

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STOCK ASSESSMENTS
FOR 2009-2010 GROUND FISH FISHERIES

The Scientific and Statistical Committee (SSC) reviewed eight stock assessments and the associated Stock Assessment Review (STAR) Panel reports. Six of these were full stock assessments and two were updated assessments. The SSC evaluated each stock assessment in terms of whether it represents the best available science and whether it satisfies the Terms of Reference for Groundfish Stock Assessments. In some cases, the SSC has identified additional information which needs to be included in the assessment reports before they are finalized and included in the Stock Assessment and Fishery Evaluation (SAFE) document. Moreover, all stock assessment reports will be reviewed by STAR Panel Chairs for consistency with the Groundfish Terms of Reference prior to being submitted to the Pacific Fishery Management Council (Council) Staff for inclusion in the SAFE.

The outcomes of the assessments are summarized in terms of relative biomass (the ratio of current to unfished spawning output; also referred to as “depletion”) and, in particular, how current spawning stock biomass relates to the Council’s management target of 40% of unfished spawning output ($0.4B_0$) and its overfished threshold for groundfish species of 25% of unfished spawning stock biomass ($0.25B_0$). An evaluation of whether overfishing has occurred in recent years is also provided for each stock. The SSC identified a base-model, “low” and “high” states of nature, and the resulting decision table for use in Council decision making for each acceptable full stock assessment.

The SSC acknowledges the great amount of work put forth by all the assessment authors and thanks them for their efforts. As a whole, the assessment documents were much more thorough and of higher quality than during the previous cycle and they more closely followed the Terms of Reference. Finally, the SSC notes that convening STAR Panels which consider only two stocks undergoing full assessment reviews was much more manageable and resulted in a more in-depth and rigorous review.

The assessments raised several general issues that require further work, preferably before the next round of assessments. These issues are listed in the SSC statement on off-year science improvements (Agenda Item G.2.c, Supplemental SSC Report).

NORTHERN BLACK ROCKFISH

The SSC reviewed the assessment, the STAR Panel report and a statement by the Washington Department of Fish and Wildlife (WDFW) for black rockfish (*Sebastes melanops*) north of Cape Falcon, Oregon. A presentation of the assessment was provided by Mr. Farron Wallace and Dr. Theresa Tsou (WDFW) and some of the key considerations during the STAR Panel were highlighted by the Panel Chair (Dr. Owen Hamel). The last assessment of this stock was conducted in 1999. The 2007 assessment was based on fitting the estimates of abundance and catch-rates from tagging, along with age- and length-composition data for the trawl fishery, the non-trawl fishery and the sport fishery. Substantial new information has become available since

the 1999 assessment, including revised catch data, discard estimates, recent length and age data, and recent tagging information.

During the STAR Panel meeting, the stock assessment team (STAT) and STAR Panel agreed on a base-model. However, following the STAR Panel meeting, and having informed the STAR Panel, the STAT created an alternative base-model in which the natural mortality for mature females (>15 years) was 0.24yr^{-1} rather than the STAR base-model value of 0.20yr^{-1} . The STAT noted that this model fitted the data better than the final STAR base-model and the STAR Panel Chair agreed that had this alternative model been provided during the STAR Panel, it would likely have been selected as the base-model given the STAT support for it. The SSC agrees that the alternative base-model should supplant the base-model selected during the STAR Panel. The STAT also provided evidence that the “low” state of nature (mortality for females increasing from 0.12 to 0.16) led to a very poor fit to the data. The SSC recommends that the “low” and “high” states of nature be replaced by scenarios in which female natural mortality increases from 0.12 to 0.18 (“low”) and 0.19 to 0.28 (“high”). The change to the “low” and “high” states of nature will necessitate a change to the decision table and the assessment report.

The alternative base-model estimates that the spawning output of black rockfish north of Cape Falcon has been increasing over recent years and is currently above the Council management target of $0.4B_0$ (projected 2007 spawning output 55.2% of B_0). This assessment also indicates that overfishing has not occurred in recent years.

