Star Panel Report on the Blackgill Rockfish (*Sebastes melanostomus*) Assessment

Blackgill Rockfish STAR Panel Meeting
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Summary of the Blackgill Rockfish (*Sebastes melanostomus*) Assessment

The STAR Panel met in Olympia, Washington, during June 15th to 19th, 1998 to review an assessment prepared by the blackgill rockfish STAT Team comprised of Dr. J. Butler, NMFS/Southwest Fisheries Science Center, Dr. L. Jacobson, NMFS/Southwest Fisheries Science Center, and Dr. T. Barnes, California Department of Fish and Game. Their assessment represents the first quantitative evaluation of the status of the blackgill rockfish resource off the west coast.

The blackgill rockfish stock assessment is somewhat unique in that it is the first full assessment of one of the minor rockfish stocks. It differs from most previous stock assessments in that it is based on considerably less information than is generally available for stock assessments made for the Pacific Fishery Management Council.

Major sources of uncertainty for analyses based on the limited data sources for blackgill rockfish, as well as other minor rockfish species, are:

1. No index of blackgill rockfish biomass is currently available. This is a severe limitation for conducting a quantitative assessment of resource status.

2. Landings are poorly known. Landings used in the assessment are based on nominal blackgill rockfish landings in California and on estimates derived from multispecies market categories used in California, Oregon, and Washington.

3. The age composition of annual landings is not available. Limited size composition data is available for landings from California.

4. The number of aged fish is minimal (n=202) for determination of mortality rates in a species with this longevity (87 years); use of an otolith weight-age relationship is a novel solution.

5. There is little information on the abundance and distribution of blackgill rockfish from the time they are pelagic larvae until they recruit to the fishery about 30 years later.

6. No index of blackgill rockfish recruitment is currently available. This led the STAT Team to assume that recruitment is constant for modeling purposes. In contrast, experience with other long-lived rockfish species suggests that recruitment is likely to be episodic.

7. Biomass estimates based on swept-area methods are of limited utility for blackgill rockfish because they do not account for differential habitat utilization and

heterogeneous bottom topography and also because research survey catchability is unknown.

8. Catch curve analyses may not produce accurate estimates of total mortality for blackgill rockfish due to their longevity and due to the spatial patterning of the fishery in relation to stock abundance. Potential bias due to the inclusion of older ages would lead to underestimation of total mortality. Potential bias due to the fishery operating on a small portion of the recruited population would lead to overestimation of total mortality. The relative magnitude of the two sources of potential bias is unknown.

During the first day of the meeting, the STAT team reviewed the sources of data. These were principally biological information and catch statistics from the INPFC Conception Area, but also included a more limited data set from the INPFC Monterey Area. The bulk of the US portion of what is presumed to be a single stock is distributed within the Conception and Monterey Areas. However, an unknown proportion of the stock resides in Mexican waters. It is not known if there is any exploitation of the stock by Mexican fishermen.

Available biological information, which is relevant to stock assessment, includes size-at-age data and growth rates derived from a limited number (n=202) of otolith-aged fish. These data were augmented by age estimates derived from an otolith weight-age relationship developed by the STAT Team. These data show that blackgill rockfish do not begin to recruit to the fishery until they are about 10-20 years of age and that they are fully-recruited at an age of between 30 and 35 years. Growth is sexually dimorphic with females achieving larger sizes than males. In comparison to other rockfishes, age at first maturity is delayed. First maturity of females occurs at about 16 years and most females are mature by age 26. The instantaneous natural mortality rate (M) was estimated, by maximum age methodology, to be about M=0.05. The average total mortality rate (Z) during 1980-97 was calculated, by regression of the back slope of the age composition data, to be Z=0.10.

There is some concern about the accuracy of the catch

statistics for blackgill rockfish. Annual estimates of catch (1980-97) were derived from the TIGRBASE database at the SWFSC. The STAT Team thought that total landings may be underestimated and they presented some sensitivity analyses using an alternative (+30%) time series where annual landings were set to be 30% above estimated values. In the Conception Area, where the majority of landing have been taken, the fishery is prosecuted primarily with hook and line and set net fishing gear. These gears are also used in the Monterey Area where trawl landings are predominant.

