# CABEZON

## STAR Panel Report

July 27-30, 2009

Deca Hotel
Seattle, WA

**Panel Reviewers**
Dr. Vidar Wespestad, STAR Chair and SSC representative
Dr. J.J. Maguire, Center for Independent Experts
Dr. Stephen Smith, Center for Independent Experts
Dr. Jim Ianelli, National Marine Fisheries Service Alaska Fisheries Science Center

**STAR Panel Advisors Present:**
Ms. Joanna Grebel, California Department of Fish and Game, GMT Representative
Mr. Dan Platt, GAP Representative
Mr. John DeVore, PFMC Representative

**STAT Team:**
Dr. Jason Cope, National Marine Fisheries Service Northwest Fisheries Science Center
Ms. Meisha Key, California Department of Fish and Game

## Overview

The Star Panel met at the Hotel Deca in Seattle, WA to review the third full assessment of the population status of cabezon (*Scorpaenichthys marmoratus* [Ayres]) off the west coast of the United States. The first assessment was for a state-wide California cabezon stock in the year 2003, the second assessment in 2005, considered two sub-stocks (the northern California sub-stock (NCS) and the southern California sub-stock (SCS)), demarcated at Point Conception, CA.

The current draft assessment retains the two California sub-stocks, also evaluating the population as a State-wide California stock (CAS), and extends the assessment to a third sub-stock for cabezon in the waters off of Oregon (ORS). Separation of these spatial sub-stocks is based on distinguishing localized population dynamics, preliminary population genetics results, and is supported by spatial differences in the fishery (the NCS has been the primary area from which removals have occurred), the ecology of nearshore groundfish species, and is consistent with current state management needs.

The last full assessment of cabezon was done in 2006. Major changes made in this assessment, compared with the previous assessment include:

The assessment used the Stock Synthesis platform (version 3.03a) and incorporated a variety of data sources. Similar to the 2005 assessment each sub-stock assessment uses data on size (mean weight and length compositions) and indices of abundance. Primary catch data are from recreational databases and from commercial hook and line and trap fisheries in California. The low occurrence of cabezon in standard trawl surveys precludes their use.

Additional modifications made to the specification of this year's assessment models, relative to the previous assessment included:

- Implementation of time blocks on the selectivities of the commercial live-fish fishery and boat-based recreational fleets for all sub-stocks to account for regulatory changes.

- Additional variance was applied to the estimated variability of the candidate abundance indices in order to address the underestimation of variability in the delta GLM-based models.

- The models were tuned to balance the input of recruitment variability ($Sigma_R$) and sample sizes of length and age compositions with model output estimates of these same values. This resulted in $Sigma_R$ values less than those used in the last assessment.

- Incorporation of conditional age-at-length data for the first time to estimate growth parameters internal to the model (previous assessments used growth parameters derived from externally fitted growth curves).

Several potential indices of abundance were included for the California sub-stocks and one for the Oregon fishery:

- Fishery-dependent CPFV Logbook CPUE, a CDFG hook-and-line survey, and PSMFC dockside and onboard surveys,
- Fishery-independent adult surveys (TENERA and PISCO), and
- Recruitment surveys (CalCOFI, Southern California Edison Impingement, PISCO SMURFS, SLO SMURFS).
- Oregon Ocean Recreational Boat Survey (ORBS) sampling program.

Changes in bag and size limits in California also necessitated the separation of the CPFV data into two series: 1) 1960-1999 and 2000-2008. This approach differs from the previous assessment, which used a continuous index from 1960-2004.

The STAR panel concluded that the Cabezon assessment constitutes the best available scientific information on the status of Cabezon off the U.S. west coast and recommends that it be used for status determination and management in the Council process. The STAR panel thanks the STAT team members for their excellent preparation, presentation, and willingness to respond to panel requests.

