SPLITNOSE ROCKFISH

STAR Panel Report

May 4-8, 2009
Northwest Fisheries Science Center
Hatfield Marine Science Center
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Overview

A draft assessment of splitnose rockfish (*Sebastes diploproa*) off the U.S. west coast was reviewed by the STAR panel during May 4-8, 2009. This assessment is the first full assessment for the species, which assumed a single coastwide stock given no distributional breaks or genetic information suggesting more than one stock. This assessment used Stock Synthesis platform version 3.02e and incorporated a variety of data sources into the candidate base model. Data from commercial fisheries included landings, discards, and biological information. Abundance indices used in the model were the Alaska Fisheries Science Center (AFSC) shelf (triennial) survey (1977-2004), the AFSC slope survey (1997, 1999-2001), the NWFSC shelf-slope survey (2003-2008), and the NWFSC slope survey (1999-2002). Biological information from three of the four trawl surveys was also included.

The STAT team presented assessment results based on the model in the draft document distributed for review and from an improved model. The differences were through tuning and limiting the survey index to those years where the latitude and depths relative to splitnose distribution were well covered. Also the 1977 and 1980 survey data were removed because the length compositions in those years were implausibly large and the surveys were not well sampled in those years.

The Panel reviewed the revised assessment and requested a number of runs as outlined below. In performing these runs a question arose about the use of 'tuning', i.e., iteratively re-weighing of the recruitment variability parameter (σ_R) and effective sample sizes during the analysis. Tuning the model runs has a substantial effect on the results. In general, the results of the tuned runs are much more similar to each other than those of the non-tuned versions. The effect is to reduce R_0 compared to the base run with a fairly flat trend in spawning output in the period from 1900 to the 1960s. While tuning has the effect of producing similar trends in spawning output, it also tends to result in larger differences in scale between the various runs. In summary, the runs requested suggest that the model is heavily influenced by the recruitment assumptions in the analysis, and the effect of tuning.

Considerable progress has been achieved in evaluating the population dynamics of splitnose rockfish and all model formulations tested indicate that splitnose rockfish is not overfished and that overfishing is not occurring. The results of the assessment suggest that the current fisheries management measures result in catches that appear to be sustainable, but it would not be prudent to allow catches to increase markedly above the long term average until the next stock assessment, with a few more years of data, substantiate the yield reference points calculated in the current assessment.

The STAR panel concluded that the splitnose rockfish assessment was based on the best available data, and that this new assessment constitutes the best available information on splitnose rockfish off the U.S. west coast. The STAR panel thanks the STAT team for their willingness to respond to panel requests and their dedication in finding possible solutions to difficult assessment problems.

Analyses requested by the STAR Panel

The STAT team ran all the following requests in both non-tuned and tuned mode. The effects of tuning were summarized above.

1. **Provide a run with the time series of domestic landed catches reversed from the beginning of the time series to 1977.**
   Reason: There is uncertainty in the historical catches resulting from reconstructing historical records. This uncertainty applies mainly to the data prior to 1978, given there is sparse data informing catches in this period. This means that the estimated stock trends in the early part of the time series may be influenced by errors in the estimated catches. The run was requested to evaluate the sensitivity of the assessment, especially in early years, to possible uncertainty in the catch data.
   Response: Compared to the initial base run, inverting the catch series has relatively little effect and shows a similar long term decline in spawning output, though the rate of decline to the 1970s is somewhat higher as might be expected due to the higher catches in early years. The run illustrates the fact that B_0 is heavily influenced by the estimate of R_0 which is determined to a large degree by model assumptions, rather than the data.

2. **Provide a run beginning catch in 1960.**
   Reason: Prior to 1960 there is very little data available apart from reconstructed catches. Running the assessment from 1960 using the average catch of pre-1960 years as the initial catch provides an opportunity to assess the extent to which early data affect the results in the more recent period.
   Response: There was very little change to the assessment compared to the initial base run.

3. **Provide a run where recruitment deviations are estimated only from 1960 onwards.**
   Reason: In the initial base model recruitment deviations were calculated for the whole period of the assessment. There is no information in the data prior to 1960 on year class strength and it may be unrealistic to try to estimate deviations with only catch data. Therefore, the panel requested a run where recruitment deviations are estimated beginning in 1960 and bias correction beginning in 1980.
   Response**:** Spawning output in the early period up to 1960 was substantially reduced in the revised run mainly as a result of higher estimates of σ_R and much lower estimates of R_0. Unlike the base run where spawning output shows a sustained reduction during the period up to the 1950s, this run shows an almost flat trend. The reduced value of R_0 appears to be a result of the influence of σ_R which is lower in this run. There appears to be an inconsistency between the input value of σ_R and the estimated root mean square error (RMSE) from the model which is larger. It did not prove possible to set an input value of σ_R that caused the model to estimate a lower RMSE, unless the effective sample sizes were also tuned; this is a reason to be cautious about the reliability of the model output.