There is a minimal amount of information on blackgill rockfish available from the NMFS 1995 triennial shelf and the NMFS 1997 slope surveys. These surveys do not cover the portion of the stock south of Point Conception.

Data availability suggested that a quantitative assessment could be made for the Conception Area where landings have been the greatest. Information from the Monterey Area was considered to be inadequate for a quantitative assessment.

The STAR Panel and STAT Team concurred that catch curve analyses may not produce an accurate estimate of total annual mortality (Z) and that estimates of Z from the assessment may be biased low. The direction of the bias due to older ages being included in the catch curve would be towards underestimation of total Z. The STAR Panel discussed the potential bias in the catch curve analyses and emphasized a cautious interpretation of results.

This discussion also focused on the fact that the population is assumed to be in an unfished equilibrium at the beginning of 1975 within the assessment model. In each year after 1975, total mortality includes fishing mortality and this shifts the population age composition away from the initial equilibrium level through an increase in Z above natural mortality. While the population age composition would eventually become independent of the initial equilibrium, this would take many decades due to the number of recruited age classes (about 50, age-35 to age-85 fish). In effect, most of the cumulative mortality experienced by older blackgill

rockfish during the 1980's was accumulated natural mortality.

The STAT Team conducted catch curve analyses based on age composition data collected during 1985 and 1997. For the 1985 ageing data, abundance of age classes between 35 to 45 years old are determined by the recent values of Z during the 1970's and 1980's. All older age classes include some effect of the equilibrium age structure with this effect being more pronounced for older age classes. For the 1997 ageing data, the age-35 to age-57 abundances are solely determined from recent Z's and are independent of the initial condition in 1975. As a result, the STAR Panel concluded that inclusion of age classes older than roughly age-60 would tend to bias the results of the catch curve analyses.

Another feature of the catch curve analyses would have an opposite effect on the Z estimate. This is the spatial patterning of the fishery in relation to blackgill rockfish population abundance. Implicit assumptions for the catch curve analyses are that the recruited population is closed and fully-susceptible to fishing mortality and that fishing and natural mortality are not age-specific. The fishery on blackgill has apparently operated on distinct spatial components of the resource through time, as indicated by the spatial pattern of set net effort. If much of the blackgill rockfish population has not been susceptible to fishing mortality because the fishery did not cover the range of recruited biomass in the Conception Area, then a catch curve estimate of total mortality would be biased low. If an accurate estimate of Z was developed for the susceptible recruited biomass, then the total mortality on the recruited population would be a weighted average of natural mortality on the unfished component and estimated Z for the fished component. As a result, the estimate of total Z from the fished component would be biased high for total recruited biomass. The amount of bias due to spatial patterning depends on the proportion of recruited biomass that has been susceptible to fishing and this proportion is unknown for blackgill rockfish.

The STAR Panel concluded that the catch curve analyses

in the current assessment produce estimates of average Z that are probably biased low due to the cumulative effects of natural mortality on older age classes. This is in accordance with the STAT Team's preferred model of Z=.125 which presumes that the bias in Z is 25%. However, the inference that the catch curve Z's are biased low is also contingent on the assumption that recruited biomass of the Conception Area stock has been fully-susceptible to fishing mortality and this is another source of uncertainty.

The STAT Team constructed decision tables with a range of plausible natural mortality values (4-6%) for 3-year harvest projections. Results of the 3-year projections under an F40% policy (about 270-410 mt per year with M=0.05) indicated that blackgill spawning biomass would decline by 1% to 5% during 1999-2001. In contrast, spawning biomass would likely remain near current levels if status quo catches of 150-250 mt per year were taken during 1999-2001. Status quo catch levels correspond to harvest rate policies between F50% and F55% for blackgill rockfish.

In summary, the results of the blackgill assessment modeling are uncertain. The catch curve estimates of Z are probably biased low. The magnitude of the bias is not known but the STAT Team has put forward a preferred model scenario that indicates a bias of 25%. The STAR Panel considered this to be plausible but observed that the tradeoff between potential downward and upward biases on Z was not quantified. Projections based on the STAR Panel preferred scenario indicate that spawning biomass would likely decrease if catches increase beyond status quo levels of 150-250 mt per year. Overall, the STAR Panel emphasizes that the model results are contingent upon the estimated Z and assumed M and that cautious interpretation of results is warranted.