**Analyses requested by the STAR Panel**

1. Clarify if larvae and juveniles are pelagic and for how long? This is related to stock structure and recruitment, whether spawners contribute locally or globally. This could also be a research recommendation for the next assessment.

   <u>Rationale</u>: The assessment assumes that there is little mixing at all life stages. Yet, after hatching the young of the year spend 3–4 months as pelagic larvae and juveniles which leaves considerable margin for mixing depending on where and when hatching occurs.

   <u>Response</u>: O'Connell 1953 states that "In all probability, the young carried offshore perish, unable to attain the bottom at the proper time. Assuming this to be true, extensive coastwise mixing would not occur." The chair consulted with Steve Ralston (NMFS/SWFSC) who considers that there is limited knowledge on cabezon larvae and juveniles and that there is no basis for O'Connell's probability statement. Further investigation of the abundance and distribution of cabezon larvae and juveniles in existing databases appears warranted for the next assessment.

2. Provide a model run using the pier catches as a recruit index for OR to compare with the ORBS index currently used in the assessment.

   Rationale: The catches of cabezon in the man-made fishery on piers and jetties are mostly of small cabezon and could possibly provide an early index of year class size.

   Response: The STAT was unable to complete this request because the data were not in an appropriate format and there appears to be several missing fields in the database. There were also questions on the appropriateness of estimated effort measures obtained from the RecFIN database. The next assessment should continue to explore additional indices of stock sizes for OR and CA as they become available.

3. Normalise, rather than standardize to a common year, the trends on Fig. 26 for a better comparison.

   Rationale: Figure 26 shows the geometric mean and delta GLM-based CPUE abundance indices for each sub-stock each on different scales which complicates their interpretation.

   Response: An updated graph was prepared with each series on similar scale. The trends for SCS, CAS and ORS showed greater consistency, but NCS still showed different trends.

4. Figure 26 in the draft assessment shows a big difference between the trends of the various treatment for NCS CPFV (table 13 of the draft assessment), in particular the geometric average. The Geometric average does not include any effect. Investigate what factor(s) accounts for the difference in trends.

   Rationale: Standardized catch per unit of effort is expected to be different than unstandardized CPUE, but the differences in trend in fig. 26 are more than normally expected and warrant further investigation.

   Response: The STAT found that location 6 had different CPUEs than the other locations and that December and January consistently had higher CPUEs than the other months. The standardization has no interactions term. The STAR Panel provided a general recommendation to address this issue in this and other assessments.

5. Provide a plot of the proportion of zeros for the NCS CPFV vs time.

Rationale: This was a further attempt at explaining the differences between the geometric mean average and the GLIM estimates in figure 26.

Response: The proportion of zeros seems to be increasing, particularly in the NCS where the problem is seen. The geometric mean does not include zeros, while the GLM does, so this may explain the differences.

6. Fit the growth model externally without $t_0$ to the data in fig. 8 assuming a zero intercept. Compare the fits and trends from this analysis to the case where growth was estimated in the model with $t_0$ estimated.

Rationale: The von Bertalanffy growth equation was fitted in the model and resulted in relatively large negative $t_0$ estimates. The panel wanted to see how the $L_{inf}$ and k parameters would change if a zero intercept was assumed.

Response: Assuming a zero intercept made a relatively large difference in estimates of $L_{inf}$ and K, but there is no basis to choose which one is better. For assessment purposes, the growth parameters were fit internal to the population model and resultant growth curves fit closely curves generated by the external fits when estimating $t_0$ (see Figure 74 of assessment document for the comparisons). The panel recommended that younger cabezon be aged to better inform the growth curves. The model estimate of spawning biomass is sensitive to estimates of k.

7. Provide a run with using the original CVs estimated for the NCS and the SCS CPFV 1960-1999. Show the fit to the NCS and the SCS CPFV 1960-1999 with the original CVs to see if fits better (figure 38).

Rationale: The CVs derived when calculating surveys and CPUE indices are believed to underestimate the uncertainty in the indices. The draft assessment multiplied those CVs by 3 to better reflect the perceive uncertainty.

