Canary Rockfish
Stock Assessment Review (STAR) Panel Meeting Report

Hotel Deca
4507 Brooklyn Ave NE
Seattle, WA 98105

April 27 - May 1, 2015

STAR Panel Members

Tom Jagielo, Scientific and Statistical Committee, Panel Chair
Neil Klaer, Center for Independent Experts
Stuart Reeves, Center for Independent Experts
James Ianelli, NMFS Alaska Fisheries Science Center

Stock Assessment Team (STAT) Members

James T. Thorson, NMFS Northwest Fisheries Science Center
Chantel Wetzel, NMFS Northwest Fisheries Science Center

STAR Panel Advisors

Daniel Erickson, Oregon Department of Fish and Wildlife, Groundfish Management Team
Dan Waldeck, Pacific Whiting Conservation Cooperative, Groundfish Advisory Subpanel
John DeVore, Pacific Fishery Management Council

Overview

The Stock Assessment Review (STAR) panel reviewed a new benchmark stock assessment of canary rockfish over the course of a five day meeting in Seattle, WA. The assessment region covers the U.S. west coast ranging from southern California to the U.S.-Canada border. This area encompasses the range of canary rockfish within the jurisdiction of the Pacific Fishery Management Council.

Summary of Data and Assessment Models

This assessment employs stock synthesis (v3.24v) including spatial structure that uses port of landing to approximate the spatial regions of WA, OR and CA.

All data sources were disaggregated with respect to these areas and where possible modeled for females and males. The main sources of information were:

1. Landed catch, as recorded by comprehensive catch landing receipts and historical data from foreign and domestic fisheries.
2. Length composition from fisheries and surveys.
3. Marginal age composition from the commercial fisheries.
4. Conditional age at length composition from surveys.
5. Maturity and fecundity at age.
6. The Triennial survey conducted by the Alaska Fisheries Science Center 1980-2001; West Coast Groundfish Bottom Trawl Survey (WCGBTS) conducted by the Northwest Fisheries Science Center 2003-2014; pre-recruit survey, which combines data collected by the Southwest Fisheries Science Center, Northwest Fisheries Science Center, and Pacific Whiting Conservation Cooperative 2001-2013.

The key model features include:

1) Length-based selectivities were estimated for all surveys and fisheries.
2) Growth was estimated within the model.
3) Discard information was explicitly included and used in the estimation of retention functions and rates. Historical discard data (or assumptions about discard rates) were added to the total landings information.
4) Survey data were modeled using a new geostatistical approach prior to being applied within the assessment model. Previously, a Bayesian stratified delta-GLMM estimate of biomass (and variances) were used.
5) A new prior distribution on natural mortality was developed and used, based on recently published research by O. Hamel.
6) A new prior distribution on stock-recruitment steepness was employed, updated from the work of Dorn et al. 2009.
7) Conditional age given length data were compiled and were available for guiding model parameter estimates.
8) A new maturity schedule was estimated and used in the assessment model. The age at 50% maturity changed from 8 years to about 6 years.
9) Age composition data from surface readings of otoliths were included in the assessment

model, based on new estimates of ageing error and imprecision relative to break-and-burn reads. Previous assessments did not use surface readings.

Requests by the STAR Panel and Responses by the STAT

The following sets of runs and analyzes requested by the STAR panel are summarized (with rationale for the request, and STAT response) below:

Request 1: Evaluate treatment of early discard rates, bracketing the historical reconstruction as appropriate. This evaluation may include discard rates that are reflective of potential trip limit impacts.

Rationale: The GMT representative on the Panel provided some suggestions to the STAT for these sensitivity runs. The GMT representative noted that the STAT assumed a constant discard rate of 5% for the historical period (1892 - 2001), and applied the West Coast Groundfish Observer Program (WCGOP) discard rates for recent years (2002-2014). The assumed discard rate for the historical period was based on data collected by the Pikitch et al. study (1985-1987) as reanalyzed by Wallace (unpublished report). The GMT representative and others questioned whether a flat discard rate was appropriate throughout the historical period. It is generally assumed that discarding increases as trip limits became more restrictive (historically prior to the IFQ program). For example, there were no trip limits prior to 1982, and rockfish trip limits became increasingly restrictive since rockfish trip limits were first implemented in 1982.

STAT Response: The STAT made the following decisions regarding assumed ratio of discards to landings for the base case model (expressed as a percentage):

- 1892-1980 = 1%
- 1981-1994 = 5%
- 1995-1999 = 20%
- 2000-2001 = 70% Trawl, 200% Non-Trawl (based on average rates in WCGOP)
- 2002-2014 = WCGOP discard rates

The comparison showed the alternative discard rates made very little difference to model results with a slight increase in the scale of the population.

Request 2: Validate the recreational catch records from Oregon.

