

## Minutes of the BSAI Groundfish Plan Team

North Pacific Fishery Management Council  
605 W 4th Avenue, Suite 306  
Anchorage, AK 99501

Held at  
Alaska Fishery Science Center  
Seattle WA

### Bering Sea and Aleutian Islands Groundfish Plan Team Minutes

The Bering Sea and Aleutian Islands Team convened on Monday, November 17 at 3pm. Writing/rapporteur assignments were provided.

In attendance: Diana Stram, Mary Furuness, Liz Chilton, Lowell Fritz, Brenda Norcross, Kerim Aydin, Dana Hanselman, Bill Clark, Chris Siddon, Dave Barnard, Alan Haynie, Mike Sigler (co-chair), and Grant Thompson (co-chair)

#### *Ecosystem considerations*

Stephani Zador presented the Ecosystem Report Cards, Assessment, and Ecosystem Considerations. This year indices were presented to give “annual” pictures, completing the picture for 2013, and presenting a 2014 summary and a 2015 outlook; key highlights are presented in the Introduction. The 2015 outlook is based on projections of a newly-developed Regional Oceanographic Model with included ice and plankton dynamics (ROMS-NPZ), built as part of BSIERP and continued as part of NOAA Integrated Ecosystem Assessments and in conjunction with AFSC’s Recruitment Processes Alliance. Only temperature results were presented, but the authors expect to expand predictions to other areas in coming years. The authors expect to make detailed results available for individual stock assessment scientists to develop indicators suited to specific results.

Concern was expressed that the index of Trawl Disturbance Area should be better examined, as known decreases in effort in the Aleutian Islands did not show a corresponding change in the index. The index counts any spatial cell that was “touched once” by a trawl; thus, if trawling effort is substantially reduced but spread out, this index would not capture that.

**The Team recommends exploring alternate versions of the index, including versions that count the number of times a particular cell was fished in, to produce a (potentially) more meaningful indicator.**

#### *Eastern Bering Sea pollock*

Jim Ianelli presented the EBS pollock assessment.

Highlights from data:

- 40% catch taken in A season (proportion has been consistent since 1992)
- Catch of pollock in other fisheries exceeds catch of all non-pollock species taken in the pollock fishery
- Consistent 50:50 sex ratio in both A and B seasons
- Roe production since 2010 has been below average from 2011-2014
- This year’s fishery was finished by the end of September
- Fishery age compositions show that the 2008 year class is very strong
- 2014 was a warm year in the EBS

- Kotwicki and Lauth (2013) examined pollock distribution relative to temperature: pollock tend to avoid the “cold pool,” although there appears to be some exceptions in 2012-2013
- Bottom trawl survey (BTS) biomass in 2014 is second highest in the time series
- This year’s BTS age compositions also show that the 2008 year class is very strong (more fish at age 6 this year than at age 5 last year; this has not occurred since the 1992 year class)
- Acoustic-trawl survey (ATS) shows above average biomass in 2014, up from 2012
- This year’s ATS found unusually high densities of small fish in the vicinity of Unimak
- This year’s BTS age-length key applied to this year’s ATS size composition also shows that the 2008 year class is strong (ATS selectivity of age 6 is much lower than in BTS); 2007 year class also appears strong
- This year’s “acoustic vessels of opportunity” index has not been processed yet (because the resources were needed to process the ATS index instead), but it will be available for next year’s assessment
- The 2008 year class continues to be 10-20% lighter than average at ages 3-5, based on fishery data through 2013
- BTS also shows 2008 year class to be lighter at age, although less so than in the fishery

Highlights from this year’s model explorations:

- Models in the “Model 0.x” series explored the effects of adding one piece of new data at a time, cumulatively, to last year’s model. For example, addition of the 2014 BTS data had a large impact on the fit to the data (Model 0.2). Model 0.3 incorporates all of the new data, and is the authors’ recommended model.
- Models in the “Model 1.x” series explored alternative schedules of age-specific natural mortality rates. Model 1.0 is the same as Model 0.3, and Models 1.1 and 1.2 use schedules based on Lorenzen’s and Gislason’s approaches, respectively. Model 1.1 performed about as well as Model 1.0, whereas Model 1.2 performed poorly and resulted in unrealistically high biomass estimates.
- Model 2.0 explored the use of the “Kotwicki index.” This index, which was introduced last year, attempts to correct for the effect of fish density on the efficiency of the net used in the shelf bottom trawl survey. In general, the method estimates that efficiency varies inversely with density. Because fish density varies with space, so does the effect. Overall, high survey estimates tend to get corrected upward, and low survey estimates tend to get corrected downward. Coefficients of variation are higher than for the raw (uncorrected) estimates. Age composition data also get revised as a result of this method. The authors view Model 2.0 as preliminary, and do not recommend moving to this model at present.

Highlights from assessment results:

- The estimated strengths of the four most recent above-average year classes (2006, 2008, 2010, 2012) all increased (by 3%, 19%, 25%, and 67%, respectively).
- Spawning biomass is projected to be 39% above  $B_{MSY}$  in 2015 .
- Maximum permissible ABC for 2015 is 2.9 million t
- 5-year average F would give a 2015 ABC of 1.409 million t
- Annual surplus production (“replacement yield”) for 2015, which is the authors’ recommended ABC, is 1.35 million t.
- If the stock were managed under Tier 3, the maximum permissible ABC for 2015 would be 1.637 million t.

Highlights from discussion (including public comments):

- Authors’ rationale for a 2015 ABC of 1.35 million t:
  - Keeps spawning biomass stable

- Tier 1 maxABC is very high, and would result in high catch variability in the long run if implemented
- ABC of 1.35 million t is similar to long-term average yield in Tier 3 (1.39 million t)
- Recent large ABCs (1.5 million or so) in 2002-2006 were followed by the lowest ABCs in the time series
- 2008 year class will account for over half the 2015 spawning biomass
- Salmon bycatch may increase under a higher ABC
- Medium-term effects of anticipated warmer conditions
- Member of the public: Why should ABC go down for 2015, given such big increases in all indicators?
- Member of the public: Back in 2009-10, biomass was at a low point, so we switched to a 5-year average F harvest strategy, and now the stock has recovered. This is a Tier 1 stock; we should be fishing at a rate at least equal to the 5-year average F. A spawning biomass greater than 3 million t is likely to produce low recruitment; we need to get spawning biomass down to the range where good recruitments are likely.
- Jim: This year's F was much lower than the 5-year average; an ABC of 1.35 million t would keep next year's F closer to what it was this year.
- Team member: The analysis of alternative M schedules in the assessment was helpful.
  - Jim: The SSC wants time-varying M examined, too.
- Team member: Very little impact (about 8,000 t) on 2015 spawning biomass from going with 5-year average F.
- Team member: Warmer years may be good for older fish to feed; we now have a series of cold years transitioning to warm, which is different than neutral years transitioning to warm; all ages now have refuges from predation; transitioning to warm is not necessarily bad (no need to be extra precautionary).
  - Team member: It is true that warm years are not always bad, but our most recent experience was bad.
- Team member: We do not need to be as precautionary as we were in the past when we first instituted the 5-year average F strategy; going with the maximum permissible ABC under Tier 1 will, in the long term, result in occasional low biomass and high catch variability; however, going with maximum permissible Tier 3 ABC is reasonable. Going forward, a Tier 3 calculation of ABC can be expected to be more predictable and rational than either an average-F policy or the constant-biomass policy suggested by the author for 2015.
- Team member: Under what circumstances would we feel confident in using the Tier 1 maxABC?
  - Jim: We need to take account of how recruitment behaves under different "stanzas"—did high recruitment occur at low spawning biomass because there was less cannibalism or because of good environmental conditions? It was probably both. If it were just the former, then Tier 1 maxABC might be OK.
  - Team member: If we could truly quantify all the uncertainty, Tier 1 maxABC would be OK.
- Team member: Going with Tier 3 maxABC keeps spawning biomass above  $B_{MSY}$ .
- Team member: There has always been a single dominant year class.
  - Jim: We have had even higher concentrations of spawning biomass in a single year class (2008 year class is about 3<sup>rd</sup> or 4<sup>th</sup> in rank).
- Team member: This is the only stock where we use 5-year average F; why not go with Tier 3 maxABC like most of our other age-structured model stocks?
- SSC member: You should base your harvest policy on the best estimate; then increase the buffer between OFL and ABC if needed.
  - Team member: We should say that Tier 3 maxABC is our best estimate; then increase the buffer between OFL and ABC.
  - Team member: The SSC decides which Tier the stock is in, and they have decided that