Response: For NCS, using the original CVs did improve the fit noticeably, but it did not for SCS. Fitting the indices with the original CVs increased the absolute biomass outputs and resulted in higher depletion ratios ($SB_{2009}/SB_{1916}$) in the NCS, CAS and ORS. There was little change to either biomass or the depletion value in the SCS.

8. Label points as years in fig. 38 on the plots of expected vs. observed for NCS CPFV 1960 - 1999.

   Rationale: Figure 38 shows considerable lack of fit to the index and the panel wanted to evaluate if there was a temporal component to the lack of fit.

   Response: The largest outliers were at the beginning of the time series when there was little change in the expected values but relatively large changes in the observed values. There was no a priori reason to exclude those early years from the model. For more recent years there appears to be a better agreement between observed and expected values.

9. Verify that the confidence intervals on fig. 40 to 43 were correctly calculated. In the unlikely event that they were not, provide a run of the base case with the appropriate confidence intervals.

   Rationale: The panel found that the confidence intervals on those figures looked larger than expected.

   Response: The STAT confirmed that the confidence intervals were correctly calculated and that they were large.

10. Figure 105 (of the STAR assessment draft) showing the results of the retrospective analysis shows very different absolute stock size estimates for ORS depending on the number of years that are used in the assessment. Provide the confidence bounds of the retrospective analysis (base, -1 year and -5 years) to see if they overlap for OR.

    Rationale: Differences in absolute estimate of stock size of the magnitude showed in Fig. 105 for ORS are cause for concern. They imply very uncertain assessments.

    Response: The confidence intervals do overlap, confirming that the assessment is uncertain. The retrospective run with 5 years removed from the assessment shows a non-zero probability that the stock would go extinct. If asymmetric CI were calculated this problem would be eliminated.

11. Provide a table of the number of California commercial nearshore licenses for 2003 to 2008.

    Rationale: The panel wanted to have a better understanding of the potential changes in fishing effort.

    Response: In California the number of licenses decreased from 219 in 2003 to 171 in 2009.

12. Investigate why the plateau for fleet 4 ((beach/bank) in the California models) looks the same for all areas. This may be important for projection forward and for allocation calculations.

    Rationale: The panel wanted to be reassured that the selectivities were correctly estimated.

    Response: The STAT found that the model was not moving much from the starting value. The STAT used different starting values and parameter estimates but these modifications did not appreciably change the results from those obtained from the base model.

13. Provide a run where the selectivity for fleet 2 (live-fish fishery) for SCS comes from the coast wide estimates for the two periods.

    Rationale: Fleet 2 in SCS (figure 85) showed a highly peaked selectivity pattern that is unlikely to happen. The CAS selectivity (figure 93) shows a wider plateau and is more likely to have a biological basis.

    Response: The State wide (CAS) selectivity was used in the SCS base case and showed very similar results. The panel recommended using this State wide selectivity curve in the SCS base case.

14. On bubble plots for length compositions, remove years with only one sample (not necessarily for this meeting, but for final document).

    Rationale: Including those years with only one sample complicates the interpretation of the bubble plots.

Response: This was done in the final assessment.

15. Investigate interactions with years in the CPUE standardization for NCS CPFV (table 13 and figure 26 of the draft assessment).

Rationale: This was a continuation of the discussion covered in requests 3, 4 and 5 above. The panel has provided a general recommendation to address the issue of CPUE standardization for this and other assessments.

Response: The STAT team responded with runs examining alternative fits,

16. Multiply the geometric mean on slide 5 of the STAR request 1 for the NCS by 1 minus the proportion zero and plot against the GLIM.

Rationale: The panel wanted to see if the increasing proportion of zeros in the NCS CPUE caused the difference between the GLIM and the geometric mean time series.

