

## SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON FINAL STOCK ASSESSMENTS AND CATCH REPORTS

### **I. Catch Reports, Update Assessments and Data-Moderate Assessment**

The Groundfish Subcommittee met in Spokane on June 10 to review the catch reports and assessment documents. Representatives from the stock assessment teams (STATs) (Dr. Jason Cope – NWFSC, Felipe Hurtado-Ferro – UW, Dr. Melissa Haltuch – NWFSC, Kelli Johnson – UW, Christine C. Stawitz – UW) also attended the meeting, presented results from the assessments, and answered questions from the subcommittee. The Scientific and Statistical Committee (SSC) was briefed by its Groundfish Subcommittee regarding the following groundfish stock assessment items informing 2017-2018 management decision-making: (1) catch reports for three rockfish species managed under rebuilding plans (yelloweye rockfish, Pacific ocean perch (POP), and cowcod) (Agenda Item D.8, Attachment 9), (2) updated assessments for chilipepper rockfish, petrale sole, and sablefish (Agenda Item D.8, Attachments 6, 7, and 8), and (3) a data-moderate stock assessment for arrowtooth flounder (Agenda Item D.8, Attachment 5.)

The petrale sole and sablefish updates were conducted as a graduate course in applied stock assessment at the University of Washington, with Drs. Owen Hamel (NWFSC) and Melissa Haltuch providing training and guidance. The SSC would like to acknowledge the work by both the teachers and the students that went into these update assessments, which were very comprehensive and carefully prepared.

#### **Catch Reports**

The catch reports provide updated information on the rebuilding progress of yelloweye rockfish, POP and cowcod off the U.S. Pacific coast using data through 2014. The 2012-2014 total catches (landings plus dead discards) for all three species are estimated to be less than the annual catch limits (ACLs). Catches for all these species have declined since the start of the catch share program.

#### **Update Assessments**

##### *Chilipepper Rockfish*

The most recent full assessment of chilipepper rockfish was conducted in 2007. The current assessment represents the first update of that 2007 assessment. Changes from the 2007 assessment include using an updated version of the Stock Synthesis model, which results in better treatment of time-varying growth; updated historical catch estimates; a new 2003-2014 time block to account for changes in recreational fishery selectivity; updated maturity and fecundity relationships; updated ageing error estimates; and 8 additional years of data. Each of these changes is within the terms of reference (ToR) for updates, and caused minor changes to model results, which were consistent with the 2007 assessment. Recent recruitments have been higher than those seen in the early 2000s (following the strong 1999 year class), resulting in an upward trend in biomass.

The assessment update estimates a depletion in 2015 of 64%. The chilipepper rockfish update assessment represents the best available science for use in developing 2017-2018 management measures as a category 1 assessment. The SSC recommends that the next assessment of this stock be a full assessment due to the length of time since the last full assessment.

### *Petrale Sole*

The most recent full assessment of petrale sole was conducted in 2013; therefore, this update includes only two years of additional data. The draft petrale sole assessment update in the briefing book was revised slightly by the STAT to include additional age composition data and to account for several other minor adjustments. The subcommittee reviewed the revised model, which will ultimately be documented in a revised assessment document. The subcommittee requested that the STAT also include additional information to more fully document the transition from the 2013 model to the base 2015 assessment update.

The assessment update estimates a depletion in 2015 of 30.8%. The ten year projections, assuming that the ACL's are attained, predict that the relative depletion will range between 28 and 30% of the unfished level. Improvement in the estimated stock status (relative to the 2013 model projection) is attributed to greater strength of the 2006-2008 year classes, and a consistent increasing trend in the NWFSC trawl survey index.

The petrale sole update complies with the ToR for assessment updates and represents the best available science for use in developing 2017-2018 management measures as a category 1 assessment. The base update model indicates that the stock is above the  $B_{MSY}$  proxy of  $B_{25\%}$ . Since the SSC has previously recommended that a stock can be declared rebuilt based on an assessment update, the SSC recommends that petrale sole be declared rebuilt. The NWFSC trawl survey appears to be an excellent indicator of petrale sole trends, and should be monitored to evaluate the need for a new assessment. The SSC recommends the next assessment of petrale sole be an update assessment.