this is a Tier 1 stock; any ABC recommendation other than the Tier 1 maxABC already increases the buffer.

- Team member: It would be nice to see at least two years of increase in the survey, given that all species except plaice went up in this year's survey.
- Team member: The retrospective pattern suggests that the model tends to underestimate spawning biomass, which suggests that an increase in ABC is OK.

Decision: The majority of Team members supported basing the 2015 and 2016 ABCs on the maximum permissible harvest rate associated with Tier 3, the stock's Tier 1 classification notwithstanding, giving values of 1.637 million t and 1.554 million t, respectively. A minority preferred staying with the current (since 2010) 5-year average F strategy.

#### **Research priorities:**

- Methods for combining acoustic and bottom trawl indices in a more integrated way. The area of overlap between the two indices is problematic, as is time-varying catchability; authors would like to get one consistent index of abundance every year; also, authors would like to conduct both surveys on the same vessel.
- Role of the environment in Tier 1 calculations is an urgent research priority

#### *Bogoslof pollock*

Jim Ianelli presented an update of the Bogoslof pollock stock assessment. The most recent survey occurred during winter 2014. At the request of the SSC, Jim re-evaluated the natural mortality value used in the Tier 5 calculation. He did so using an age-structured model since survey age composition data were available from 1988 to 2012. The estimated natural mortality was 0.3 rather than the previous assumed value of 0.2. Jim also evaluated the random effects model for use in the Tier 5 calculation. The previous method of ABC recommendation resulted in a value of about 17,000 t, compared to the author's ABC recommendation of about 16,000 t (random effects model,  $M = 0.2$ ). In contrast, the value is about 24,000 t for the random effects model and  $M=0.3$ . For this assessment, the Plan Team seconds the author's recommendation for use of the random effects model and  $M=0.2$ .

**For the next assessment, the Team recommends that the author re-estimate M using the age-structured model, in the anticipation that the resulting value will be used in the next specifications cycle.**

#### *Aleutian Islands pollock*

Steve Barbeaux presented an update of the Aleutian Islands pollock stock assessment. There has not been a directed fishery since 2010, only incidental catch, which has not exceeded 3,000 mt since 1999. The 2014 trawl survey biomass estimate doubled since the last survey. Three models were presented: model 1, which is the same as the 2013 preferred model; model 2, which added age-1 within the model; and model 3, which included age-varied natural mortality. All 3 models overestimate earlier trawl survey biomass estimates, as well as the last two estimates, which are low. All 3 models provide similar fits to the age compositions. Steve recommended model 2 as the preferred model. This model indicates low biomass with below average recent recruitment. Current status is about 34% of unfished biomass. The Plan Team agreed with Steve's preference for Model 2.

#### *EBS Pacific cod*

Grant Thompson reported that survey biomass was higher again in 2014, continuing an upward trend that began around 2006 and has been sustained by several good year-classes. Spawning stock biomass is now estimated to be in the vicinity of  $B_{40\%}$ .

As requested by the Team/SSC at their September/October meetings, Grant had fitted two candidate models for this meeting. Model 1 was the base model, used for specifications in 2011-2013, with these main features:

- (i)  $M$  fixed at 0.34.
- (ii) Length-specific commercial selectivities for all fisheries/seasons, some forced to be asymptotic, estimated for blocks of years.
- (iii) Age-specific survey selectivity with annually varying left limb.
- (iv) Survey catchability fixed at the value obtained in the 2009 assessment (0.77), where it resulted in the product of catchability and selectivity equal (on average, over the 60-81 cm size range) to the desired value of 0.47 in the EBS. The desired value was based on a small number (11) of archival tags.
- (v) A single von Bertalanffy growth schedule estimated for all years.
- (vi) Intercept and slope of age reading bias estimated internally.
- (vii) Standard deviation of length at age estimated internally.
- (viii) Mean length at age data left out of the fit.
- (ix) All age and length composition data included in the fit.

Model 2 had been presented as an exploratory model in September. It differed from the base model in many respects, all of them regarded as desirable features of a succession of alternative models that had been developed and discussed over the last few years:

- (i) Annually varying length-weight relationship.
- (ii) 10 (rather than 3) initial abundances at age estimated.
- (iii) Richards (4-parameter) growth curve.
- (iv)  $\sigma_R$  estimated freely.
- (v) Length-specific survey selectivity.
- (vi) 2 (rather than 1) survey selectivity parameters have annual devs.
- (vii) Input catch composition sample sizes tuned to be no less than the output effective sample sizes.
- (viii) A single fishery and fishing season instead of nine season-and-gear-specific fisheries.
- (ix) Natural mortality  $M$  estimated internally.
- (x) The mean value of survey catchability  $Q$  estimated internally.
- (xi) Survey catchability allowed to vary annually (penalized devs estimated).
- (xii) Selectivity for both the fishery and the survey potentially allowed to vary annually (penalized devs estimated).
- (xiii) Selectivities for both the fishery and survey modeled as random walks with respect to age instead of the usual double normal (SS selectivity-at-age pattern 17). Priors are set on the age-specific parameters such that the form tends to a logistic if the data are uninformative, but the priors have large standard deviations (minimum CV of 0.5).

Both models achieved satisfactory fits. Model 2 naturally fitted the survey times series better because  $Q$  was allowed to vary annually. Both models fitted the survey age and size composition data well, matched the first three modes in the average survey length compositions, and estimated similar survey selectivities. The time series of recruitments and spawning biomass were also similar except for the last few years, where the Model 1 estimates rose above the Model 2 estimates, which was somewhat puzzling. The freely estimated value of  $M$  in Model 2 was 0.34, equal to the fixed value in Model 1. A likelihood profile showed that the best value of  $M$  in Model 1 would be 0.40. The freely estimated value of survey  $Q$  in Model 2 was close to 1, consistent with recently reported field work on survey trawl catchability.

