Greenspotted Rockfish
STAR Panel Report

Pacific Fishery Management Council
Southwest Fisheries Science Center
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Overview
A draft assessment of greenspotted rockfish (*Sebastes chlorostictus*) in U.S. waters off California was reviewed by the STAR Panel that met at the Southwest Fisheries Science Center (SWFSC) in Santa Cruz, CA, during August 8-12, 2011. Greenspotted rockfish is not a primary target species, but it ranks 7th in total landings south of Point Conception and 12th north of Point Conception. Although the Greenspotted rockfish is found from Copalis Head, Washington to Baja California, Mexico, the assessment is limited to California U.S. waters only, because the greatest abundance of the species is observed from Mendocino County in California to northern Baja California (data from Mexican waters are unavailable). No information is currently available on stock structure for this species, but the resource is modeled as two separate stocks (north and south of Point Conception) to account for differences in species biology and exploitation history in two areas.

The Panel operated under the Pacific Fishery Management Council's (PFMC) Terms of Reference for the Groundfish Stock Assessment and Review Process for 2011-2012. The assessment models estimated that the stock of greenspotted rockfish is at 37% of its unexploited level south of Point Conception, and at 31% of its unexploited level north of Point Conception. Depletion levels of both stocks were estimated above the overfished level of $SB_{25\%}$ but below management target of $SB_{40\%}$ and, therefore, the stocks are in the precautionary zone.

The STAR Panel agreed that the greenspotted rockfish assessment constitutes the best available scientific information on the status of the species in the assessed areas and recommends it to be used for status determination and management decision in the Council process.

Summary of data and assessment models
This is the first assessment for the greenspotted rockfish. Previously, a coastwide overfishing limit (OFL) for species was estimated via Depletion-Based Stock Reduction Analysis (DB-SRA) used for data limited stocks. The assessment includes two separate models – one is for the stock south of Point Conception (hereafter described as "Southern model") and the other for stock north of Point Conception (hereafter described as "Northern model"). Both models use the Stock Synthesis (SS) modeling framework (version 3.21f) and incorporate a variety of fisheries-dependent and fishery-independent data sources.

In the northern model, the fishery-dependent data are divided among four fisheries, including three commercial fleets (trawl, hook-and-line and net gears) and one recreational. The southern model includes five fisheries – three commercial (trawl, hook-and-line and net gears) and two recreational (CPFV and Private/Rental boats). In both models, fishery-independent data sources include the Northwest Fishery Science Center's (NWFSC) shelf-slope bottom trawl survey that has operated annually since 2003, and NWFSC Southern California hook-and-line survey that has operated annually since 2004. Both models utilize recreational CPUE indexes (1980-2001), while the northern model also includes an index derived from recreational CPFV data from California Department of Fish and Game's (CDFG) onboard observer program (1987-1998).

Both models are single sexed, since no evidence of sexual dimorphism in growth was found. Due to the limited amount of data available, a number of biological parameters (natural mortality, stock-recruit steepness, and a number of growth parameters) are fixed at externally estimated values. Annual recruitment is estimated as deterministic values from a Beverton-Holt model according to the fixed input steepness and the estimated R_0

Requests by the STAR Panel and Responses by the STAT
At the meeting, the Panel decided on a number of model runs for the STAT to undertake. These runs were designed to explore model behavior and identify the major axes of uncertainty to formulate alternative states of nature. The runs requested, and the rationales and the responses, are listed below. At the end of the meeting, the STAT and the STAR Panel agreed upon "new" base models.

Request № 1: Add 6% discard to the northern trawl removals.
Rationale: This catch was accidentally omitted in the pre-STAR base model.
STAT Response: Addition of the omitted catch had a minor effect. Estimated stock depletion changed from 32.7% of unfished spawning output to 32.6%.

Request № 2: If possible, get Hamel's prior on natural mortality (*M*) and compare with values of *M* from alternative methods for estimating natural mortality considered in the assessment.
Rationale: In both models *M* is fixed and the results are likely sensitive to this parameter. Hamel's prior on *M* would provide additional external information on parameter that is not possible to estimate within the assessment (due to limited amount of data available)
STAT Response: STAT made a number of attempts to obtain the prior during the STAR Panel week, but it was not possible (Owen was not available at that time).