### *Sablefish*

The last full assessment of sablefish was in 2011. There were only minor changes to the 2011 assessment when updating to the new version of Stock Synthesis. All data inputs were updated, additional corrections to data were made (e.g. discards), and new software was used to generate survey indices using delta-GLMM models.

A more thorough review is needed of standardized procedures and new software used to produce fishery size and age compositions, used for the first time in the current assessment cycle, especially in the context of sablefish. Port sampling data for sablefish are more complicated than for other groundfish species because there is a complex set of size-graded market categories for sablefish and many of the fish are landed in dressed condition.

The draft sablefish assessment update in the briefing book was revised slightly by the STAT to add additional age data and to improve the data weighting procedures. The subcommittee reviewed the revised model, which will ultimately be documented in a revised assessment document. The assessment update estimates a depletion in 2015 of 34.5%. The assessment shows similar trends to that of the 2011 assessment. Data reweighting and model tuning caused the largest differences in biomass from the last full assessment, but these procedures followed current best practice and are permissible in update assessments. The sablefish update complies

with the ToR for assessment updates and represents the best available science for use in developing 2017-2018 management measures as a category 1 assessment. The SSC recommends the next assessment of this stock be a full assessment.

### **Data-Moderate Assessment**

The SSC was briefed on the subcommittee's review of the data-moderate assessment of arrowtooth flounder that was conducted by Dr. Jason Cope. These types of assessments are informed by data on catches as well as one or more indices of abundance. The SSC has endorsed two data-moderate assessment methods, extended Simple Stock Synthesis (XSSS) and Extended Depletion-Based Stock Reduction Analysis (XDB-SRA). A stock assessment review (STAR) Panel in April 2013 identified a set of review criteria for assessments conducted using XSSS and XDB-SRA (Agenda Item F.5.a, Attachment 2, June 2013).

The last assessment of arrowtooth flounder was conducted in 2007. The assessment of arrowtooth flounder presented to the SSC this year involved fitting a population dynamics model using three approaches: maximum likelihood estimation (MLE), Markov Chain Monte Carlo (MCMC) and XSSS. The latter two methods are Bayesian, which is the estimation framework on which past data-moderate assessments have been based. However, the assessment of arrowtooth flounder differed from past data-moderate assessments in that results of the 2007 assessment were used to inform stock depletion and selectivity was set based on the results of the 2007 assessment.

The SSC identified model scenarios in MLE and XSSS configurations of the assessment that merited further exploration. However, the SSC was unable to endorse any of the model runs presented in the draft assessment report as providing a suitable basis for management decision making for the 2017-18 management cycle. This is because the Bayesian analyses all exhibited results that were unexpected given the observed data or had reused the data inappropriately, and MLE-based approaches are not endorsed for data-moderate assessments. The difficulty in obtaining robust results using data moderate methods may be due to the history of light exploitation of arrowtooth flounder, and survey indices that show flat or increasing trends. The SSC commends Dr. Cope for the extensive work undertaken on the assessment of arrowtooth flounder, which will inform refinement of how data-moderate assessments are to be conducted in the future.

The 2007 assessment could be used as the basis for projecting overfishing limits (OFLs) for arrowtooth flounder. The SSC recommends providing new OFL projections using actual catches since 2007. These new projections will provide the best available science to support management decision making for 2017-18 fisheries. While the analyses included in the assessment report were not endorsed for management decision-making, there was no evidence that the stock is below the management target of 25% of unfished biomass. The SSC recommends that the next assessment of arrowtooth flounder be a full assessment given that the current assessment is eight years old.

## II. Full Stock Assessments

The Scientific and Statistical Committee (SSC) reviewed the full assessments of canary and darkblotched rockfish and received the reports from the STAR panel review that took place during April 27-May 1. Representatives from the assessment teams (Drs. James Thorson and Vladlena Gertseva—NWFSC) presented results from the assessments and answered questions.

### Canary Rockfish

The last full assessment of canary rockfish was conducted in 2007. Stock assessment updates were done in 2009 and 2011. A number of revisions were made to the data used for stock assessment, including 1) a new method of index standardization for NWFSC trawl survey using a geo-statistical delta-GLMM model, 2) a new steepness value (0.773) based on an updated meta-analysis of steepness, 3) a re-estimated relationship for maturity, 4) new ageing error tables, and 5) a re-estimated length-weight relationship. Ageing data based on surface otolith reads were added to the assessment using an ageing-error table appropriate to surface reads. This added about 10 years of historical ageing data to the model.