The retrospective behavior of Model 1 was poor. It persistently produced biomass estimates that subsequently were revised downward by 50% or more when fitted to later data. The retrospective behavior of Model 2 was good.

Grant recommended sticking with Model 1 this year because it avoids changes in methods and because he feels there are some properties of SS selectivity pattern 17 that need further investigation. The Team is willing to go along for this year, but we feel that the assessment should advance to Model 2 or something similar next year. Model 2 implements many technical improvements on Model 1, fits the data better, has good retrospective performance, and does not rely on the fixed value of survey Q based on archival tags, which is no longer very credible. We suspect that the divergence between Model 1 and Model 2 biomass estimates in the last few years is associated with the poor retrospective behavior of Model 1 rather than with any problem in Model 2. Moving from Model 1 to Model 2 would be a wholesale change, but we think it would be a change for the better in many ways.

**The Team therefore recommends Model 1 for this year but urge Grant to resolve his remaining questions about selectivity and bring Model 2 back next year as the presumptive reference model for 2016.**

While recommending that Model 1 be chosen again as the reference model, Grant regarded the model point estimates of ABC and OFL as risky because of the model's retrospective record of persistent downward revisions of current biomass estimates. As a way of accounting for that, Grant proposed holding the 2015 ABC at the 2014 level of 255,000 mt rather than adopting the Model 1 estimate of 295,000 mt.

**The Team endorses this downward adjustment as a reasonable measure in the circumstances. We also recommend a provisional ABC of 255,000 mt for 2016.**

#### *AI Pacific cod*

Grant Thompson reported that the survey biomass index has been flat and below the long-term average for the last ten years.

The Team and SSC at their September/October meetings had asked Grant to fit three models for November, all of them excluding data before 1991 as recommended by an advisory committee last spring. (Grant had also done some research to recall the exact reasons for excluding the pre-1991 data.) Model 1 was Tier 5, specifically a random effects model that filters the survey biomass estimates. Model 2 was nearly identical to Model 2 in the EBS assessment (which see) except that a constant rather than annually varying value of survey Q was estimated, the standard von Bertalanffy growth equation was used (i.e., the fourth ("Richards growth") parameter was not included), and sigmaR was estimated internally rather than by the method of Thompson and Lauth (2012). Model 3 was the same as Model 2 except that the priors on survey selectivity were tightened until estimated selectivity at the oldest age was midway between one and the value estimated by Model 2.

In the fits, Model 1 naturally tracked the survey biomass estimates closely. (That's all it does.) Models 2 and 3 both fitted the age and size compositions well, but Model 2 achieved a better overall fit. Models 2 and 3 produced similar estimates of present biomass, but the estimates are on the order of three times the swept-area estimates from the survey, which seems suspiciously high. Models 2 and 3 both displayed poor retrospective performance; historical estimates of abundance were revised upward by 100% or more when the models were fitted to later data.

Grant recommended sticking with Model 1 (ABC=17,600 mt) for this year because of the very high Model 2&3 biomass estimates relative to the swept-area estimates, the poor retrospective patterns, and the same concerns about SS selectivity pattern 17 as in the EBS assessment.

**The Team concurred, but at the same time we recommend that Grant continue work on the problems with Model 2 so as to make progress toward an age-structured AI assessment. Specifically, the Team recommends examining NMFS trawl survey data, IPHC longline survey data, AFSC longline survey data, and commercial data to investigate the distribution of AI Pacific cod relative to the NMFS trawl survey stations.**

*BSAI Yellowfin sole*

Tom Wilderbuer presented the yellowfin sole assessment. One minor change to the maturity schedule was made to the stock assessment this year, and the model was updated with most current survey and fishery data available. In general, the model fits the survey biomass estimates quite well. Yellowfin sole female spawning biomass is ~1.5 times above Bmsy, but declining since the 1980s. However, total biomass has been stable over the last number of years. Additionally, the average exploitation rate (1978 – 2014) is only 0.05 and the catch is only, on average, 75% of the ABC. The Team noted that this is a textbook stock assessment and commended the author for his effort. There was some discussion about the new maturity schedule and its seeming lack of significant difference from the previously used maturity data; the new maturity data increased the FSB by 2%.

**The Team recommends testing for differences of maturity curves, and if no significant differences are found pooling all maturity data for next assessment.**

In 2011, the authors examined four models of weight at age for yellowfin sole (the below model numbers refer to the 2011 assessment models, not the current year):

Model 0: parametric fit of time-invariant and age-specific growth increments to the year-and-age-specific survey data

Model 1: year-and-age-specific mean weights from the survey

Model 2: growth increments from Model 0 multiplied by random year-and-age effects

Model 3: growth increments from Model 0 multiplied by random year-and-age effects and temperature-dependent year effects

**The Team recommends that the 2011 weight-at-age analysis be revisited with the following modifications:**

1. Model 1 in the 2011 analysis was regarded as the “truth,” meaning that it was determined to be the preferred model *a priori*. Because the weights at age in Model 1 were empirical estimates obtained from the survey, the Team feels that they necessarily contain some amount of sampling error, and so should not be viewed as perfect estimates.
2. Models 2 and 3 contain more nominal parameters than data, and are unnecessarily conditioned on the results from Model 0. The Team feels that one or more models with fewer parameters should also be considered (e.g., some sort of random effects model or other smoother, where the growth increments are not tied to the results of Model 0).

*BSAI Greenland Turbot*

Steve Barbeaux presented the Greenland Turbot stock assessment. There were a few data changes from the previous year, which included: addition of 2014 data, updated catch data, addition of Northwest area length composition, and increased female length at 50% maturity from 55 to 60cm. In addition to the accepted model from last year (Model 1) an alternative model (Model 2) was put forth (and subsequently accepted) that included autocorrelation in recruitment and fixed catchabilities for slope and shelf surveys. A long discussion occurred debating the relative appropriateness of both models. Model 2 was ultimately

selected based on: 1) better results from retrospective analysis and 2) the large increase in  $q$  over time in Model 1. However, the fixed  $q$ 's in Model 2 and the unknown ramifications of using autocorrelation in recruitment for Model 2 caused substantial concern about its efficacy, though there is evidence that this approach is reasonable (Thorsen et al. 2014). Although Model 2 was ultimately accepted by the Plan Team, the length and detail of the discussion suggests that further evaluation of this model is warranted.

Utilizing Model 2,  $B_{100}$  increased from ~100K to 130K from 2014 to 2015. Similarly, the ABC increased from about 2K to 3K from 2014 to 2015. Strong recruitment in the late 2000s will likely continue the increase in turbot biomass over the next few years. The author also noted the importance of the slope survey for informing the model and suggested that its continuation is critical for continued improvements. Additional research priorities include projects on stock structure, movement, and maturity schedule updates.