Analyses Requested by the STAR Panel

Following the discussion of the presentation by the STAT Team, the STAR Panel made a number of suggestions for additional analyses.

I. Requests that maturity at length ogives be fit

through 1% and 99% percentiles of Love et al. and Echeverria curves. The rationale for this request is that the ascending portion of these curves are too broad when translated to age and appear inconsistent with similar species of rockfish. This recalculation will affect computed values of reference points for the stock, including F40%. The STAT Team produced these analyses at the Panel meeting. They were reviewed and accepted by the Panel and the STAT Team.

II. Some sensitivity analyses of model results to catch levels from unspecified rockfish landings during 1980's should be conducted. The STAT Team conducted a sensitivity analysis to the level of reported catch of unspecified rockfish during the 1980's at the Panel meeting. An adjustment of catches upward by 30% was considered reasonable by the Panel. However, the Panel considered the model run with the nominal catch level to be preferred to adjustment of catches upward by 30%. In particular, the STAR Panel preferred model for the Conception Area was the Z=0.099; M=0.047; nominal catch model run. In comparison, the STAT Panel preferred model used Z=0.125 and catches at 30% above the nominal catch.

III. Some sensitivity analyses of model results to catch levels assumed during 1976-79 should be conducted. These sensitivity analyses were completed by the STAT Team during the Panel meeting.

IV. Provide additional information to support use of catch curve analyses to estimate average values of fishing mortality. The STAT Team provided several additional analyses that were reviewed by the Panel. Based on this review, there was consensus of the STAT Team and the STAR Panel that an age of 35 years was an appropriate value for the age of recruitment. The STAR Panel accepted the catch curve analyses for the Conception Area but had reservations about the applicability of the approach to the Monterey Area due to the limited amount of data available for this region. As a result, there was a consensus that the catch curve approach should be applied to the Conception Area but not the Monterey Area.

V. Some sensitivity analyses of model results to

estimated value of M should be reported. Use of 99 percentile of age distribution as estimate of maximum observed age (to account for sampling variability and imprecision of age determination for older fishes) with Hoenig equation or some other method to provide higher value of M. The STAT Team provided several sensitivity analyses for the value of M and these were accepted by the Panel.

VI. Provide projections of the status quo catch for 10 years under a range of management options. The STAT Team provided a wide range of 10-year projections proposed by the STAT Team and STAR panel.

VII. Perform sensitivity analyses for these choices: Effect of using nominal catch vs 130% nominal catch. Effect of using the initial model year as 1970 vs 1975. Effect of choice of harvest policy (F30% to F55%). The STAT Team provided these sensitivity analyses during the meeting.

The STAR Panel thanked the STAT Team for their timely responses to Panel requests. After conclusion of the review meeting, the STAT Team agreed to complete these items for inclusion in the final assessment report.

a. A Stock Summary Report.

b. A decision table that characterized the effects of uncertainty in natural mortality.

The STAR Panel suggested that the following information would be useful to include in the final assessment document if the STAT Team had time to prepare it:

c. Include values of yield and spawning biomass per recruit for commonly-used biological reference points.

d. Present additional price information on other rockfish to see whether blackgill prices are unusual or typical, by fishing gear.

e. Present nominal biomass estimate for Monterey Area based on expansion of trawl survey density estimates and available habitat area.

Prioritized Research Recommendations

1. Develop and apply an appropriate research survey method to track trends in the abundance of blackgill rockfish.

2. Conduct additional ageing with a high priority on a research survey in areas with a nearly virgin population structure (such as in Mexican waters) leading to a better estimate of natural mortality.

3. Monitor age and length composition of commercial landings.

4. Develop fine-scale characterization of habitat utilization to allow stratified habitat-area assessment.

5. Consider development of a logbook program for longline fishers to provide information on the spatial distribution of effort and on levels of CPUE.