981-2002.
Non-Canadian foreign catch data from 1966-1976.
Canadian data from 1967-2002.

Nontrawl and recreational catch represent less than 5% of total landings and were not included in the update or in previous assessments. The fishery dependent data were used to construct three sets of time series for each area:

1. YT2000 (used in the 2000 assessment).
2. YT2003R (same as YT2000 but updated with 1999-2002 data on catch).
3. YT2003N (includes all changes in the time series 1967-2002).

The panel unanimously considers YT2003N to be the best time series of catches to use in the yellowtail rockfish assessment.

Three abundance indices were used in the update, i.e., the NMFS triennial trawl surveys 1977-2001, the yellowtail rockfish bycatch CPUE from the whiting fishery 1978-1999, and the trawl logbook CPUE statistic from 1988-1999. The latter two CPUE indices were not extended by the STAT team because of major changes that have occurred in the whiting and trawl fisheries since 1999, and a single year has been added to the survey data. Using all three abundance indices was the preferred approach by the STAR panel for the 2000 assessment. The three indices were also pooled (unweighted) to form a single coastwide abundance index.

The STAR panel discussed updating the CPUE abundance indices, which was an area of disagreement between the STAT team and the STAR panel. The STAT team cited changes in the fishery since 1999 as the rationale for not updating the CPUE indices. However, the panel

[1]Han-Lin Lai represented the STAT team at the meeting and did not contribute to the preparation of the Panel's report on yellowtail rockfish.

thought that the time-variant nature of catchability in the model should account for the recent changes in management, which could be captured under the current formulation.

Age composition data from 1977-2002 were used in the update. Unlike the situation with darkblotched rockfish, the Panel was confident in the accuracy of the aging data used in the yellowtail rockfish assessment. Conversely, the maturity-at-age data is from the 1980s and is somewhat outdated. Also, small sample sizes in the 2001-02 commercial age data are a serious issue that could create significant problems for future stock assessments.

Model. The stock assessment model used for the update is essentially the same as that used for the assessment in 2000. This model uses a complex set of prior weighting factors to ensure smooth curves and dome-shaped selectivity.

The panel discussed implications of using different values for the weighting factors and alternative assumptions in the model regarding catchability. The STAT team cited work that was done in prior assessments to identify a robust set of weights, and these were used in the updated assessment. The catchability coefficients for the CPUE indices are assumed to be time dependent and stochastic, while the survey catchability is constant. However, placing tight constraints on interannual variability in triennial survey catchability, while simultaneously placing weak constraints on the catchabilities of the logbook and whiting bycatch time series, effectively reduces the influence of the latter two indices to a negligible level. Given the high amount of residual variance that is evident between the model and the triennial survey data, the Panel questioned the philosophy adopted by the STAT team and the previous STAR panel.

Statistics (Table 25) and figures (Figs. 7-11) show that the model's fit is reasonable. The residual plots with the pooled data for all years appear to follow a normal distribution. On the other hand, some anomalies appear in the residual plots for different years, for example 2001. The panel judged the overall fit of the model to be acceptable but the panel suggested showing 95% confidence intervals around plots of abundance statistics (e.g. Fig. 7) to determine, for example, whether the 1998 value for the survey index is noise.

The model shows a declining trend in biomass but spawning biomass has been relatively stable since 1990. However, the number of females has been declining since 1995 and low recruitment could have serious effects in the future.

The panel discussed the potential strength of the 1998 year class. These fish (age 4) were recruited into the fishery in 2002 but low selectivity in both the commercial fishery and the survey made estimates of the strength of the 1998 year class imprecise. The panel considered several alternative hypotheses about the low observed selectivity of the age 4 fish, including discard and differences between mid-water and bottom trawling. The panel underscored the need to fully implement data from the observer program into the stock assessment process as soon as possible.

Harvest Projections The arithmetic average of recruitment was used to calculate virgin biomass, B_0. Other variables in the harvest projections (Table 26) used the geometric average for recruitments from 1967-2002. A rationale for the use of geometric averages was to be consistent with lognormal assumptions in the model. The panel discussed the implications of using

geometric averages for the projections. In particular, the use of geometric means for recruitment in the projections may give a low impression of actual recruitment, especially if recruitment is highly variable. Nonetheless, the panel accepted use of geometric means for recruitment in the harvest projections, with some reservations. Given a constant level of recruitment, ten year projections based on an F50% harvest rule show a reduction of SPR to 50% of unfished SPR.

The panel requested plots of biomass projections in Table 26; these show a slight decline in the near future based on current low recruitment, followed by an upward trend with long run average recruitment.

The panel discussed the investigation of constant catch policies in the harvest projections. However, an analysis with constant catch policies was not possible with the current model configuration. Future work should consider further model development to analyze constant catch policies.

Explanation of areas of disagreement among panelists and between the Panel and STAT team.

There were no significant areas of disagreement among the panelists, or between the STAT team and the STAR panel. The panel would like to commend the STAT team for a well organized, thorough, and complete analysis.

Recommendation regarding the adequacy of the updated assessment for use in management.

Model projections appear to use conservative estimates for recruitment and upper bounds on catch. Even so, projected abundance remains outside the precautionary zone. Also, new observer-based bycatch rates may mean larger area closures that would be expected to keep yellowtail landings below the levels of catch used in the harvest projections.