**The Team recommends fitting Model 1 with recruitments since at least 2007 estimated freely in order to confirm or reject the supposition that the large increase in survey  $q$  is attributable to the recruitment dispersion and/or autocorrelation parameters.**

#### *Arrowtooth Flounder*

Ingrid Spies presented the arrowtooth flounder stock assessment. Changes to the assessment inputs included: survey size composition, biomass, and standard deviations for the 2013 and 2014 EBS shelf survey and 2014 AI survey; fishery size compositions from 1992-1999 and for 2012, 2013, and 2014; estimates of catch through 10 October 2014; and age data from the 2010 EBS and AI surveys and the 2004 shelf survey. Changes to the assessment methodology included estimating fishery selectivity non-parametrically rather than with a 2-parameter logistic, and adding an additional likelihood component to incorporate the new AI age data. Results of the preferred model included small decreases in projected biomass relative to last year's assessment as well as decreases in female spawning biomass, OFL, and ABC.

Two models for fishery selectivity were evaluated: In Model 1, selectivity was estimated separately for each age and the shape was constrained to be a smooth function; whereas in Model 2, where selectivity was modeled as a two-parameter ascending logistic function. Model 1 was the preferred model on the basis of a lower AIC, even though the number of "effective" parameters is overstated for Model 1 in the AIC calculation. The differences in the resulting estimates of biomass between the models were small.

Observed trends include slight declines in total biomass in the EBS slope and shelf surveys and the AI survey since 2006, increasing female spawning biomass, and stable size composition. Estimated total biomass shows a slight downturn in the last few years and estimated female spawning biomass shows a continued increase and is above  $B_{35\%}$ . Also examined was a new maturity at age relationship (Stark 2011, BSAI) with maturity at older ages that significantly brings down female spawning biomass but does not affect total biomass.

Sex specific mortality was discussed. In data from the 2010 EBS shelf survey, there were no male arrowtooth older than 10 years, while data from the AI survey of the same year had males over 30 years. This is a pattern also seen in halibut. This discrepancy may confound estimation of natural mortality and selectivity. The proportions of males in the AI survey tend to be higher than those of the EBS shelf and slope. A discussion of catchability by area as a function of temperature followed with comparisons to Greenland turbot.

In summary, non-parametric fishery selectivity is recommended, the current likelihood weightings are better than the single alternative that was presented, the new maturity based on Stark (2011) is better than Zimmerman (1997), and new AI age data indicate males may not have higher natural mortality.



The Team felt the authors' preferred model (Model 2) was reasonable and accepted the authors' recommended OFL and ABC.

**The Team recommends that retrospective analyses be conducted for the next assessment.**

Research priorities suggested included investigating selectivity by age for the survey and fishery, and conducting population structure and movement studies (medium importance).

*BSAI Kamchatka Flounder*

Tom Wilderbuer presented the Kamchatka flounder stock assessment. Changes to the assessment inputs included: estimates of catch for 2012-2014, fishery length compositions for 2012 and 2013, shelf survey length compositions for 2013 and 2014, shelf survey biomass estimates and standard error estimates for 2013 and 2014, 2014 Aleutian Island survey biomass and standard error estimates and length compositions, and 2012 slope survey age compositions. There were no changes made to the assessment methodology. Tier 3 and Tier 5 assessment models were prepared as requested by the SSC. Tom noted the Tier 5 numbers in the report differ from those presented, which are corrections.

Kamchatka flounder were lumped with arrowtooth flounder until 1991 when they were identified as a separate species. The fishery catches from 2007-2014 were included in the model. Catches from 1991-2006, years when Kamchatka and arrowtooth were not identified to species, were calculated by assuming that Kamchatka flounder comprised 10% of the catch during that time period. The 2014 catch to date is about 90% of the ABC.

Abundance estimates are up in 2014 shelf and AI surveys. There are good estimates of length and weight at age. Males do not grow as fast as females. The 22 year average survey biomass proportions are 37% for the shelf, 20% for the slope, and 42% for the Aleutian Islands. The assessment started with catchability apportioned by the relative survey biomass estimates for the three survey areas. Examination of the results from the initial model run indicated that fishery selectivity is poorly determined (presumably due to the low sample sizes) and that there are males present in the fishery length records that are larger than those observed in any survey data. It is suspected that this is the result of some mis-sexing of Kamchatka flounder in the commercial fishery sampling. This was resolved by fixing the slope of the logistic curve (age at 50% selection is still estimated for each sex) which produced more sensible results and estimated reference F values similar to other Bering Sea flatfish species. Based on selectivity patterns, the shelf survey showed big differences in the ages of fish available to these different surveys. The slope survey selectivity estimates seemed most stable, hence alternative values of q were fixed for the slope survey and freely estimated the q values for the shelf and Aleutian Islands surveys. M is confounded with q and was discerned through profiling to have a value around 0.11. With the model configured in this way (slope survey q=0.18, M = 0.13 and fishery selectivity logistic slope fixed) the model was run to estimate the status and the population dynamics of the Kamchatka flounder stock over the period 1991-2014.

Model fits to the surveys are reasonable and indicate an increased stock size. Estimates of total biomass and female spawning biomass showed slight increases and female spawning biomass is 13% above  $B_{40\%}$ . Estimates of age 2 recruitment showed previously identified strong year classes for 2001 and 2002, and possible strong recruitment in 2008 and 2010. Projections of female spawning biomass remain above the  $B_{40\%}$  level for the foreseeable future.

There was no retrospective analysis due to the short time series for this model. The assessment is reasonable and is a straightforward update of what was presented to the Plan Team last year. The Team accepts the authors' recommended Tier 3 OFL and ABC estimates.

There were no research priorities specific to Kamchatka flounder.

**The Team recommends that retrospective analyses be conducted for the next assessment.**

*BSAI Northern Rock Sole*

Tom Wilderbuer presented the northern rock sole assessment. There was not a full assessment of this stock in 2013 because of the furlough, so two years of data were added. The 2014 biomass estimates are down from the last estimates calculated in 2012.

This is a highly desirable species and 95% of catch was retained in 2013. Female spawning biomass has been increasing steadily since 2009. The age data show a sex difference; females are longer and heavier than males.

The SSC and Plan Team recommended retaining the base model for setting ABCs and OFLs for 2015 and 2016.

In 2012 an alternative model with a temperature relationship was presented. The SSC wanted to see a more complete analysis of the performance of the base and temperature model. In November 2013, the Plan Team recommended that the authors provide a full assessment including the temperature-dependent model with new data (Model 7 herein), which is described in the next paragraph.

The author calculated seven models with variations of  $q$  and  $M$ . Model 1 is the base model used in 2012 and 2013. The alternative models do not fit the observed sex ratio from the survey age composition as well as using the fixed  $M$  values in Model 1. Model 7 (with male and female  $M$  fixed at 0.15) sets average  $q$  equal to 1.4 by fixing the alpha value in the temperature- $q$  equation and then allows the beta value to co-vary with annual bottom temperature. The result is an improved fit to the survey biomass time-series and fits the experimental value of  $q$  better than models which estimate  $q$  as a free parameter. Model 7 gives results similar to Model 1, but does not fit the observed age compositions as well and is not selected as the model of choice from an AIC analysis. This result is different from two years ago; the author no longer recommends the model (7) that incorporates bottom temperature.