Response: A continuation of request 15 that examined the effect of different treatments of zeros in the NCS CPUE (see request 19 and response for final resolution of issue)

17. For the base case, plot the gender ratio over time for ages 3+ in numbers from year 0.

Rationale: The panel wanted to see if there had been changes in gender ratio over time.

Response: The STAT plotted the gender ratio over time for the ORS, NCS and SCS. In all cases, the proportion of females was slightly higher than that for males, but there were no noticeable trends.

18. Provide a graph of main results with more informative confidence intervals.

Rationale: Sensitivity analysis focuses primarily on point estimates (the maximum posterity density) yet in some cases the results of the sensitivity runs relative to the base model should show the change (if any) of uncertainty for key parameters of interest (e.g., current stock size). For this reason, CVs or some other easy way to judge estimates of model uncertainty should be displayed.

Response: For the base case and each realization of the sensitivity trials, standard deviations were added to all tables reporting derived outputs (initial and terminal spawning output, depletion, and MSY) to provide a measure of the uncertainty around each point estimate. The STAT also presented to the STAR panel a figure comparing the CVs of the NCS base case versus the trial using the original (non-inflated) CPFV CPUE CVs. Much larger uncertainties were observed with the inflated CVs, except in most recent years (where it would count the most). The CPUE series stops in 1999, so it was not surprising that uncertainty increases afterwards. There was a strange period with stable CVs in the 1950s for base case which may have been due to the large catches in the late 1940s.

19. Plot the mean CPUE as shown in slide 22 of the STAR over the GLM values and the model results (expected and observed from base case over the slide 22 ln (cpue)).

    Rationale: This relates to requests 3 to 5 and 15 above to understand the differing trends between the GLM estimates and geometric mean estimates of CPUE.

    Response: The graphs provided by the STAT confirmed that the standardization was probably done correctly and that it was the geometric mean that was confusing the issue, having been calculated as the mean of the logs of the positive values and then exponentiated.

**Description of base case model and alternative models to bracket uncertainty**

The Panel agrees that the sub-stock configuration using Oregon (ORS), northern California (NCS), and southern California (SCS) model configuration is the most appropriate.

The NCS and SCS models include six fleets (two commercial and four recreational) and the ORS model includes four fleets (2 commercial and 2 recreational). The NCS and OCS (California) time series began in 1916, with the onset of commercial landings, while Oregon began in 1973. For the SCS, there were issues with the 1980 estimate of catch being nearly 4 times higher than 1979 and 1981. Because this estimate was derived from a new program, the Panel and authors agreed that a base model that uses the mean value for 1979 and 1981 for the 1980 estimate was preferred.

The base model includes the fishery-dependent CPFV Logbook CPUE (modeled through a GLM) for the California sub-stocks; the Oregon sub-stock model includes the Ocean Recreational Boat Survey (ORBS, 2001-2008). Note that changes in bag and size limits in California split the CPFV data into two series: 1) 1960-1999 and 2000-2008. The base model included the extra variance term added to the abundance indices (as specified in the document). Include available data on size (mean weight and length compositions) for each sub-stock assessment.

The underlying model is dis-aggregated by gender in order to capture the sex-specific differences in natural mortality (set to 0.25 $yr^{-1}$ for females and 0.3 $yr^{-1}$ for males). Data on gender-specific composition data were unavailable. The steepness parameter is also set to 0.7 for all base models. Recruitment residuals are estimated for 1970–2006 for all California sub-stocks and 1980-2006 for the Oregon sub-stock. The panel accepted the “tuned” recruitment variability ($\sigma_R$) and sample sizes of length and age compositions. Other details for the base model were agreed and are as specified in the document (i.e., Tables 17 and 18).

**Technical merits of the assessment**

This was a very thorough assessment, the team did a very complete analysis of all available fishery independent data and carried out many sensitivity runs to evaluate alternative model assumptions. The STAT team assembled all available data relating to both fishery and fishery independent time series data. The outstanding problem was that the traditional groundfish surveys provide very little information on cabezon trends since most of the biomass is concentrated in near-shore waters.