Rationale: An apparent oversight was found in which incorrect average weights by wave for B1 fish was applied in the years 2004-2014. The average weights used was from the old Marine Recreational Fisheries Statistical Survey (MRFSS) estimation process rather than the Oregon Recreational Boat Survey (ORBS) data in the Recreational Fisheries Information Network (RecFIN) database.

STAT Response: The STAT replaced the data shown in the draft assessment with Oregon recreational data provided by the GMT for the years 2004 - 2014.

Request 3: Ensure that the tribal catch data (from all sources) have been included in the

Washington catch data reconstruction.

STAT Response: The tribal catches in the proposed base model were included in the WA catch data.

Request 4: Exclude catch from BC and AK that was inadvertently included in the WA catch history.

Rationale: It was discovered that the WA catch history was contaminated with non-WA catch data (from BC and AK). These data should be removed from the time series.

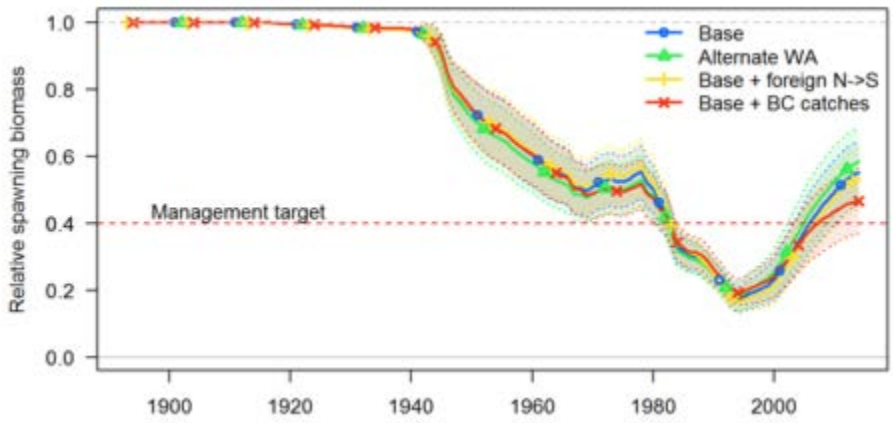
STAT Response: The STAT made the following decisions regarding the WA historical catch reconstruction:

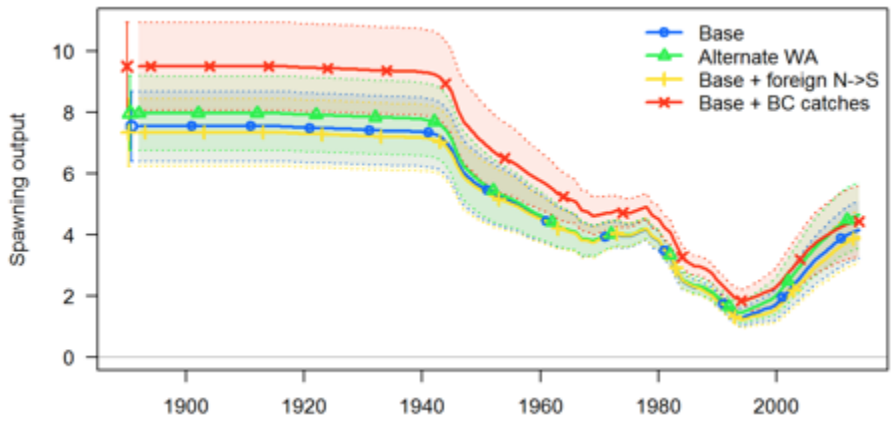
- 1935-1965 (prior to foreign): use 2007 assessment time series
- 1966: WA from Hongskul (Foreign catches in a separate fleet)
- 1967-69: WA from Kimura & Tagart (1982) (Foreign catches in a separate fleet) [1966-69 values, as in the current base model]
- 1970-80: use the FT-derived series from Theresa for WA (Foreign catches in a separate fleet)

Request 5: Conduct a sensitivity run to evaluate alternative catch histories to reflect uncertainty. Construct the catches as in Request 4 but omit the change for the 1935-1965 period (i.e., keep the historical WA trawl catches provided in the draft assessment).

Rationale: This sensitivity run will help to examine the impact of uncertain historical catch.

STAT Response: Adding in the historical BC catch increased the scale of the population and decreased the current depletion as expected (see Figures below).





Request 6: Include BC trawl catches as part of the WA trawl catch time series in the base model.

Rationale: This is an additional run to explore model sensitivity to uncertain catch history.

STAT Response: This was completed (see STAT Response to Request 5).

Request 7: Reapportion INPFC area foreign catches in an alternate manner (N to S vs. S to N).

Rationale: The overall purpose of this request is to evaluate sensitivity of how straddling INPFCs were allocated to the regions (states). The STAT team used the following INPFC areas to represent states: WA: Vancouver and Columbia ~ 46 - 49° N; OR: Eureka ~ 42-46° N; CA: Monterey 32-42° N.