The author recommended Model 1 and the Team agreed. Model 1 results are presented in the summary. In that model,  $q$  is estimated subjectively at a value of 1.5, as in in the past. Model 1a uses  $q=1.4$ , but it is only based on one year of catchability data and would make ABC higher. Model 1 is the same as was approved last year.

**The Team recommends that the author investigate the possibility of including the sex ratio as a likelihood component so as not to have to consider it independently.**

**The Team recommends that retrospective analyses be conducted for the next assessment.**

*Flathead Sole and Bering Flounder complex*

Carey McGilliard presented the flathead sole and Bering flounder stock assessment. New data added to the assessment included: updated 2013 catch and 2014 catch to date, fishery age data for 2011 and 2012, 2013-2014 fishery length data, EBS shelf survey data for 2013 and 2014, AI survey biomass for 2014, 2013-2014 survey bottom temperatures, 2013 survey ages, 2014 survey length data, and minor changes in historical survey catch for the EBS shelf trawl survey database. There were no changes to the assessment methodology. The estimated OFL and ABC for 2015 are little changed from last year. The OFL and ABC increased by 3% to 79,419 t and 66,130 t, respectively. The stock is not overfished or being subjected to overfishing. Catch history shows a sharp increase around 1990 to fairly constant catches thereafter, ranging from about 15,000 to 25,000 t from 1990 to the present. Flathead sole are taken as both directed and incidental catch.

The distribution of flathead sole captured in the EBS trawl survey indicates that bottom temperatures may influence their abundance. Bering flounder are present in survey and fishery catches but are more abundant on the northwest Bering Sea shelf where temperatures are typically colder. Survey estimates show that the Aleutian Islands contribute very little to the total survey biomass, and similarly Bering flounder comprise a small fraction of the species complex. Survey biomass appears to be positively correlated with bottom temperatures. The length at age and weight at age relationships are the same as those used in the last assessment. At around age 7 years females become larger and heavier than males of the same age.

Model fits to the survey biomass estimates were generally choppy due to the relationship between temperature and catchability. Plots of model-predicted and observed age frequencies for the survey did not show any real trends or mismatches for either males or females. Similar plots for survey length frequencies indicated mismatches for males. For fishery data, plots of model-predicted and observed ages and lengths indicated mismatches for males and females for both measures. These mismatches indicate the model is missing some relationship with age and length, sex specific selectivity, or natural mortality. Selectivity was different for the survey and the fishery, with the selectivity occurring at a larger length in the fishery than the survey. Fishing mortality was much higher in the past and decreased during the 1980s to a nearly constant rate since 1990. Length at 50% selectivity is greater for the fishery than the survey by about 7 cm. The temperature-dependent catchability parameter was estimated to be 0.059. Trends in biomass estimates show a slowly decreasing total biomass and a relatively flat spawning biomass. Retrospective analyses resulted in a Mohn's rho equal to 0.021 with discrepancies in the 2004 and 2005 temperature-dependent catchability parameter being most notable.

Ecosystem considerations show walleye pollock to be the major predator of flathead sole, while numerous pelagic and benthic invertebrates are the major prey items. The major cause of flathead sole mortality is "unknown" (79.6%), followed by flatfish trawls, Pacific cod, walleye pollock, and other predators.

Potential data gaps and model improvements include: exploring methods to account for scientific uncertainty, investigating appropriate data weighting, exploring the use of a stock recruitment curve in the model, and exploring the use of survey averaging with random effects models to interpolate Aleutian Island biomass. Research priorities include investigating the causes of mismatches in observed and predicted length frequencies and an improved aging error matrix.

The Team accepts the author's OFL and ABC recommendations.

#### *Alaska plaice*

Alaska Plaice was presented by Tom Wilderbuer.

*The author examined removing pre-1982 survey data from the assessment, given changes in catchability associated with the switch in survey gears, as well as a model fit with the full data so that the effect of this change could be evaluated.* Both models were run and model output compared. Results of estimated female spawning biomass and fit to surveys indicate a small difference (4%) in estimates from the early part of the time series when 4 extra data points were included. Both models produce the same population trends. Given the unknown differences in catchability between the 2 survey trawls (estimates are all treated the same), the current assessment proceeds without the 1975 and 1979-1981 survey estimates (as do all other BSAI groundfish assessments). The Team agreed with this change.

A significant portion of the Alaska plaice biomass resides in the northern Bering Sea. The Team and author discussed this point and agreed that there is no way to address the biomass of Alaska Plaice in the

stock assessment model without conducting further trawl surveys in the northern Bering Sea, preferably at least every other year.

An NPRB-funded study estimated maturity from histological analysis of samples collected in 2012. The last such analysis was in 1985. The new maturity schedule which resulted was implemented in the assessment model and caused a 5% decrease in female spawning biomass.

This is a split-sex, age-structure model. There is a long time series of ages for Alaska plaice and the Age and Growth lab is starting to process 2014 fish. The survey biomass estimates were rather flat, with the total biomass in a gentle decline. The population of Alaska plaice has gone down since the last assessment; the shelf survey biomass decreased 22% from 2012 to 2014. Age-3 recruits are down. The projected female spawning biomass is expected to go up after 2020. There is little harvest on this stock and the FSB is well above  $B_{40}$ .

**The Team recommends that retrospective analyses be conducted for the next assessment.**

#### *Other flatfish*

Tom Wilderbuer presented this Tier 5 stock assessment. Catch is much less than the TAC. The majority of the fish caught are starry flounder, which is increasing in biomass. The biomass estimate of Other flatfish overall has also increased.

The change this year was that a random effects model was used to estimate biomass for all Other flatfish. Despite a 33% increase in stock of other flatfish, using the RE model estimate increased the ABC by only 7%.

**We recommend that the random effects model continue to be used for this complex in future years' assessments.**

#### *BSAI Pacific Ocean Perch (POP)*

Paul Spencer presented the BSAI POP assessment. Much of what he presented is an update of what he presented in September. The AI survey biomass was the third in a row near 1 million t. Paul is considering methods to add the biomass estimates from the EBS slope survey to the total, but the AI survey covers most of the biomass. The top ten year classes track well in both the fishery and survey ages. Paul presented 5 models, including two bridging models with data updates. The second bridging model removed the 1980s cooperative survey data and the new models also excluded these data. For the new models, he explored iterative reweighting of the compositional data and new selectivity functions. Excluding the 1980s cooperative surveys had little effect on model results.