Request № 3: Add length composition to fleets and surveys (in both models) where conditional age-at-length compositions are used.
Rationale: With age data input as conditional age-at-length compositions, length composition data can be fully utilized (fish are not being double counted).
STAT Response:
<u>Northern model:</u> Length compositions associated with conditional age-at-length data for the NWFSC trawl survey and recreational CPFV fleet were added. The estimated growth curve was more consistent with the data (length at Amin increased and von Bertalanffy *k* decreased). Notable changes were observed in selectivity parameters which included a shift in the peak of the NWFSC trawl survey toward maximum length, and a decrease in the descending width of the dome-normal curve for the recreational fishery. Maximum annual F for the hook-and-line fishery increased from 0.32 to 0.49. Depletion dropped from 32.6% to 29.9%.
<u>Southern model:</u> Length compositions associated with conditional age-at-length data for the NWFSC trawl survey and NWFSC hook-and-line survey were added. Growth parameters remained fixed for this run (as in the pre-STAR base). No major changes were observed, apart from a decrease in the descending width of the selectivity curve for the CPFV fleet.

Request № 4: Estimate all growth parameters for the <u>southern model</u>.
Rationale: In pre-STAR configuration of the southern model all growth parameters (except for CVs of lengths at Amin and Amax) are fixed at the externally estimated values; however, the addition of length composition data may make growth estimable.
STAT Response: Estimated growth parameters suggest slower growth than external fits to the length and age data. The change produced a large effect on estimated stock status, with depletion

now estimated at 26.8% compared to the base model estimate of 34.5%. Selectivity parameters also changed, but the results did not appear to be inconsistent with expected patterns.

Request № 5: Conduct a run with NWFSC survey selectivity in the southern model to be asymptotic while still estimating growth.
Rationale: To explore how the selectivity pattern affects growth parameter estimation.
STAT Response: Fixing NWFSC trawl survey selectivity asymptotic resulted in slightly slower growth (k=0.036) relative to results from request 4 (k=0.04). It also resulted in reduced estimates of current stock depletion from 26.8% to 23.2%. The descending limbs of both recreational fleets' selectivity curves were slightly shifted to the right, as was the curve for the NWFSC hook-and-line survey. The width of the descending limb of selectivity curve for the trawl fleet (for the time block starting at 2001) also increased. Maximum estimated fishing mortality rate for the recreational CPFV fleet increased from 0.20 to 0.25.

Request № 6: Conduct a run with M fixed at: (a) 0.05 and then (b) 0.08 in the northern model while allowing the asymptotic trawl selectivity pattern to change (change the ascending limb of the selectivity curve first and then explore dome-shaped selectivity).
Rationale: To better understand the pattern exhibited by the length composition data.
STAT Response: Selectivity curves for the northern model were significantly affected by changing the natural mortality rate from the base model value (0.065). Fixing M at 0.08 resulted in a gradual shift toward selection of smaller fish in the northern trawl fishery, which is consistent with visual patterns in the data. However, selectivity for the hook-and-line fleet after 1988 shifted far to the right under the higher natural mortality rate, so much so that peak annual F for the fleet rose to 1.45. This fishery is a minor component relative to the trawl, so alternative configurations for selectivity should be considered in subsequent runs. Peak selectivity for the recreational fishery also shifted toward larger fish, with an abrupt decline near 40 cm length. Individual growth rates are negatively correlated with M. Fixing M at 0.05 results in better fits to the recreational CPFV length composition data, but estimated trawl selectivity patterns no longer reflect the increasing selection of smaller fish over time. Estimated length at Amin (age 7) is more consistent with the observed length-at-age data when M=0.08. When shape of the trawl selectivity is allowed full flexibility with M=0.05, the data still support essentially asymptotic curves. With M=0.08, trawl selectivity shifts to a dome-shape for all time blocks. The ascending limb of each time block follows observed patterns in the data as well. Fishing mortality rates for the hook and line fishery still exceed 1, and the fit to recreational data again degrades with higher M. Individual growth is well-estimated (reasonable size at age 7), similar to the models with asymptotic trawl selectivity and M=0.08.
In general, it appears that the recreational composition data prefer a lower M, while the trawl data are more consistent with a higher M. Since the recreational fishery appears to select smaller fish, an increase in M with size or age could possibly explain the conflict between these two data sources under a constant M assumption.