The SSC endorses that the alternative base-model and decision tables based on the revised “low” and “high” states of nature can form the basis for Council decision making. The “low” and “high” states of nature should be considered to be equally likely and half as likely as the alternative base-model. Given the uncertainty associated with the allocation of historical catch to species, and the inability to fully utilize the tagging data in the assessment, the SSC recommends that northern black rockfish again be a full assessment for the next assessment round.

CANARY ROCKFISH

The SSC reviewed the canary rockfish (*Sebaster pinniger*) assessment and STAR Panel report. A presentation was provided by Dr. Ian Stewart of the Northwest Fisheries Science Center (NWFSC). The previous canary rockfish assessment was done in 2005. New data added to the assessment model included NWFSC survey data from 2003 to 2006, and coast-wide pre-recruit indices during 2001-2006. Ageing of both historical and recent otolith samples added substantial new age data to the assessment. Although these new data are not highly influential, they do address issues identified during previous assessment reviews.

In this assessment (and in previous assessments) fishery selectivity was modeled in multi-year time blocks with changes in selectivity allowed between blocks. In contrast to the previous assessment, where blocks were defined arbitrarily to improve model fit, the current assessment defined selectivity blocks according to major management actions. Both the STAT and the STAR Panel considered this to be a more objective and rigorous approach to defining selectivity blocks, and the SSC endorses this decision. A result of this change is that the best overall fit to the data now occurs at a much higher stock size than the previous assessment. In addition, the estimate of steepness, which previously had been precisely estimated at a low value, was now

higher and less precisely estimated. However, the data were not entirely consistent. Composition data (length and age data) fit best at high stock size (and high steepness), while the trend from triennial trawl survey fit best at low stock size (and low steepness). Since steepness was no longer reliably estimated by the model, the STAR Panel and STAT agreed that the best approach was to use the meta-analysis of steepness to identify a base model and “high” and “low” states of nature.

These revisions to the model produced a consistent pattern of underestimating the first half of the triennial trawl survey index and overestimating the more recent portion. The STAT and STAR Panel identified a potentially important shift in the seasonal timing of the Triennial trawl survey in 1995, and developed a model with two survey catchability blocks to allow catchability to change as a result of this shift. This model eliminated the pattern in the fit to the survey index, had relatively minor impact on model results, and was adopted by the STAT and STAR Panel as the base model. While the SSC accepted this decision for the current assessment, because of the broader implications to other assessments that use this time series, a high priority should be given to further examination of trawl survey data to support the change in catchability (see Agenda Item G.2.c, Supplemental SSC Report).

The base model estimates that spawning stock biomass has been increasing from a minimum of 13% of B_0 in 1994 to 32% of B_0 at the start of 2007. These features represent a significant change from the previous assessment. For example, in the 2005 assessment, spawning stock biomass was estimated to be between 6% and 11% of B_0 at the start of 2005. Fishing mortality rates have been less than 1% since 2001, indicating that overfishing has not occurred since then. The rate of increase is highly dependent on the value of steepness, and moreover the rate of increase is projected to slow as weaker recruitments in recent years begin entering the mature population.

The identification of stock-recruit steepness as the major axis of uncertainty is an important qualitative change from the previous assessment. However, canary rockfish stock-recruit dynamics cannot be fully explored without incorporating Canadian data into the assessment. Joint work with Canada should be considered for the next assessment.

The SSC endorses the decision table with base model and “high” and “low” states of nature as the best available science to provide the basis for Council decision-making. The “low” and “high” states of nature should be considered to be equally likely and half as likely as the alternative base-model. The SSC recommends that canary rockfish be considered for an update in the next assessment cycle unless further examination of trawl survey data do not support the change in triennial trawl survey catchability or progress is possible on a transboundary assessment.

WIDOW ROCKFISH

The widow rockfish (*Sebastes entomelas*) assessment update was initially reviewed by the SSC Groundfish Subcommittee in June 2007. During that review, it was noted that two sources of landings over the 1991-2006 period were not included in the assessment update, namely 1) at-sea processing records and 2) bycatch estimates from observers.