The logistic selectivity model after reweighting increased the biomass substantially by lowering  $q$ . The double logistic gave a very low biomass with a very large  $q$ . Paul is recommending the bi-cubic splines that he showed in September. After reweighting, there was a very large increase in weight on age composition data. It was pointed out that there is much more length data than age data, but they are weighted similarly. The reweighting fit the survey biomass data similarly and deemphasized the fit to the length data. Paul thinks that the fishery CPUE data (1968-1979) may be unnecessary at this point and may consider removing it in future models. Paul was asked if the CPUE data were published. Paul said that they were in the assessment when he inherited it. Model 3 with bi-cubic splines provided a better fit to the biomass survey and the age composition data than the alternative models. The selectivity in Model 3 is dome-shaped through most of the time series, but is nearly asymptotic selectivity in the last few years. Paul was asked if these were natural splines or clamped splines. Paul said that they were natural. Part of the trend in selectivity may be explained by the fishery going deeper.

The retrospective trend (Mohn's revised rho) was about -0.343. Fixing q at 1.28 raises rho to -0.14. Paul presented some graphs showing the effect of the prior on estimating M. When fixing q at the 2014 estimate, and loosening the prior on M, M comes out at 0.07 which is similar to new methods shown in Then et al. 2014. The reason why q is higher than 1 is because of expansion of higher densities in trawlable ground to untrawlable ground. The fit to the survey biomass has a residual pattern that does not fit the early years (too high) or the recent years (too low). Recruitment estimates from the new model are similar to the 2012 model except that the 2000 year class has increased in magnitude. The CVs of the recruitment estimates are lower under the preferred model. The fits to the age compositions have improved, particularly the plus group. Biomass is high and total biomass has the same trend as spawning biomass. The phase plane plot showed that the ABCs are almost fully exploited, but the status is well above  $B_{35\%}$ . The reference points have changed a bit because of the different selectivity curves.

For apportionment, Paul applied the random effects model to the area biomass estimates and the results were very similar to the survey average approach previously applied.

Paul was asked whether the weights on the smoothing parameters of the spline were the same as in the preliminary assessment. It was suggested that the weighting on the position of the knots and the weighting on the smoothness be explored. Paul was asked why splines were not suggested for the BS/RE model. Paul suggested that there were not enough data to use them because BS/RE lack the historical data. It was noted that Paul uses a five year average for fishery selectivity for the projections. The Team was discussed whether it would be possible to be to use splines for all rockfish species. The Team also discussed whether survey selectivity should be forced asymptotic. Paul thinks that the survey is standardized and goes deep enough to get most of the fish. The Team discussed whether it was reasonable to have such a steep increase in selectivity for older fish from early years to recent years and whether that pattern might change back to dome-shaped in the future. Selectivity is time-varying both in time and age. Paul was asked whether changes in other target species were driving the POP change in depth. It was mentioned that work has been done in other assessments on the weighting on the spline selectivity by showing the point of diminishing returns of the fit to the data. The Team agreed with Paul's choice of Model 3 that uses bi-cubic splines and reweights the compositional data.

Paul was asked if it was better to choose the model that has a lower WAI ABC to avoid BS/RE. Paul said that maybe we should have been apportioning the ABCs for lower-biomass rockfish species all along. We could flag concerns regarding potential BS/RE bycatch as a possible rationale for setting a lower POP TAC for the WAI. It was also mentioned that we could use the weighted average approach because it gives a slightly lower ABC in the WAI. The Team agreed to use the RE model but expressed concerned about the effect of a high WAI ABC on WAI BS/RE. Paul's research priorities are to determine a better prior for catchability through empirical studies and to determine how to use the EBS slope survey biomass estimates. Paul also thinks periodic estimates of biological parameters like maturity would be useful to see if there are trends in these estimates.

#### *BSAI Northern rockfish*

Paul Spencer presented the BSAI Northern rockfish assessment. The trawl survey biomass estimate was up substantially from prior years, in the EAI and WAI, but not the CAI. The fishery catches more fish in the EBS than the EBS slope survey says are out there. The top ten year classes track well in both the fishery and survey ages. The depth comparison of the fishery and survey catches do not show much temporal variation. It was mentioned that the fishery may have been fishing shallower recently to avoid shortrakers in the BS. The fishery and survey seem to pick up the same age distribution of fish. Paul presented 6 models, including two bridging models with data updates. The second bridging model removed the 1980s cooperative survey data and the new models also excluded these data. For the new models he explored iterative reweighting of the compositional data and new selectivity functions. Excluding the cooperative survey data had a large effect on the scale of the biomass time series, particularly before 2000.

The iterative reweighting put more weight on age data than length data. In terms of root mean squared error, all selectivity options had similar fits. Paul generally preferred model 1 (logistic, time-invariant selectivity) because the increases in complexity found in Models 2-4 did not affect results or improve the fits very much. Paul was asked again whether he should use splines for all rockfish. Paul was asked whether the Deviance Information Criterion was also calculated as a metric of fit to the data. He said he didn't understand the output well enough to use it as a criterion at this point. Northern rockfish results did not meet the preponderance of evidence that would merit switching to a more complex selectivity function. It was noted that the Bayesian Information Criterion can be calculated in different ways depending on how one counts the number of parameters (for example, it might be better to add the input multinomial sample sizes than the number of length bins). Paul suggested that  $M$  cannot be estimated in the model, but it was pointed out that the freely estimated value was quite close to the 2012 model estimate. Paul does not think that  $q$  can be estimated either, as it goes to 0.1. There was little evidence of a retrospective pattern, with a Mohn's rho of -0.15, which is mainly influenced by the large 2014 biomass estimate. Most data sources were fitted well by the model, except the survey biomass index, where the model doesn't fit well because the biomass estimates are so imprecise. Area-specific exploitation rates look pretty low relative to BS/RE. The genetic data suggest structure, but there is not a stock structure concern at this point because of the low exploitation. Natural mortality has increased since the 2012 assessment. The Team concluded that Model 1 was the best choice based on AIC and an adequate level of complexity given the data. Natural mortality, when estimated, was the same as the natural mortality last year, but the prior (the same as last year) kept  $M$  at 0.049, which was higher than 201,2 which also resulted in a higher ABC. The ABC for 2015 represents about a 30% increase from 2014. The Team accepts the author's recommendations.

**The Team expressed some concern about the substantial increase in the natural mortality estimate from 2012. The Plan Team recommends that Paul report back on what values for natural mortality were used in Then et al. (2014) to determine whether longevity-based estimators were superior.**

#### *BSAI Blackspotted/Rougeye Rockfish*

Paul Spencer presented a full update of the blackspotted/rougeye assessment. The Team discussed questions about the difference between the model and survey and continued to express strong concern about the exploitation rate in the Western Aleutians sub-region. The AI portion of the assessment is conducted with Tier 3 methods while the Bering Sea portion is conducted with Tier 5 methods.

After an introduction, Paul showed catch data for 2011-2014 and showed that the survey was down quite a bit in 2014 from 2012, with the decrease primarily occurring in the Eastern Aleutians. There are no new fishery age data since 2011. There is some variation among recent assessments about the certainty of estimated strengths of the 1998 and 1999 are strong year classes. Some smearing across years leads to uncertainty about the strength of 1999 year class; also, perceptions of uncertainty can be influenced by the choice of metric (e.g., variance versus CV). This year the assessment also shows more strength in the 2002 year class in the survey ages. Despite the decline in this year's survey, there is considerable evidence of a growing stock. There is also no evidence of historical overfishing, indicating that the stock is overall in good shape relative to unfished levels.