The new assessment is an innovative spatial model with three areas corresponding approximately to the waters off the states of Washington, Oregon, and California. Population trends by area can differ according to exploitation histories and deviations from a shared stock recruit relationship. Best practices for spatial models are not well developed; however, the SSC regards the model as a promising development. In future assessments, the SSC requests that greater attention be given to examining results by spatial areas in addition to the overall assessment, since results should be plausible locally as well as globally.

Dr. Thorson provided an addendum to the stock assessment that corrects an error in NWFSC trawl survey size composition used in the model. The annual size compositions were replicated in each area rather than using area-specific information. The correction had relatively little effect on assessment results (depletion in 2015 changed from 56.0% to 55.5% of unfished). A revised document will be made available in September with revised tables and figures.

Stock status is estimated to be at 55.5% depletion in 2015, which represents a substantial improvement in status from previous canary rockfish assessments. The primary factors driving the improvement in stock status are the use of a higher steepness value, the reduction in harvest due to the rebuilding plan, and above average recruitments in 2001-2003, and in 2007 and 2010. The relatively strong effect of steepness on estimated stock status is a reason for concern about the reliability of model results, since steepness is a relatively uncertain parameter value. However it should be noted that even a relatively low steepness of 0.6 (e.g., the low state of nature in the steepness decision table) results in a biomass estimate above the rebuilding target.

The SSC endorses the use of the 2015 canary rockfish assessment as the best scientific information available for status determination and management as a category 1 assessment. The canary rockfish spawning stock biomass is estimated to be above the  $B_{MSY}$  proxy of  $B_{40\%}$ , and has therefore achieved the rebuilding target. Two decision tables were provided in the executive summary, a table for different levels of steepness, and another for different levels of natural mortality of males and young females. Both of these parameters are relatively uncertain and strongly affect assessment results, and therefore both decision tables should be considered by the

Council when setting the ACL. Canary rockfish is recommended for an update when it is next assessed.

### Darkblotched rockfish

The last full assessment of darkblotched rockfish was conducted in 2013. Revisions that were made to the data used for stock assessment included 1) a new method of index standardization for NWFSC trawl survey using a geo-statistical delta-GLMM model, 2) a new steepness value based on an updated meta-analysis of steepness, 3) a new value for natural mortality, 4) an updated maturity at length relationship, 5) a re-estimated length-weight relationship, and 6) additional ageing data. Changes to the assessment model were relatively minor, but included a change from two fleets to three fleets, with at-sea hake fishery now modeled as a separate fishery, and a change from asymptotic selectivity for the shore-based fishery to dome-shaped selectivity.

The SSC identified a potential issue related to the inclusion of shrimp trawl size composition data with the shore-based fishery data, since these are very different fisheries. There was concern that these data had a large influence on the estimated selectivity of the shore-based fishery, which showed that the smallest fish (< 20cm) were about 10% selected. Dr. Gertseva presented results from a sensitivity run that demonstrated that even when the shrimp trawl data were excluded the selectivity of smallest fish was greater than zero, indicating the small darkblotched rockfish are also caught in other components of the shore-based fishery. While this result helped to alleviate the SSC concerns, the SSC nevertheless recommends that future darkblotched rockfish assessments explore models in which the shrimp trawl fishery is modeled separately.

The base model estimate for 2015 spawning depletion is 39%. Several factors were identified as being responsible for the slower than expected rebuilding of darkblotched rockfish, which were projected to be rebuilt by 2015. The model results were very sensitive to the addition of the 2014 NWFSC survey age composition data, which showed strong recruitment but reduced numbers of older mature fish. Furthermore, biomass index in the NWFSC survey for darkblotched rockfish has shown a slight downward trend during 2003-2014, with consistent drops in 2013, and again in 2014.

The SSC endorses the use of the 2015 darkblotched rockfish assessment as the best scientific information available for status determination and management as a category 1 assessment. Darkblotched rockfish is recommended for an update assessment during the next assessment cycle.

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