Subsequently, the assessment database was updated to include these data and additional model runs were made. The SSC reviewed the revised runs – presented by Dr. Steve Ralston – and found that none of the key assessment results (including current relative biomass) was affected by inclusion of the additional landings data. Correspondingly, projection results were quite similar. The SSC endorses the use of the assessment results in support of management decisions.

In the next assessment cycle, widow rockfish would benefit from a full stock assessment. Projections indicate that the stock may be approaching its rebuilding target (0.4B₀). The Council's ability to classify this stock as "rebuilt" will be greatly enhanced if it is based on a full assessment. The SSC also encourages exploration of the use of the Stock Synthesis 2 (SS2) model in the next widow assessment to better handle the apparent area-specific growth rates and other modeling issues.

BOCACCIO

The SSC reviewed the bocaccio (*Sebastes Paucispinis*) assessment and STAR Panel report. The last full assessment of bocaccio was conducted in 2003 and was subsequently updated in 2005. The 2007 STAR Panel had expected a full assessment for this cycle; however, an update was delivered. The update continued to use the original Stock Synthesis 1 (SS1) model. Conversion to SS2, and exploration of concerns raised by the previous two STAR Panels would have been the main reasons for a full assessment.

The update had the same base model configuration as the original 2003 assessment and the 2005 update, but included: 1) refreshed landings, 2) recent length compositions, and 3) one new point for the California Cooperative Oceanic Fisheries Investigations (CalCOFI) survey. Assessment results indicated that the stock continued to increase. The 1999 year class is still a driving factor, and a larger than average 2003 year class appears to be evident based on updated Recreational Fishery Information Network (RecFIN) length composition data from Southern California. Rebuilding follows the same upward trajectory as was previously projected in 2003; spawning output has doubled since rebuilding started. Depletion in 2005 assessment was estimated at 10.7% in 2005, while depletion in 2007 assessment was estimated to be 13.8% in 2007.

The SSC endorses the bocaccio assessment for use in management; however, the same unresolved problems and major uncertainties remain as in the 2003 assessment. The SSC recommends that the next assessment should be a full assessment and should explore issues recommended by the past three STAR Panels.

COWCOD

The SSC reviewed the assessment and the STAR Panel report for cowcod (*Sebastes levis*) in the Southern California Bight. A presentation of the assessment was provided by Mr. E. J. Dick and the key points of the STAR Panel report by the STAR Panel Chair (Mr. Tom Jagielo). The last full assessment of this stock was conducted in 2005. The 2007 assessment was originally scheduled to be an update. At the update review in June, 2007, a number of technical issues were raised by the STAT and the SSC concluded that it would be appropriate to conduct a full assessment. The STAT was able to provide a full assessment for review at the STAR Panel in mid-July. Given the limited time frame it was not possible for the STAT to fully explore all issues which might have been addressed had cowcod originally been scheduled for a full assessment. This inability to fully explore all of the issues was recognized when the recommendation for a full assessment was made in June.

A number of changes were made from the 2005 assessment in terms of both data and model structure. Gear selectivity, which had been mis-specified in the 2005 assessment, was corrected and revised. The growth curve for cowcod was re-estimated based on corrected data. The commercial and recreational sectors were modeled as separate fisheries. Commercial landings were revised based on a new ratio estimator for historical commercial landings (1900-1968) and port level information from the Southern California Bight. In addition, the California Commercial Cooperative Groundfish Program (CALCOM) (1969-1985) landings estimates had been revised recently, and those changes were incorporated into this assessment. Significant changes were made to the spatial stratification and the model used to develop the Commercial Passenger Fishing Vessel (CPFV) logbook indices. Steepness changed from 0.5 to 0.6 in the base model based upon the expectation of the prior.