In the past Paul weighted the age and length composition data entered in the model based on the number of otoliths read or lengths taken (e.g., using the square root of actual sample size), with fishery data given half the weight of the survey data. Model results are sensitive to how the data are weighted; Paul now uses an iterative reweighting procedure that attempts to get the standard deviations of the normalized residuals close to one. Paul looked at the proportion of the population that is in the plus group in the fishery and the survey across years and found it was relatively balanced across years. Iterative reweighting gives more weight to composition data and less to the noisy survey abundance data. Because of iterative reweighting, one cannot compare the AIC for model fit so Paul looks at RMSE.

The retrospective analysis showed a Mohn's rho of 0.78, which was higher than any assessment in the Retrospective Investigations Group report.

The Team discussed several models – an updated base model (Model 0), one with cooperative (i.e., pre-1991) survey data removed (0.1), and then 4 models with the cooperative survey data removed and with different selectivities.

Model 1) Logistic fishery selectivity, cooperative survey data removed, age/length composition weights iteratively reweighted.

Model 2) Model 1, but with double logistic selectivity.

Model 3) Model 1, but with selectivity parameterized as a time-invariant cubic spline

Model 4) Model 1, but with selectivity parameterized as a bicubic spline

Paul used the results of the iterative reweighting for Model 2 in Models 3 and 4 - the standardized deviations of normalized residuals didn't vary much for the different models.

Paul examined fishery selectivity across time and showed that the fishery in the past did not select older fish compared to the survey.

Paul examined the SSC request of whether  $M$  or  $q$  could be estimated inside the model. Allowing  $M$  to be freely estimated with  $q$  fixed at the 2014 estimate produced an  $M$  of 0.16, which seems implausible for a long-lived rockfish. Similarly, estimating  $q$  with fixed  $M$  gave an implausible estimate of 6.78.

Model 2 is the author's recommended model for the AI portion of the assessment. The Team accepts this model.

How should  $B_{40\%}$  be estimated for this stock? Stock status is measured as  $B/(\text{mean recruits} \& \text{SPR}(F_{40\%})) = B/B_{40\%}$ , so is a function of mean recruitment. If recruitment is increasing quickly for a long-lived species, this would suggest a decline in stock status even if the stock is actually increasing, which does not really make sense.

The 1998-2011 year classes now comprise 68% of the total biomass. Fish 34 cm and smaller comprised about 30% of the 2013 fishery length composition.

Paul proposed that mean recruitment be based on the 1977-1998 year classes. These classes have reached the age that they are 10% selected by the AI trawl survey. **After considerable discussion, the Team recommended that 1997 and 1998 also be excluded from the time series. This had a significant impact on the stock status, pushing it from Tier 3b to 3a. This seemed more in line with model results suggesting that projected spawning biomass would be at its highest historical level in 2015.**

The Team noted that the author's proposed cutoff for exclusion of recent year classes was a modification of the recommendation from the recruitment working group, which was to exclude recruitments corresponding to all age groups in the current numbers-at-age vector below  $\text{age} = \text{round}(0.05/M + A10\%)$ . Although the recommendation of the working group has not yet been accepted by the Team or SSC, it has been subject to analysis, comment, re-analysis, and revision over the last few years. The Team felt that it was therefore more appropriate to use the working group's recommendation in this case than the author's.

Members of the Team noted that the survey biomass data are flat or decreasing but spawning biomass as estimated by the model is sky-rocketing. The model is emphasizing the fit to fishery age and survey ages relative to survey abundance data.

An SSC member in the audience commented that the near-linear Model 2 selectivity was akin to a fishery catch curve and also pointed out that solutions to the reweighting process are not always unique.

Members of the Team also wondered why survey age data are so much more heavily weighted than survey length data. In the end, the Team expressed concerns with the selectivity curve in model 2, although the Team appreciated the logical process that Paul took to arrive at this model.

The Team also discussed the issue of sub-area apportionment and continues to express strong concern about the exploitation rate in the Western AI. Things look relatively similar to last year in terms of the status of the stock in the WAI. Members of the Team noted that more fishing will likely occur in the Western AI in 2015 because of the change in Steller Sea Lion Regulations.

At the September 2014 meeting, the Team noted that, although an increased number of genetic samples no longer showed statistically significant isolation by distance in the BSAI, **the Team recommended continued annual reporting on the status of the population in each AI management area. The Team reiterated this recommendation.**

With cooperation from industry, catch in the Western AI was close to the target exploitation rate this year. Informal communication between Paul and members of industry led to an industry goal of staying below 50 t in the WAI. An industry representative in the audience noted that the Amendment 80 fleet had caught 52 t, plus there had been more unobserved catch from other vessels, which matches the recorded catch of 56 t. One member of industry also suggested that it was very helpful to have a suggested number.

**The Team recommends that we use the random effects model for sub-area allocation.**

Last year the Team expressed “strong concern” about the exploitation of the Western AI sub-stock. According to the “Stock structure and spatial management policy” developed by the Council in 2013, after the Plan Team and SSC express concern about a stock, the following two steps should occur (from page 2 of the November 2013 Plan Team Minutes):

*“2. With input from the agency, the public, and its advisory bodies, the Council (and NMFS) should identify the economic and management implications and potential options for management response to these findings and identify the suite of tools that could be used to achieve conservation and management goals. In the case of crab and scallop management, ADF&G needs to be part of this process.*

*3. To the extent practicable, further refinement of stock structure or other spatial conservation concerns and potential management responses should be discussed through the process described in recommendations 1 and 2 above.”*

While industry has taken steps to limit fishing effort, the Team notes that none of the other actions associated with steps 2 and 3 of the Council policy have been taken.

**The Team expressed concern that the estimates of biomass from the model do not have much similarity to the trend in survey biomass estimates and recommend that the authors attempt to reconcile this discrepancy in future assessments.**

**The Team recommends continued attention to the exploitation rate in the WAI and that the author bring back the 7 metrics that he has previously shown the Team at the September 2015 meeting. At that meeting, the Team will review the WAI stock status again and evaluate the effect of any management response in 2015.**

#### *BSAI Shortraker Rockfish*

Ingrid Spies presented an update of the shortraker rockfish stock assessment. Biomass estimates from the 2014 AI survey and 2002-2012 Bering Sea slope survey data were added to the model input data. At the request of the Team and SSC, the 2014 biomass was estimated using the random effects model and is the Team’s preferred model to set ABC and OFL for this Tier 5 assessment. The recommended 2015 ABC and OFL are 518 t and 690 t, respectively, which are 40% increases from the 2014 ABC and OFL. The



shortraker rockfish biomass estimate increased to 23,009 t in 2015 from 16,447 t in 2014. This increase in biomass estimate is primarily due to including the EBS slope survey data along with the change to a random effects model.