Request № 7: Provide profiles on M for both models by data source.
Rationale: To better understand consistency of data from different sources.
STAT Response: Profiles were created for models containing all length composition data (*Request № 3*), catch data (request 1), internally estimated growth parameters (*Request № 4*), and asymptotic selectivity for the NWFSC trawl survey (*Request № 5*).

Request № 8: Provide sensitivities to historical catch estimates by varying catch back to 1969 ±25% and ±50%.
Rationale: To explore model sensitivity to uncertainty in catch history.
STAT Response: The STAT will provide those runs for the final post-STAR base model.

Request № 9a: Southern model: Conduct a run with $A_{min} = 0$, and $A_{max} = 999$.
Request № 9b: Southern model: Conduct a run with $A_{min} = 4$, and $A_{max} = 999$.
Rationale: To examine effects of change in input parameters on growth estimation.
STAT Response: Results from request 4 were the starting point for this request. 9a: Estimated von Bertalanffy growth parameters were 2.3 cm at age 0, asymptotic length of 60 cm, and growth coefficient (*k*) of 0.034. In SS, distributions of size at age are accumulated up to the lower edge of the smallest population length bin (R. Methot, pers. comm.). The effect of this will be negligible for greenspotted rockfish, as fish of this size and age are not selected by any surveys or fisheries. The revised growth curve appears to fit the NWFSC trawl survey data better. The age composition data are better fit in the results for request 9a, but there is a larger degradation of fit to the length compositions, resulting in a lower total likelihood. 9b: The estimated growth curve from request 9b is almost identical to 9a, with the exception that length at age zero is now constrained to equal 4cm (the lower edge of the smallest population length bin). With this parameterization of the growth curve, the descending width parameterization of the selectivity curves for the NWFSC trawl survey decreases, but there is little actual change in the curve, and almost no change in likelihood relative to request 9a.

Request № 10a: Southern model: Fix all growth parameters from request 4 except CVs, and set growth CVs to those estimated in request 3.
Request № 10b: Southern model: Fix growth CVs to those from request 3, and estimate the rest of the growth parameters.
Rationale: To examine effects of growth parameters on model output (i.e. depletion).
STAT Response: 10a: Fixing length at Amin, length at Amax, and *k* at values from *Request №4*, and fixing CVs at values from *Request №3*, resulted in a significantly degraded fits to the age and length composition data. Relative spawning output (depletion) was reduced from 26.8% (see Request 4) to 23.1%, illustrating the sensitivity of models driven by composition data to variability in population growth. Maximum F increased by 34%, with annual F for the recreational CPFV fleet peaking at 0.29, compared to 0.22 in the model from request 4.
10b: STAT fixed the growth CVs at the values from request 3, but allowed the model to estimate the other 3 growth parameters. Fixing the CVs resulted in a visually improved fit to younger/smaller fish caught by the NWFSC trawl survey, relative to the estimated growth curve from request 4. The likelihood component for the age composition data is smaller (317.4) with CVs fixed from request 3 than it is when CVs are estimated (320.9; request 4). Of course, fixing the two parameters results in a higher total likelihood which is driven by an approximately 10-point increase in the negative log likelihood for the length composition data. Spawning output is estimated at 22.9% of the unfished level.

Request № 11: Northern model: Run the model with no blocks on hook-and-line fishery selectivity (with all length data in, *M* fixed at 0.065).

Rationale: To explore effect of blocks in selectivity on model output; evaluate the need for blocks in hook-and-line fishery (given the limited amount of length composition data).
STAT Response: The fits to the hook-and-line data do not seem to be strongly affected by the assumption of constant selectivity, even though the peak of the selectivity curve shifts more than 4 cm to the right of the estimated peak from request 3. Stock depletion is essentially unchanged from request 3. Maximum F decreases slightly, from 4.9 to 4.7 in the hook and line fishery. The change (no time blocks in hook-and-line gear) was retained for the "new" base model.