The base model agreed upon at the STAR Panel is based upon a stock-recruitment steepness value of 0.6. The “low” and “high” states of nature are based upon steepness values of 0.4 and 0.8 respectively. In addition, the CPFV index was excluded from the “high” state of nature, thus increasing the influence of the visual survey. The base model depletion in 2007 is 4.6% with a slowly increasing trend (~ 0.3% per year). The “low” and “high” states of nature have depletion levels in 2007 of 4.1% and 27.3%, respectively. This assessment supplants the 2005 assessment and the results are not comparable to that assessment due to structural changes identified in June.

The SSC endorses the base model and the decision table based on the “low” and “high” states of nature for Council decision making. However, the “low”, “base”, and “high” states of nature have not been assigned relative probabilities. Given issues with the CPFV index, the historical catch series, and the lack of time to fully address all issues, the SSC recommends that cowcod again be a full assessment for the next round of assessments.

CHILIPEPPER ROCKFISH

The SSC reviewed the assessment and STAR Panel report for chilipepper rockfish (*Sebastes goodei*) in the waters off California and Oregon. A presentation of the assessment was provided by Dr. John Field and the key points of the STAR Panel report summarized by the STAR Panel Chair (Dr. David Sampson). The last full assessment of this stock was conducted in 1998. Substantial new data have been incorporated into this assessment including a revised catch

reconstruction back to 1982 and extensive length and age composition data extending back to 1978. The model also included fishery-dependent indices of relative abundance based on trawl log-book and CPFV observer data, and fishery-independent indices based on AFSC triennial shelf and NWFSC shelf/slope bottom trawl surveys. A juvenile index of abundance from the Southwest Fisheries Science Center (SWFSC) Santa Cruz young of the year (YOY) rockfish survey and coastwide YOY rockfish survey was also used.

The current chilipepper rockfish assessment used Stock Synthesis 2 (v2.00c), and represents a substantial improvement over the last assessment. Sexes were modeled separately and selectivity was modeled using a double-normal selectivity curve for the recreational fisheries and catch-per-unit-effort (CPUE) indices. Growth was modeled as time-varying and blocked to correspond to shifts in Pacific decadal oscillation (PDO), which improved model fit. Steepness was fixed at the meta-analysis prior of 0.57 and natural mortality fixed at 0.16 and 0.20 for the females and males, respectively. The 1998 assessment used M of 0.22 and 0.25 for the females and males, respectively. The assessment model fit the age and length compositional data reasonably well, with poorer fits to the survey indices. In general, there were conflicting signals between compositional and survey data, although the strength in the 1999 year class supports the upward trend in triennial survey abundance indices.

The current stock assessment shows similar trends in biomass in comparison to the 1998 assessment. The overall magnitude of biomass is lower primarily due to a lower natural mortality assumed for the current assessment. In general, recruitment strengths are similar for both assessments.

The base model estimates that spawning stock biomass has declined since the early 1900s to a low of 26% of B_0 in 1999, but has subsequently increased to 71% in 2007 due to a very strong 1999 year class. As with many other rockfish, the stock-recruitment value of steepness represents the dominant axis of uncertainty. The “low” and “high” states of nature are based upon steepness values of 0.34 and 0.81, respectively, and represent 25% probability and half as likely as the base case. The base model depletion in 2007 is 71%, with a depletion of 46% and 81% associated with low and high states, respectively.

The SSC endorses the stock assessment and the decision table with base model and “low” and “high” states of nature as the best available science to provide the basis for Council decision-making. The SSC recommends chilipepper rockfish be considered as an update in the next assessment cycle.

DARKBLOTCHED ROCKFISH

The SSC reviewed the darkblotched rockfish (*Sebastes crameri*) stock assessment and STAR Panel report, which was greatly facilitated by a presentation provided by Dr. Owen Hamel. The new assessment supersedes the 2005 assessment and includes the following new sources of data: 1) updated landings from 1980-2004 and new landings estimates for 2005 and 2006, 2) updated 2003 and 2004 discard rate estimates, and a new 2005 estimate, 3) new 2005 and 2006 NWFSC slope trawl survey data, 4) addition of the 2003-2006 NWFSC shelf trawl survey, 5) new GLMM estimates for all surveys, and 6) a variety of conditional age-at-length data that were developed using consistent aging criteria over the 2004-2007 time period. In addition, the new assessment

eliminated AFSC slope trawl survey “super-years” and the Pacific Ocean perch survey (1979 and 1985) from the model. Retention curves are now estimated using full length compositions, rather than the average size, of discards. Collectively, these changes represent a substantial advance in the development of the darkblotched model.