**The Team recommends including the 2002-2012 EBS slope survey biomass estimates of shortraker rockfish in future assessments.**

#### *BSAI Other rockfish*

Ingrid Spies presented an update of the other rockfish complex stock assessment. New data in the 2014 assessment included updated catch and fishery lengths for 2014. Biomass estimates, CPUE, and length frequency compositions were also included from the 2014 Aleutian Island trawl survey and the 2013 and 2014 eastern Bering Sea shelf survey. In previous assessments, a 4-6-9 weighted average of the three most recent surveys for each region (Aleutian Islands, Bering Sea shelf, and Bering Sea slope) has been used to calculate the BSAI other rockfish biomass estimate. To remain consistent with other assessments, the Team recommends using a random effects model for each region to calculate the biomass estimate for the entire BSAI area.

The recommended 2015 ABCs for the other rockfish complex in the EBS and AI are 695 t and 555 t, respectively, with an OFL of 1,667 for the entire BSAI area.

**The Team recommends using the random effects model to estimate the other rockfish complex biomass for future assessments.**

#### *BSAI Atka mackerel*

Sandra Lowe presented an updated assessment of the Atka mackerel stock in the Bering Sea/Aleutian Islands. Significant new inputs to the model were the survey biomass estimate from summer 2014 and age data from the 2013 fishery. These new inputs combined to increase the strength of the 2006 and 2007 year classes, as well as the four large year-classes that were responsible for the peak in abundance in the mid 2000s (1998-2001). The Team approved the assessment and agreed with the author's recommendation for Tier 3a ABC, but had the following concerns: First, the 2012 survey biomass estimate may be an underestimate, yet it has a low CV, and the 2014 estimate is considerably higher (161% increase). The model does not fit either of these survey estimates very well. Second, the recommended ABC for 2015 is 65% greater than in 2014, yet there is only 1 year class in the last 12 that is estimated to be above average in size. The last time an ABC > 100,000 t was recommended was in 2005 and 2006, and this was supported by 4 above average year classes spawned in successive years, and three of these (1999-2001) were the among the largest ever estimated. The Team discussed the new fishing regulations that are proposed for 2015 that will re-open parts of area 543 to Atka mackerel directed fishing (TAC will be a maximum of 65% of the 543 ABC), as well as relax restrictions that were in place in areas 541 and 542. The new regulations and the significantly larger ABC could result in catch in area 543 increasing substantially (from an estimated 302 t in 2014 to as much as 22,360 t in 2015). Steller sea lions in area 543 continue to decline at ~7% per year and surveys in 2014 resulted in the lowest pup and non-pup counts in the time series.

#### *BSAI Skates*

Olav Ormseth presented the skates stock assessment. This was a scheduled "on-year" assessment because all three surveys were scheduled, but since the slope survey was cancelled, he used the 2012 data for biomass distribution. For Alaska skate, he presented four models. For "other skates" he presented a random effects model.

Additions to the Alaska skates model:

- The entire time series (1982-present) of EBS shelf bottom trawl biomass estimates.

- Reconstructed historical catch data beginning in 1954.
- Four length-at-age (LAA) datasets from the EBS shelf survey (2003, 2007-2009); a LAA dataset from the 2005 longline fishery was determined to be inadequate and was not included.
- Weight-at-length data from a dataset on Alaska skate tagging activities on the 2008-2010 EBS shelf survey.

Highlights from this year's model explorations:

- Model 1: Existing model with updated data (i.e., the model used in the 2012 assessment).
- Model 2: Author's preferred model, with features described in the chapter text. Model 3: Same as Model 2, except with selectivity parameter 6 fixed for both fisheries and the survey, creating asymptotic selectivity curves. This model offered a contrast to the dome-shaped selectivity curves generated in Model 2.
- Model 4: Same as Model 2, except starting in 1977 rather than 1950.

Model 2 provided the best overall fits when the data are considered as a whole and produced results that are consistent with the author's conceptual approach.

**For Alaska skates, the Team concurred with the author and recommended Model 2. However, concern about the change in estimated spawning biomass between the two assessments led the Team to recommend rolling over the lower 2014 ABC for 2015 and 2016. The Team also recommends, for September 2015, an evaluation of the optimum starting year, age composition data, and recruitment variability. Recruitment variability may help explain the change in the estimates of spawning biomass. The Team reminds the author to include a retrospective analysis and harvest scenarios next year.**

**For "other skates", the random effects model is the Team's preferred model for estimates of biomass and recommends use of it to set ABC and OFL for this Tier 5 assessment.**

#### *BSAI Sculpins*

Ingrid Spies presented the BSAI sculpins stock assessment. Biomass estimates and length compositions were included from the 2014 AI survey and 2013 and 2014 EBS survey. Two models were presented by Ingrid: the current model, which uses the average of the three most recent surveys to calculate the Tier 5 biomass estimate, and the author's preferred method, using a random effects model to calculate the biomass estimate. The Team recommends using the random effects model to calculate the 2014 Tier 5 biomass estimate. The recommended 2015 and 2016 ABC and OFL are 52,365 t and 39,725 t, respectively.

**The Team recommends using the random effects model to estimate the sculpin biomass for future assessments.**

#### *BSAI Sharks*

Cindy Tribuzio presented the shark assessment, incorporating the most recent catch and survey data. There was a steep decline in the IPHC longline survey and incidental catch rates of sleeper sharks beginning around 2000 and continuing for several years, but in recent years catch rates have been low and stable in both the surveys and bycatch fisheries.

Cindy stated that CIE reviewers had criticized the use of maximum historical catch as way to set OFL for sleeper sharks, but the individual reviewers' remarks on this point in fact showed a wide range of opinions, so there was clearly some support for the present practice and certainly no consensus in opposition. One Team member observed that setting a Tier 6 OFL (and ABC) involved picking a range of reference years and some catch statistic (e.g., maximum, average, or 95th percentile) as the OFL. In the case of sleeper sharks there was not a clear conservation issue because all the animals in the bycatch were juveniles and there was no new information to suggest a change in the procedure that the Team had

adopted before, after long discussion. The Team therefore favors continuing to set OFL and ABC at the same levels (1,363 and 1,022 t).

**The Team recommends that both the reference period and OFL/ABC levels be re-evaluated after a few years of data from the restructured Observer Program have accumulated.**

*BSAI Squid*

Olav Ormseth presented the squid stock assessment. This was a scheduled “on-year” assessment because all three surveys were scheduled, but the cancellation of the slope survey limited new information. The squid catch was low between 2009-2013, then has increased in 2014; it remains below the ABC but above the initial TAC. Most of this catch occurred near the Bering Canyon. Fishery catch data suggest multiple cohort fishing in 2007-2010, but unimodal in 2011-2013.

*BSAI Octopus*

Olav Ormseth presented the octopus assessment for Liz Conners. This was a full assessment year. There were no changes to the 2012 predation-based estimate of octopus mortality from 1984-2008 survey data on Pacific cod diets, which is used as an alternative Tier 6 estimate. The consumption methodology is based on extensive diet data and includes estimation of uncertainty. In the document, but not discussed during the Team presentation, the authors responded to comments from the May 2013 CIE review. Based on CIE comments, for the 2015 Team meetings the author has started to examine a size-based assessment model to use as a simulation model for identifying monitoring and management metrics, and for possible fitting to habitat pot data.