The panel is concerned about the scarcity of data for yellowtail south of Cape Mendocino. The panel also recommends that sampling effort for biological data in all areas of the yellowtail fishery, and maturity-at-age and length-weight in particular, should be updated. The panel is concerned about the effects that small sample sizes for commercial catch-at-age data for 2001-02 will have on future stock assessments. Similarly, the panel was concerned about the small number of samples for the survey catch-at-age data in 2001 for the North Columbia area. The panel recommends that future sampling effort be increased to address these concerns.

Overall, the updated stock assessment for yellowtail maintains the *status quo* from the last full assessment in 2000. In particular, this assessment meets the SSC's terms of reference for expedited stock assessment updates. The STAR panel endorses the use of the updated stock assessment for yellowtail in management of the 2004 fishery.

Stock Assessment: Cowcod

STAT team: John Butler, Tom Barnes, Paul Crone, and Ray Conser[2]

Comments on the technical merits and/or deficiencies of the update

Cowcod were last assessed in 1999. Based on that assessment, cowcod were declared overfished, and a rebuilding plan was developed. In addition, the council established a Cowcod Conservation Area (CCA) in 2000 in southern California, where bottom fishing was prohibited in waters deeper than 20 fm. John Butler presented the Cowcod Rebuilding Review. The objective of the review was to gauge the success of the rebuilding plan in reducing fishing mortality, and to evaluate trends in stock indices since the 1999 assessment. The assessment model was not rerun, nor was the rebuilding analysis updated.

Data.

Fishery removals – Estimates of fishery removals were updated to 2002. Rebuilding plan restrictions on fishing have kept landings below the OYs in both northern and southern areas, except an estimated catch of 5.6 t in the southern area in 2000 which exceeded the 5.0 t OY. These removals were primarily a result of bycatch in the spot prawn trawl fishery, which was not accounted for in 1999 assessment.

A preliminary analysis of commercial passenger fishing vessel (CPFV) discard of cowcod using observer data suggests that discard of cowcod occurs very infrequently (at least while observers are onboard). The STAR panel requested that discard information be included in the update.

Revised population indices – Three abundance indices used in the 1999 assessment were updated: CPUE from commercial passenger fishing vessel logbooks (1964-2000), an otter trawl survey by Los Angeles and Orange County Sanitation Districts (1970-2002), and spawning biomass index based on larval counts in CalCOFI plankton tows (1951-2003).

Due to new bag limits and gear restrictions, and changes in fishing behavior in response to management restrictions, fishery CPUE will no longer provide a useful index of cowcod abundance. In particular, CPUE indices after 1999, which are very low, should not be used to infer that the population has continued to decline. The index from the otter trawl survey, which samples mainly juvenile cowcod, was higher in 1999-2002 than at any time in the previous decade. This suggests that recruitment of cowcod may have increased since the 1999 assessment. The CalCOFI index shows an increase in 2003, but information for 2003 is incomplete, and this result should be considered highly preliminary. Altogether, these indices suggest a slight improvement in cowcod status since the 1999 assessment. Evaluating what this potential increase implies for stock rebuilding will require quantitative population modeling.

[2]Ray Conser did not contribute to the development of the Panel's report on cowcod.

Explanation of areas of disagreement among panelists and between the Panel and STAT team.

There were no significant areas of disagreement between the Panel and the STAT team. The Panel appreciates the efforts of the STAT team in providing an update to the rebuilding plan for cowcod.

Recommendation regarding the adequacy of the update.

GLM models with more appropriate error structure for fishery and survey CPUE data, such as the delta-gamma and delta-lognormal, have been used successfully in other West Coast stock assessments (i.e., black rockfish and bocaccio), and these should be evaluated the next time the cowcod stock is assessed. The most recent bocaccio assessment also developed a novel approach to extracting informative records from non-specific recreational fishery CPUE databases that might be applied usefully to cowcod. We note that the fishery CPUE index used in the previous assessment was derived from aggregated data. A better approach would be to fit the GLM to the individual records.

Monitoring cowcod rebuilding will require new surveys or augmentation of existing surveys, particularly since fishery CPUE statistics can no longer be considered a valid population index. Recent efforts to develop non-extractive survey techniques for rockfish (i.e., the Love and Yoklavich submersible survey, and a proposed acoustic/ROV survey) are promising developments. Since these surveys produce habitat-specific estimates of abundance, better habitat mapping is needed to produce overall population estimates for stock assessment.

Enhanced ichthyoplankton surveys have the benefit of maintaining continuity with existing time series used in the assessment, and may increase the precision of the index at low population levels. The Panel, therefore, encourages the Southwest Fisheries Science Center to continue the enhanced ichthyoplankton sampling the CCA that it has conducted over the last several years. Also, the newly developed hook-and-line fixed gear cooperative research survey in Southern California is another promising development for assessing rockfish populations in the region.

The panel notes that the value of an index for stock assessment is strongly related to the length of the time series. Once sufficient work has been done to the assess the merits of these new approaches, there should be a winnowing process, and a long-term commitment by NMFS and the council to establishing time series that are effective in monitoring rockfish abundance trends in southern California.

Finally, the panel notes that there are no abundance indices for areas outside of southern California and that the original stock assessment was for the Southern California Bight only. Nonetheless, management action taken by the Council for areas north of Point Conception is likely to have a major impact on fisheries outside of the assessed area. Consequently, it is essential that a more spatially comprehensive view of the cowcod stock be developed in the next assessment. In the interim, the Council may wish to re-examine its approach to setting a cowcod ABC in the north.