4. **Provide a run where recruitment deviations are estimated only from 1960 onwards and steepness is estimated within the model.**

Reason**:** This run was requested for similar reasons justifying request #3 and to see if the model-estimated value of steepness is consistent with the assumed input value. The panel requested a run where recruitment deviations are estimated beginning in 1960 and bias correction beginning in 1980.
Response**:** This run gave a similar result to the previous run. Steepness was estimated to be 0.71 compared with the value used in the base model of 0.58 (based on a meta-analysis). This run assumed a lower σ_R to allow the model to estimate steepness.

5. **Provide a run using a Ricker stock-recruitment function.**
   Reason**:** The recruitment estimated in the base run is lower in the early period when spawning stock size is high compared to the recent period when recruitment is estimated higher although stock size is lower. This appears to be inconsistent with the assumed Beverton-Holt relationship used in the model; a Ricker curve may be able to reconcile this trend in the recruitment series. The panel again requested that recruitment deviations are estimated beginning in 1960 and bias correction beginning in 1980.
   Response**:** Replacing the Beverton-Holt function with a Ricker function did not change the trend in recruitment and gave the same general trend in spawning output seen in the base model with, if anything, a higher value of R_0. There was no evidence to suggest the Ricker model offered a preferable assumption for the analysis.

6. **Provide a run with the foreign catch halved.**
   Reason**:** There is a very high catch by foreign fleets estimated for the mid-1960s which in turn is based on catch reconstruction where there is uncertainty about the species composition of the catches. The large estimated catch in this period may have a large influence on the assessment.
   Response**:** Halving the foreign catch did not have a large effect on the trend in estimated spawning output.

7. **Provide length frequency data plots:**
   Reason: Length frequency plots were requested to see if modes could be identified that track year classes.
   Response: Data suggested some identifiable year classes on the left tail of the length frequency distributions.

Description of base model and alternative models used to bracket uncertainty.

- The base model assumed a Beverton-Holt stock recruitment relationship.
- Recruitment deviations were estimated beginning in 1960 ending in 2006.
- Bias adjustment was started in 1980 and stopped in 2002.
- Tuned effective sample sizes and recruitment variation (σ_R).
- Use ± 2 S.D. of the 2000-2006 recruitment deviations to bracket the main axis of uncertainty in the decision table.

Comments on technical merits

The assessment was thorough and well investigated. Although sensitive to certain assumptions on model structure (tuning of σ_R and sample sizes, and the timing of bias adjustment), stock trends demonstrated low sensitivity to a broad range of data use and specifications. The MSY estimates (or proxies) appear high compared with the history of the fishery, thus allowable catch markedly higher than long-term average catch is not recommended. Further work in exploring model behavior is recommended before the assessment can be considered a stable basis for providing management advice.

Areas of disagreement

There were no areas of disagreement among STAR panel members or between the STAR panel and the STAT with regard to technical issues.

Unresolved problems and major uncertainties

Recent recruitment is estimated to be much higher than in early years even though stock size has reduced compared to the start of the time series.

Tuning has a large effect on the initial conditions of the assessment and there does not appear to be a clear consensus about the most appropriate choice of when to tune and when not to tune. It was agreed to tune σ_R so that the input σ_R value would be greater than the rmse of the estimated recruitments, because the data are never perfectly informative about the recruitment deviations. In this assessment, tuning on σ_R alone results in implausibly high stock size estimates. The problem can only be resolved by tuning on effective sample size as well. This illustrates the sensitivity of the assessment to the choice of model configuration.

Management or data issues raised by the GMT or GAP

None.

Research and data recommendations

- There is a need to improve age determination and collect more age data. Splitnose rockfish is a long-lived species and grows fast reaching L_{inf} at young age. This makes it difficult to identify recruitment signals using length compositions.
- Otoliths from the 1980 domestic trawl fishery should be re-aged to help clarify stock structure for the 1960-1970s time period.
- Historical catch data require further work to arrive at improved estimates. Though the panel was not able to review the reconstruction of historical catches, a constant fraction approach is not desirable. A thorough review of historical species composition in catch is needed.
- The current assessment model has a complex structure but there are not enough data with a long time series to support it. Investigating more parsimonious modeling approaches is recommended for comparing and contrasting purposes.