STAT Response: This was completed (see STAT Response to Request 5). The STAT made the following decision regarding assignment of foreign catches among INPFC areas. A sensitivity analysis was run with catch assignments made as follows:

- WA: Vancouver INPFC area to approximate 46-49° N
- OR: Columbia INPFC area to approximate 42-46° N
- CA: Eureka and Monterey areas to approximate 32-42° N

Request 8: Conduct a sensitivity run in which survey catchabilities are fixed at the estimate; then "turn off" the composition data.

Rationale: This is intended to illustrate the impact of composition data on model results.

STAT Response: This was completed. The results were similar to the base case.

Request 9: Conduct a sensitivity run in which the survey indices are "turned off".

Rationale: This is intended to illustrate the impact of the survey data on model results.

STAT Response: This showed little difference to the base model, illustrating that abundance indices are not informing the model.

Request 10: Determine a plausible range for natural mortality and steepness sensitivity runs, for potential decision table specification.

Rationale: These are likely candidates for uncertainty, and meaningful bounds will be needed for the decision tables. The intent is to treat them independently to avoid added complexity.

STAT Response: This was completed and the group agreed that two one-dimensional tables should be presented since they may show important differences in projections.

Request 11: Conduct a likelihood profile with sigma-R ranging from 0.6 to 0.9 and growth parameter CVs for L1 at 0.15 and for L2 at 0.1 (similar for L1 to previous assessments and as a sensitivity for L2).

Rationale: The CV of the growth parameters and sigma-R will likely be positively correlated; examining the sensitivity to this may affect recent recruitment estimates.

STAT Response: This was attempted but there were difficulties with convergence and configuration. There was insufficient time to resolve the issues and the group thought this would be something useful to examine for future research. In particular, the influence and likelihood specification of the age conditioned on length data may result in unrealistically small values for length at age variability.

Request 12: "Turn off" the base model parameters controlling the spatial distribution deviations.

Rationale: This is a sensitivity run to compare the base model with a less complex model.

STAT Response: This was completed and the results appear to be insensitive to this configuration option.

Request 13: Run a non-spatial version of the model.

Rationale: This is another sensitivity run to compare the base model with a less complex model.

STAT Response: This was completed and the results appear to be insensitive to this configuration option.

Request 14: Conduct "jitter" runs using the new base model.

Rationale: The exercise should provide some assurance that model convergence is stable.

STAT Response: This was done and the model appeared to converge consistently.

Request 15: Conduct an additional profile over M that uses a fixed offset for female component.

STAT Response: This was completed and showed likelihood components that appeared to be smoother for alternative values of the profile.

Request 16: Revise the table of sensitivity run results to include the full set of runs conducted.

STAT Response: The table was updated and reviewed by the STAR panel.

Request 17: Conduct runs to examine the interaction between SigmaR and steepness, and the associated impact on growth parameter estimates.

Rationale: Whereas this might be highly determined by the age conditioned on length, the impact is of interest.

STAT Response: As with request 11 above, this is an area that should be considered for future research as this requires more time for evaluations.

Request 18: When presenting the results of sensitivity runs, provide a table showing likelihood components, including management parameters of interest for all sensitivities and examined potential states of nature (from applicable requests above) and figures for profiles over: M, h, R0 and the retrospective.

Rationale: This will aid in the interpretation of sensitivity analysis results.

STAT Response: These tables were completed and helped with reviewing model results and sensitivities.

Description of the Base Model and Alternative Models used to Bracket Uncertainty

The primary issues that involved changes in the original base model included 1) revisions to the WA trawl catch time series, 2) revisions to the OR recreational catch time series, and 3) different assumptions about historical discard values.

The group agreed that the two primary axes of uncertainty were natural mortality and steepness. Two one-dimensional decision tables will be constructed to bracket uncertainty.

The STAR Panel recommended that the data and model configuration are the best available for management guidance and as such the assessment is ready to go forward for final review by the

SSC groundfish subcommittee and full SSC.

Technical Merits of the Assessment

The assessment was well constructed and modeled the available data appropriately. In particular, this assessment is distinguished by the attempts of the authors to account for spatial considerations within the model. The observation that the key survey indices (from the NWFSC) provided identical trends by region is a curiosity, and something that has been highlighted for future research.

Technical Deficiencies of the Assessment

None were identified.

Areas of Disagreement Regarding STAR Panel Recommendations

The Panel and the participants (including GMT and GAP representatives) had no areas of disagreement for all conclusions during the STAR panel meeting.