Request № 12: Northern model: Conduct a model run (above) with NWFSC selectivity peak fixed at the level estimated from the model with lower *M* (0.05).
Rationale: To better understand pattern (peak parameter hitting the upper bound) observed in NWFSC survey selectivity.
STAT Response: Patterns in the length residuals for the trawl survey are largely unchanged. A minor decrease in the quality of fit to the age composition data occurs, relative to *Request №3*. Maximum F decreases to 0.41 in this model.

Request № 13: Northern model: Conduct a model run with NWFSC selectivity freely estimated (keeping selectivity at smallest size fixed at 0).
Rationale: To better understand pattern (peak parameter hitting the upper bound) observed in NWFSC survey selectivity.
STAT Response: Residuals are unchanged relative to request 3 and the peak of the freely estimated curve hits the upper bound.

Request № 14: Southern model: Fix three growth parameters at base case from request 3, and profile over CVs from 0.1 to 0.2 with old and young equal, all for *M* from 0.05 to 0.1. Display contours of likelihood and depletion, for three values of steepness.
Rationale: To explore effect of different growth parameters on model derived quantities, help determine major axis of uncertainty for the decision table.
STAT Response: There is a clear minimum in negative log likelihood (NLL) at CV of length at age = 0.15. NLL declines as *M* declines to 0.05. NLL declines as values of *h* go from 0.59 to 0.76 then 0.93.

Request № 15: Northern model: Use a logistic curve for the selectivity of the NWFSC survey.
Rationale: To explore whether logistic selectivity parameters will be more (than double-normal) consistent with length composition data.
STAT Response: With the logistic curve, the peak of the selectivity was more consistent with the composition data from the trawl survey. The logistic selectivity curve was retained for the "new" base model.

Request № 16a: Northern model: Conduct a model run with A_{min} set to 4 years (instead of 7 years in pre-STAR base case), growth parameters estimated.
Rationale: To explore the effect of different Amin values on growth estimation.
STAT Response: This removes the "dog leg" from the fitted growth curve.

Request № 16b: Northern model: Conduct a model run with A_{min} = 0 and A_{max} set to 999, with growth parameters estimated.

Rationale: To explore the effect of changes in growth settings on growth parameter estimation.
STAT Response: Length at A_{min} hits the lower bound of 0.01.

Request № 17: Northern model: Repeat a run from 16b, while fixing length at A_{min} at 0.01.
Rationale: To confirm no differences between 16b and 17.
STAT Response: As expected, the run caused no differences from 16b. These settings of growth parameters were retained for the "new" base case.

Request № 18: Northern model: Produce a contour plot of likelihood and depletion vs. *M* and *h*.
Rationale: To determine major axes of uncertainty.
STAT Response: There is a lower NLL as *M* declines to 0.05, and lower NLL as *h* goes to 1.0. NLL declines toward high steepness and low *M*, but is not sensitive to steepness for *M* near 0.1. These results present no compelling reason to depart from the base case of *M*=.065 and *h*=0.76. They suggest that *M* be the major axis of uncertainty in defining states of nature.

Description of the base model and alternative models used to bracket uncertainty
Northern model
Start year of the model =1916; unfished equilibrium in 1915; one area; one gender; discard incorporated with landings into total removals for the period from 2002 through 2010 (no discards assumed prior to 2002); *M* fixed at 0.065 yr^{-1};
Von Bertalanffy growth model, length at Amin fixed at 0.01, other growth parameters estimated; Beverton-Holt stock-recruitment model, *h* fixed at 0.76 (Dorn's prior), R_0 estimated but no recruitments deviations estimated;
Length-based selectivity for all fleets, commercial trawl selectivity is blocked between 1987 and 1988 to reflect change in length composition data, and between 2002 and 2003 to account for implementation of the Rockfish Conservation Area (RCA).