The STAT team proposed alternative assessment and management of nearshore fisheries to compensate for the lack of data required to perform traditional stock assessments. Alternative assessment procedures that require less data, but still provide relevant management outputs should be encouraged. This assessment provided examples of some approaches as applied to cabezon. Such side-by-side comparisons of simplified assessment approaches to the statistical catch-at-age model outputs are useful in understanding the relationship of alternative to traditional assessment methods in hopes of developing the best available scientific advice for management under data-limited situations.

The STAR panel encouraged the STAT team to explore less data intensive assessment methods and also to continue to improve spatial analysis to better define stock structure and distribution and geostatistical harvest control rules.

The STAR panel finds the assessment to be the best that can be produced with available data. The Panel recommends that future assessments be limited to updates until such time as the recommended research is accomplished, or new assessment methodology established. The STAR Panel doesn't recommend a new full assessment until there are improvements in the understanding of stock structure, mortality and growth parameters.

**Explanation of areas of disagreement regarding STAR panel recommendations**

**A. Among STAR panel members (including concerns raised by the GAP and GMT representatives**

There were no areas of disagreement among STAR panel members.

**B. Between the STAR panel and the STAT team**

There were no areas of disagreement between the STAR panel and the STAT team.

**Unresolved problems and major sources of uncertainty**

Stock structure is a major uncertainty that is being addressed with genetic studies and localized sampling. There is a need to increase sampling in near-shore waters so as to be able to determine the degree of stock separation. An absence of reliable fishery independent estimators complicates the assessment and makes it difficult to determine the absolute abundance of sub-stocks. The model results are sensitive to natural mortality estimates and there are considerable differences between males and females.

**Management, data, or fishery issues raised by the GAP and the GMT representatives**

GMT and GAP representatives commented that surveys in near shore areas are critical to better estimate abundance, and encourages the development of additional local monitoring surveys. There was discussion of working with commercial fishermen to develop potential cooperative indexing surveys to monitor population change.

**Prioritized recommendations for future research and data collection**

1. M seems high for both genders for a species of that size, shape and life habits. The current high estimates could be due to higher values at some ages or length. Tag – recapture studies currently being conducted are expected to be useful in that respect and should be used to estimate M. Information would be expected for the assessment cycle after the next.

2. Further tagging studies should be conducted to estimate growth, natural mortality, migration and to investigate stock structure, including for a larger portion of the distribution range.

3. Confirm/re-estimate the landings in 1980 in the RecFIN PBR which should include correcting the RecFIN database to avoid using unrealistic landings for that year in future assessments. Including the catch reconstruction from 1980 onwards, similar to what was done for lingcod.

4. Explore the shorter yet more detailed logbook data (digitized by license number) for CA from 1980 onwards (CPFV).

5. $B_{MSY}$ is very close to the limit reference point. This suggests that further general investigation of target and limit reference point is warranted. Reference points need to be re-evaluated.

6. Develop at least one reliable fishery independent survey possibly using longline or trap (no rockfish bycatch) survey. This could be a combined cabezon and lingcod pot survey designed to adequately cover the inshore distribution area and the closed areas.

7. Continue to develop alternative management procedures that do not require traditional stock assessment.

8. Look at environmental covariates for recruitment and time-varying growth and availability inshore.

9. Investigate the implications of the male guarding behaviour (re-defining spawning output).

10. Investigate non-lethal methods to determine gender and collecting sex-specific data.

11. Investigate further the abundance and distribution of cabezon larvae and juveniles in existing databases to better understand stock structure and linkages.

12. Investigate the usefulness of catches of cabezon in the man-made fishery on piers and jetties as an index of recruitment.

**Acknowledgements**

The Panel thanks Dr. Jim Hastie and staff at the NWFSC for their exceptional support and provisioning during the STAR meeting.