Management, Data, or Fishery Issues raised by the GMT or GAP Representatives During the STAR Panel Meeting

Prior to the STAR Panel review, the GMT noted differences in some catch streams between downloads made by the STAT team and GMT. The willingness of the STAT team to reconcile differences and even replace portions of catch streams with GMT produced data was appreciated. The GMT representative agreed that clear communication needs to take~~s~~ place between STAT teams, the GMT, and States prior to STAR panel meetings to produce the most representative catch records. Indeed, although some did occur prior to the STAR panel meeting, the communication process needs to be improved. The GMT representative suggests that the GMT and other advisory bodies be given an early draft of the catch streams in order to ensure that catch streams are as accurate as possible. Regardless, communication will never be perfect, and there may be cases where catch streams shown in draft assessments may be different than recommended catch streams that may be reported by the GMT and States. The GMT representative suggests this will likely occur, even with best intentions, and that improved data records should continue to be considered at STAR panel meetings. The GMT representative should not feel stifled to present alternative data sets if large differences are identified.

Unresolved Problems and Major Uncertainties

The assessment relies on fixed values for steepness and natural mortality that are assumed to be known. Recent work to develop priors from meta-analyses has assisted with the choice of base values, but this is still a major source of uncertainty.

Substantial uncertainty remains in the US catch and discard history. Also, British Columbia catches impact the stock, which appears to be shared. Therefore, this should be accounted for in the US regional stock assessment, or a joint US-Canada assessment.

It is evident that the model's reliance on abundance trends from indices is small. Model results would be considerably improved if a reliable abundance index for older fish was available. The WCGBTS survey is currently the best available source of abundance information for older fish in recent years as a direct measure of the extent of rebuilding, although it has been recognized that the survey infrequently encounters canary rockfish, and occasional large catches occur when canary aggregations are encountered. Good progress has been made in the development of appropriate analysis methods for these types of data. Selectivity for this survey was able to be modeled as asymptotic. The overall trend for the survey is flat to declining from 2003 to 2013, with an increase in 2014. While the base model available biomass for this index falls mostly within the 95% confidence interval for the index, there are considerable systematic patterns in residuals.

This assessment differs from previous work, in that it models the stock using a spatially discrete approach. The definition of the spatial strata, and the method of apportionment of catches to the spatial strata impact the inferences of stock status for the individual strata modeled. For example, spatial strata derived by port of landing vs. area of catch can lead to substantially different spatial interpretations of stock depletion within each area.

Considerable uncertainty remains regarding the most appropriate method to account for the lack of older females in the stock (either by age-specific change in M for females, or selectivity effects).

Spatial treatment of the survey index resulted in indices that were very similar across areas. Further work is required to more clearly resolve differences in abundance trends among areas.

During the course of the current STAR panel meeting, some issues were raised about the historic estimates of catches by the Washington trawl fleet. This resulted in lengthy discussion which eventually led to an agreed dataset to use in the assessment. This consumed time at the meeting which would otherwise have been available for further exploration and discussion of the assessment.

Recommendations for Future Research and Data Collection

The historical catch data ultimately used in the assessment differed from that which was given in the original draft assessment presented for review at the panel. The review process would be improved by ensuring that any such issues (i.e. disagreements about the best available historical catch) are resolved well in advance of the assessment review meeting. One possible approach might be to have an earlier step in the process intended to sign-off on the input data, analogous to the way that the STAR panel signs-off on the stock assessments. Ongoing efforts to reconstruct Washington catch data, in the way that has already been done for Oregon and California, should help to resolve these issues in the medium term, but until then, there will still be a need to work with agreed, interim catch estimates for inclusion in stock assessments.

Catch and discard history for this stock in US waters is highly uncertain. While the STAT was able to construct alternative upper and lower bounds for catch using simple multipliers on certain years of historical catch, this is arbitrary. Work to assess the uncertainty related to each individual data source would allow a better investigation of the overall combined uncertainty and its effect on

stock assessments.

Improved documentation is required to clearly outline the process used to construct the historical catch and discard time series from the various data sources. Such documentation should also include the process for construction of alternative catch histories that are used to propagate such uncertainty into the stock assessment.

Additional work on the geospatial index is required to better resolve differences in abundance trends among areas.

Work towards a combined US/Canadian stock assessment would greatly aid our overall understanding of stock status.

If data permit, the trawl fleet should be divided into separate components so that bycatches in the shrimp and pelagic trawls are separated from catches in the main bottom trawl fleet. In the current assessment, composition data for the trawl fleet have a major influence on the estimated stock trends, so it would be desirable to use data that are more representative of the main fleet in order to improve estimated selectivity of the fleet.

Basic life history research may help to resolve assessment uncertainties regarding appropriate values for natural mortality and steepness, and how to best account for the apparent loss of older females in the population.

Acknowledgements

The STAR Panel thanks NWFSC and Council staff and advisors for facilitating the meeting and engaging in discussions. The Panel commends the stock assessment team for their work, and on their cooperation in conducting additional analysis and revisions in response to this review.