Fisheries:
- Commercial trawl
- Commercial hook-and-line
- Commercial net gears
- Recreational

Abundance indices:
- NWFSC shelf-slope bottom trawl survey (2003-2010)
- NWFSC Southern California hook-and-line survey (2004-2010)
- RecFIN CPUE (1980-2001)
- CDFG onboard observer index from recreational CPFV data (1987-1998)

Length frequencies:
- Commercial trawl
- Commercial hook-and-line
- Commercial net gears
- Recreational
- NWFSC shelf-slope bottom trawl survey

Age frequencies:
- Recreational
- NWFSC shelf-slope bottom trawl survey

Southern model

Start year of the model =1916; unfished equilibrium in 1915; one area; one gender; discard incorporated with landings into total removals for the period from 2002 through 2010 (no discards assumed prior to 2002); *M* fixed at 0.065 yr^{-1};

Von Bertalanffy growth model, CVs of lengths at Amin and Amax are estimated, all other growth parameters are fixed at the externally estimated values;

Beverton-Holt stock-recruitment model, *h* fixed at 0.76 (Dorn's prior), R_0 estimated but no recruitments deviations estimated;

Length-based selectivity for all fleets, trawl, hook-and-line, recreational CPFV and Private/Rental fleet selectivity are blocked between 2000 and 2001 to account for implementation of the Cowcod Conservation Area (CCA).

Fisheries:

- Commercial trawl
- Commercial hook-and-line
- Commercial net gears
- Recreational CPFV
- Recreational Private/Rental

Abundance indices:

- NWFSC shelf-slope bottom trawl survey (2003-2010)
- NWFSC Southern California hook-and-line survey (2004-2010)
- RecFIN CPUE (1980-2001)

Length frequencies:

- Commercial trawl
- Commercial hook-and-line
- Commercial net gears
- Recreational CPFV
- Recreational Private/Rental
- NWFSC shelf-slope bottom trawl survey
- NWFSC Southern California hook-and-line survey

Age frequencies:

- NWFSC shelf-slope bottom trawl survey
- NWFSC Southern California hook-and-line survey

The STAT and the STAR Panel discussed various alternatives for capturing the major axes of uncertainty for this assessment. There was widespread agreement that natural mortality (which strongly covaries with growth parameters and depletion) is the single greatest source of parameter uncertainty in both models. Consequently, the decision was made to bracket model uncertainty with alternative values for natural mortality.

The natural mortality values for greenspotted rockfish estimated using different methods are available from Benet et al. (2009). In the assessment, the mean value (0.065) of those estimates was used for both models. The ranges of *M* reported in Benet et al (2009) were approximately from 0.05 to 0.08. This range was interpreted as a 90% confidence interval of a normal distribution (mean=0.065, std. dev. =0.00912), and high and low states of nature for the decision table were defined based on *M* values (used in base models) plus and minus 1 standard deviation from the mean (M = 0.056 and M = 0.074 were used for low and high states of nature respectively).

Technical merits
This is the first assessment for the greenspotted rockfish. Previously, a coastwide OFL for species was estimated via DB-SRA used for data limited stocks.

The assessment evaluated available information on biology of the species (particularly differences between populations south and north of Point Conception) and fishery removals, and made an attempt to incorporate the differences by developing separate assessments for northern and southern areas.

This is a relatively simple model within SS, with a number of essential parameters (such as *M*, *h* and recruitment deviations) which are fixed, due to the limited amount of data available. The assessment, however, uses the most up-to-date external information to inform these parameters in the model, including the most recent prior on the stock-recruitment curve steepness (Martin Dorn, pers. com.).

Technical deficiencies
The data are too limited to allow estimation of important parameters such as *M*, *h* and recruitment deviations, which limits the extent of uncertainty estimated within the model. The model therefore, requires careful and extensive sensitivity testing and profiling.

Areas of disagreement regarding STAR Panel recommendations
There were no disagreements among STAR Panel members (including GAP, GMT, and PFMC representatives). There were also no disagreements between the STAR Panel and the STAT.

Management, data, or fishery issues raised by the GMT or GAP representatives during the STAR Panel Meeting
There were no management issues noted by GMT and GAP which impacted the assessment.

Unresolved problems and major uncertainties
The assessment focuses on greenspotted rockfish found in U.S. waters off California, even though the range of the species extends into Mexican waters (to northern Baja California). The relationship between greenspotted rockfish populations found and harvested in the U.S. and in Mexico is unclear. It is not known what portion of greenspotted population resides in Mexican waters and what their biological and life history characteristics are.