The SSC makes note of the fact that the STAR Panel report identified a point of disagreement between the Panel and the STAT regarding the estimation of spawner-recruit steepness (h), a parameter that has a major influence on stock productivity. In particular, the STAR Panel preferred to fix this parameter at the median value of a “prior” distribution (i.e., $h = 0.50$) that was developed from a meta-analysis of US west coast rockfishes. In contrast, because the prior was developed without any influence from darkblotched rockfish, the STAT preferred to estimate steepness within the assessment model using the prior distribution, which yielded an estimate of $h = 0.60$. In this instance the SSC concurs with the STAT’s approach because it incorporates what appears to be meaningful information from the current stock assessment into the productivity estimate.

The assessment indicates that stock size in 2007 is currently 22% of the unfished level. In comparison, the last assessment estimated stock size to be 16% in 2005. The stock is rebuilding, with spawning output having increased by 68% over the last five years (i.e., 4,071 to 6,853), much of which has been based on strong 1999 and 2000 year-classes.

The STAT and STAR Panel agreed that natural mortality rate (M) represents the major axis of uncertainty in the stock assessment. The base model assumes $M = 0.07$, which was bracketed by values of 0.05 and 0.09 as alternative states of nature in a decision table analysis. Those results showed a wide range of potential stock sizes in 2007 (i.e., 2,891 – 15,092) but probabilities were not assigned to any of the states. The SSC notes that because this species is overfished and under rebuilding, results from a rebuilding analysis that will be presented at the October mop-up panel will be more definitive. The SSC endorses the darkblotched rockfish stock assessment as the best available science and recommends that it be used in managing the stock. The SSC recommends that darkblotched rockfish be considered for an update in the next assessment cycle.

ARROWTOOTH FLOUNDER

The SSC reviewed the stock assessment document and STAR Panel report for arrowtooth flounder (*Atheresthes stomias*). Dr. Isaac Kaplan (NWFSC) gave a presentation on the assessment. This stock was previously assessed in 1993 using a dynamic pool model that was based on limited data and did not provide estimates of absolute biomass or depletion. The new assessment, conducted using Stock Synthesis 2, is based on a much more comprehensive base of information, including age and length composition data and biomass indices from several surveys.

Because substantial but unrecorded quantities of arrowtooth flounder are discarded due to limited market opportunities, the catch history of arrowtooth flounder is highly uncertain. The rate of natural mortality, which differs between males and females, was the other major source of uncertainty identified during the STAR Panel review. These two sources define the alternate states of nature for the decision table in the assessment. The more productive state of nature is based on doubling the base-model catch history and has higher rates of natural mortality; the less

productive state is based on halving the base-model catch history and has lower rates of natural mortality. The alternate states of nature differ markedly in the optimum yields that the stock could support, from a low of 2,668 mt in 2009 for the low productivity state of nature to over 142,000 mt for the high state of nature. Probabilities were not assigned to the alternate states of nature but the probabilities associated with the high and low states of nature are much lower than 25%. The base model estimates that spawning biomass has always been above the management target and has been increasing in recent years due to an exceptionally strong 1999 year-class. Spawning biomass in the base model is estimated to be 79% of the unexploited level at the start of 2007.

The SSC endorses the base-model and decision table provided in the assessment document and recommends that they can form the basis for Council decision making. The SSC further recommends that the next assessment of this stock should be a full assessment so that there can be fuller exploration of the various sources of uncertainty identified in the assessment and during the STAR review. It is unlikely that status of this stock will need re-evaluation in the next assessment cycle.

PFMC
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