

## Excerpt from the SSC minutes of December 2015

### Bering Sea

Stock assessment results for BS cod were presented by the lead author of the assessment, Grant Thompson. Public testimony was provided by Chad See and Gerry Merrigan (Freezer Longline Coalition), who endorsed the PT recommendation and highlighted the increasing trends in survey biomass, survey abundance, and spawning stock size that are evident in survey results and model estimates as a result of recent strong year classes. They also pointed to stable or increasing trends in CPUE in the fishery and the upcoming CIE review as further reasons to stay with the status quo rather than accept a new model that would require a steep reduction in ABC.

Following PT and SSC recommendations, the author brought forward a model 14.2 (has been under development for two years), along with model 11.5 (has been used since 2011), updated with CPUE, catch at age, and catch at length data from the survey and fishery. Model 11.5 continues to use a fixed value of survey catchability that is no longer very credible and has poor retrospective performance. The author and PT agreed that model 14.2 is not yet ready for use and expressed hope that a CIE review in February 2016 will help resolve some of the issues identified with the model for next year's assessment.

Both models predict increasing biomass due to a number of strong year classes during the recent cold period. The estimated 2015 survey biomass was slightly lower than in 2014 but near the upper end of the range of values observed since 1977. The increases appear to be reliably estimated because several strong year classes are seen entering the fishery. Based on projections, biomass is expected to increase further in the near future.

The SSC is encouraged by the performance of model 14.2, with its improved retrospective performance, more credible estimates of catchability, and improved fits in most data components. However, results from this model imply a significant reduction in ABC. The SSC notes that there will be a CIE review of this assessment in February 2016. **Therefore, the SSC agrees with the author and PT to roll over the 2015 ABC, which is below maxABC estimated by the model, because of continuing concerns with the poor retrospective performance and the fixed survey catchability. The resulting OFL and ABCs are:**

Stock/ Assemblage	Area	2016		2017	
		OFL	ABC	OFL	ABC
Pacific cod	BS	390,000	255,000	412,000	255,000

The SSC reiterates its concerns with the current model (11.5) as summarized in our October minutes. The roll-over of the 2015 ABC is intended as an interim measure until a more thorough review of the new model (currently 14.2) by the CIE can be completed. Our expectation is that the review will help resolve some of the remaining technical concerns with the estimation of selectivity and catchability, and that it will result in an acceptable model for next year's assessment.

In addition, the SSC had several recommendations for the next assessment cycle:

- The SSC was encouraged by the author's explanation that dome-shaped selectivity may, in part, be explained by the possibility that some of older fish may be residing in the northern Bering Sea (NBS) at the time of the survey. This is supported by the size composition of the fish in the 2010 NBS trawl survey, which suggested that up to 40% of the fish in some larger size classes reside in this area, although the overall proportion in the NBS was small. The SSC encourages the author to further examine Pacific cod catches from trawl surveys conducted triennially by the National Marine Fisheries Service (NMFS) (1976-1991) and by the Alaska Department of Fish & Game (1996 to the

present) to monitor the distribution and abundance of red king crab and demersal fish (see: Hamazaki, T., Fair, L., Watson, L., Brennan, E., 2005. Analyses of Bering Sea bottom-trawl surveys in Norton Sound: absence of regime shift effect on epifauna and demersal fish. ICES Journal of Marine Science 62, 1597-1602). While the 2010 bottom trawl survey in the NBS found relatively few Pacific cod (3% of total biomass), it is possible that the proportion of Pacific cod that are outside the standard survey area was higher in other years. A second possibility is that older Pacific cod migrate to nearshore areas to feed in the summer, making them unavailable to the survey.

- The SSC noted that the iteratively tuned, time-varying parameters in the model have not been updated since 2009. The author confirmed that the currently assumed standard deviations of two dev vectors (log of age-0 recruitment and a parameter corresponding to the ascending part of the selectivity curve) may no longer match the standard deviations of these vectors, which could contribute to retrospective bias. The SSC looks forward to a new paper on this issue that the author is preparing.
- While the model selection criteria proposed by the author are reasonable, we note that these criteria do not take into account the model fit itself. Model fit and retrospective performance should be more strongly considered in the selection of a final model for specifications.
- Although the SSC has repeatedly stressed the need to incrementally evaluate model changes, the SSC did not intend this to imply an automatic preference for the status quo model (as implied by the authors criterion #1) if alternatives with better performance are available.

### Aleutian Islands

The Aleutian Island Pacific cod stock has been assessed separately from Bering Sea cod since 2013, and managed separately since 2014. There has been some effort to develop an age-structured model for a Tier 3 assessment, and one candidate model is presented here (15.7). The model has troublesome retrospective patterns, as well as unrealistic selectivity patterns and the SSC agrees that it is not yet suitable for setting reference points. Therefore the stock remains in Tier 5 for assessment and management. The assessment model used last year (version 13.4) is a simple random effects model of the trawl survey biomass time series. A variant of this model was requested by the PT in September (version 15.6), which included the IPHC longline survey CPUE series in addition to the trawl survey data. The model estimates a catchability coefficient for converting the IPHC relative abundance index (in numbers of fish per effective hook) into units of area-swept biomass. The SSC had concerns with this approach of combining an index of numerical abundance with a biomass estimate without considering differences in selectivity and changes in size composition over time. **We therefore concur with the PT to use the random effects model to set OFL and ABC based on a Tier 5 approach, as summarized below.**

Stock/ Assemblage	Area	2016		2017	
		OFL	ABC	OFL	ABC
Pacific cod	AI	23,400	17,600	23,400	17,600

Steller sea lion protection measures require an estimate of the proportion of the AI Pacific cod stock in Area 543 to set the harvest limit for this area. **The SSC concurs with the author’s recommendation to use the most recent estimate from the accepted model 13.4 to allocate 26.3% of the overall AI ABC, after subtraction of the State GHL, to the western Aleutians (area 543).**

We recognize that this assessment will receive a CIE review in February 2016 and look forward to the results. One additional recommendation from the SSC is to examine weights-at-age of Pacific cod by area.