As with most of the west coast rockfish species, catch history is one of the major sources of uncertainty. Even with the California rockfish catch reconstruction effort reported in Ralston et al. (2010), uncertainty in historical landings remains due to fact that fishing effort exhibited a gradual shift towards deeper waters. Species composition sampling in Southern California began only in the late 1970s, and these compositions were applied to historical landings of multi-species market categories. Therefore, there is the potential to overestimate the historical contribution of slope species to overall landings of mixed-species market category (i.e. unspecified rockfish), and underestimate the contribution of shelf species, such as greenspotted rockfish.

Also, reliable fishery-independent information is essential for any stock assessment. Survey efforts on the U.S. west coast are currently closed in the CCA. This produces limitations to effectively utilize survey data and reduces the ability to accurately describe dynamic of the species.

The assessment treats the resource as two separate stocks, geographically stratified south and north of Point Conception with no linkage between the two areas. The break point between stocks was largely selected based on differences in regional exploitation history and general biogeographic considerations, as well as potential differences in growth and maturity. Further study is needed to validate regional differences in biological parameters for this species. In the absence of information on greenspotted rockfish population genetics, the uncertainty regarding stock structure of this species remains. It is possible there is only one stock that exhibits a gradual cline in life history parameters, as is observed in other rockfish species on the U.S. west coast.

Recommendations for future research and data collection (not prioritized)

To address uncertainty regarding the portion of the greenspotted rockfish population residing in Mexican waters, the Panel suggests an attempt should be made to document catches taken in Mexican waters by both U.S. and Mexican fishers, and to consider the implications of there being a single shared stock. The Panel also suggests exploring alternative sources of information (i.e. to investigate whether there are relevant studies conducted at Universities in Mexico), that could yield information on biology, life history and exploitation of greenspotted rockfish that could be used in the next assessment.

The Panel recommends devoting additional efforts to reconstructing historical landings. This recommendation applies to most groundfish species on the U.S. West Coast (and not only greenspotted rockfish). In addition to providing the best reconstructed catch histories by species, this effort should develop alternative catch streams that would reflect differences in data quantity and quality available for different time periods. Such (more realistic) alternative catch streams would be very useful while exploring model sensitivity to uncertainty in catch history (rather than applying a simple multiplier to entire catch time-series, which is currently the case for most groundfish assessments). Taking into account a spatial shift in fishing efforts to deeper waters would be a significant improvement to catch reconstruction of greenspotted rockfish and other species landed in mixed-species categories. Also, existing reconstruction efforts focus entirely on historical landings, although discard has been a significant portion of removals for many species on the U.S. west coast. The Panel recommends devoting efforts to reconstruct historical discard as well.

Both the STAR Panel and the STAT agreed that alternative means of exploring relative or absolute abundance in the CCA is a key research priority. Submersible or other non-invasive survey methods could potentially provide additional information on habitat and abundance for this species. Also, it is important to develop alternative methods to monitor length and age compositions of fish inside CCA.

The available data were limited (especially for the southern region) to reliably estimate growth, therefore, consideration of ageing available otoliths should be a priority. The Panel noted that ageing of historic samples (and future samples) would only be useful if samples were representative of the population. This needs to be examined before undertaking time-consuming and costly ageing work.

It is important to further explore stock structure and spatial variability of life history parameters of greenspotted rockfish, since currently only limited (or not species-specific) information is available. The Panel also recommends exploring alternative model structures to account for spatial pattern in species biology, including the model with one stock assumption, model with two areas (with linkage between areas), several growth assumptions and others. Given this recommendation, the Panel suggests conducting a full assessment next time the species is assessed to allow exploration of model structure (which would be impossible in the case of an update assessment).

Acknowledgements
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References

Benet, D. L., E. J. Dick, and D. E. Pearson. 2009. Life history aspects of greenspotted rockfish (*Sebastes chlorostictus*) from central California. NOAA Technical Memorandum NMFS, NOAA-TM-NMFSSWFSC-466.

Ralston, S., D. Pearson, J. Field, and M. Key. 2010. Documentation of the California catch reconstruction project. NOAA Technical Memorandum NMFS. NOAA-TM-NMFS-SWFSC-461.